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A SECTORAL ANALYSIS OF THE CONTRIBUTION OF AGGREGATE QUARRYING TO SUSTAINABLE DEVELOPMENT IN NAMIBIA

By

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Submitted in partial fulfilment of the requirements for the degree

MAGISTER PHILOSOPHIAE IN EXTRACTIVE INDUSTRY POLICY, MANAGEMENT AND REGULATIONS

Prepared under the supervision of

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October 2018

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ACKNOWLEDGEMENT

This work results from a fulfilment of a Magister Philosophiae in the Extractive Industry policy, Management and Regulations, held at the University of Pretoria. First and foremost, I would like to thank God the Almighty for his grace that carried me throughout in doing this dissertation, in him all is indeed possible. Secondly I thank the Epangelo Mining Company for granting me an opportunity to pursue my post graduate studies and the Pretoria Law Faculty for catering for me during my research work. I am very grateful for all my lectures from this Extractive Industry course. I also want to thank my supervisor Advocate Leonardus Gerber for the meaningful supervision, contributions and guidance on how to write this dissertation. I further thank my loved ones parents, sister and little Kevin for the moral support. Not to forget Uncle John for proof reading my draft final, King and my friend Bookie for the moral support. To the class of 2018, you guys are simply the best. Last but not least I would like to thank my beautiful girlfriend Josephine for the support, guidance and believing in us to pull of this master's degree.

ABSTRACT

The purpose of the study is to develop an optimal understanding of matters pertaining to quarrying aggregate in selected key regions in Namibia (particularly Erongo, Khomas, Oshana and Oshikoto), with the sole purpose of deducing its contributions to sustainable development. These will be achieved by firstly looking at the mining legislation surrounding the aggregate sector in Namibia and how it ensures that the sustainable development goals are addressed by the government and private companies or individuals that intend on doing aggregate quarrying operations. Although mining legislation will be analysed, the dissertation will not focus on legal analysis but rather more on the sustainable development of aggregate as natural resources.

Aggregate is known as being an industrial mineral or a construction mineral and it's defined by it, comprising of either sand, gravel and crushed rock. Demand for aggregate is driven by the construction industry, which involves of building houses, ports/harbours, airports, dams, bridges and shopping malls. The extraction of aggregate is subject to the regulatory regime governing the exploitation of mineral resources in the country. Secondly, aggregate quarrying has the potential to cause an impact on the environment and, so it is subject to environmental law. Thirdly, it involves the use of land and is, therefore, subject to land use planning regimes. Infrastructure development is one of the main objectives for developing nations worldwide of which sustainable development is the main contributor. The study concludes that the lack of distinct and clear legislative frameworks makes it harder for institutional custodians to execute the regulation of aggregate quarrying. This makes the journey ahead the aggregates contribution to sustainable development a long one with the current mining laws. In addition to this there is no official statistics in existence regarding aggregate production in the regions of study, which will help understand the contribution of aggregate sector to the economic, environmental and social aspects. Lastly, the author has listed recommendation for short and long-term purposes, as well as highlighting a potential area for further research.

LIST OF ACRONYMS

CoW – City of Windhoek

GDP – Gross domestic product

ECC – Environmental Clearance Certificate

EI – Extractive Industries

EIA – Environmental Impact Assessments

EMA – Environmental Management Act of 2007

MAWF – Ministry of Agriculture, Water and Forestry

MET – Ministry of Environment and Tourism

MLR – Ministry of Lands and Resettlement

MME – Ministry of Mines and Energy

MPRDA – Minerals and petroleum resource Development Act

TIPEEG –Targeted Intervention Program for Employment and Economic Growth

KEY DEFINITIONS

Biodiversity – A shortening of the term "biological diversity" meaning the diversity of life on Earth, the variability among living organisms and their interactions, both within species and between species, between ecosystems and across landscapes.

Geodiversity – Or geological diversity is the diversity of minerals, rocks, fossils, soils, land forms and geological processes that constitute the topography, landscape and the underlying structure of the Earth.

HDN – Historically Deprived Namibian as defined in the Affirmative Action (Employment) Act (Act No. 29 of 1998), refers to Namibian citizens, category of persons or community, disadvantaged by unfair discrimination before the Constitution of the Republic of Namibia, 1990, came into operation which should be representative of the demographics of the country**.**

Namibian – owned business – a business that is majority owned by Namibians. Once the New Equitable Economic Empowerment Framework becomes law, this term shall be defined as a company which is NEEEF compliant.

Quarry – is a place from which dimension stone, rock, construction aggregate, riprap, sand, gravel, or slate has been excavated from the ground.

Severed – mineral resource **that** has been mined out.

Small scale mining – is defined as a single unit mining operation with an annual production of unprocessed material of 50,000 tons or less.

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CHAPTER 1 – INTRODUCTION

1.1 Background

The (Constitution of the Republic of Namibia) Act No. 1 of 1990 Article 100 states that:

> *"Land, water and natural resources below and above the surface of the land and in the continental shelf and within the territorial waters and the exclusive economic zone of Namibia shall belong to the State if they are not otherwise lawfully owned".*

Furthermore, the report by KPMG (2014, p. 12) indicates that any extraction of the natural resource in Namibia is governed by the Minerals (Prospecting and Mining) Act 33 of 1992 "Minerals Act". It indicated that all mineral rights are conferred by the state as per section 2 of the Minerals Act:

> *"Subject to any right conferred under any provision of this Act, any right in relation to the reconnaissance or prospecting for, and the mining and sale or disposal of, and the exercise of control over, any mineral or group of minerals vests, notwithstanding any right of ownership of any person in relation to any land in, on or under which any such mineral or group of minerals is found, in the State".*

In light of the above, it is therefore clear that the Namibian government owns all natural resources, if not legally owned through the numerous mineral rights. With the above said the dissertation will not focus on legal analysis but rather more on the sustainable development of specific natural resources. Natural resources may consist of various groups of commodities that includes industrial minerals group which is mainly used for construction purposes. According to Anthony (1993), industrial minerals are well-defined as any rock, mineral or any other naturally arising substance of economic value but not used for its metallic, mineral and gemstone properties. Construction minerals are also known as industrial mineral group of commodities that comprises of other minerals like asbestos, clay, shale and limestone (Bull & Estrela, 2012). Industrial minerals can further be subcategorised as aggregate, which consists of a broad group of coarse particulate material used in the construction industry; this includes sand, gravel and crushed stone. It should be noted that aggregate constitutes a necessary and strategic component in the construction of roads, buildings, ports, railways and in the brick making factories (City of Windhoek's Policy towards Sustainable Sand Mining, 2017, P. 1).

During recent years, with rapid development there has been an increase in demand for aggregate as a source of construction material. In Namibia there is little information that governs the regulation

of aggregate. The main reason for this appears to be a grey area in the Minerals Act as it relates to aggregates. In other words, in what group of commodities does aggregate fall under for the purposes of regulation, seeing that silica sand is listed under industrial minerals group of commodities, yet gravel and crushed rocks are excluded from being defined as a mineral.

1.2. Aims and objectives of the study

1.2.1. Aims

The aim of the study is to develop an optimal understanding of matters pertaining to quarrying aggregate in selected key regions in Namibia (particularly Erongo, Khomas, Oshana and Oshikoto), in order to determine how aggregate quarrying contributes to the socio-economic development in Namibia.

1.2.2. Objectives

The main objective of the study is to analyse the mining legislation in Namibia, surrounding aggregate quarrying. This will focus on the regulation of the aggregate quarrying to ensure that socio-economic matters are address by the government authorities and private companies or individuals that intend on doing aggregate quarrying operations within the particular mentioned regions. In conclusion, recommendations will be made for the purpose of drafting the relevant policies to ensure appropriate procedures are followed by aggregate miners, and regulation procedures are monitored by various government ministries in order to meet the countries sustainable development goals.

1.3 Research Questions

1.3.1. Primary question

- To what extent does aggregate quarrying contribute to sustainable development in Namibia?

1.3.2. Secondary questions

- What constitutes, and distinguishes, aggregate resources?
- What is the legislative framework applicable to quarrying aggregate?
- What is the fiscal framework applicable to aggregate quarrying?
- What are the licensing procedures of acquiring aggregate quarrying rights?

- What are the environmental and socio economic impacts of aggregate quarrying?

1.4 Research Methodology

1.4.1. Method

The best way to answer the research questions would be by following the qualitative research analysis method. Therefore, the literature review will be based on the Namibian mining legislation and policies, aggregate mechanism, journal articles and internet sources pertaining to aggregate quarrying. Moving forward the findings will be compiled to discuss and reach a conclusion or have an understanding of issues revolving around aggregate quarrying. The research paper will review the following legislation in terms of the (City Of Windhoek's Policy towards Sustainable Sand Mining, June 2017) which states that the various legislation that is applicable to aggregate quarrying is Forest Act (No. 12 of 2001), the Income Tax Third Amendment Act 15 of 2011, the Labour Act 7 of 2007, the Environmental Management Act (Act No. 7 of 2007) the Minerals (Prospecting and Mining) Act (No. 33 of 1992) as well as the Charter For Sustainable and Broad-Based Economic and Social Transformation in The Namibian Mining Sector 2014-2020. In terms of aggregate mechanism research paper will look at the Anthony (1993 book titled Ore Geology and Industrial Minerals and other related sources.

1.4.2. Research parameters

The discussion areas were selected based on the major aggregate quarrying activities taking place in these areas due to infrastructure development at the time of writing.

1.4.3. Limitations associated with the research

The limited availability of data, with regards to aggregate quarrying in Namibia, will be the main limitation to be encountered during the research paper.

1.4.5. Mitigations

In regards to mitigating the limited resources on aggregate quarrying in Namibia, the study considers other African countries for ease of reference. The motivation for the selection is discussed in-text.

1.5. Relevance of Study

The (Namibian 5th National Development Plan, 2017, P. 113) under the economic progression pillar states that a sustainable transport system supporting a world-class logistics hub connecting SADC to

international markets should be constructed by the year 2022. This infrastructure construction to achieve national goals will require a massive amount of construction materials mainly aggregate for the transport and logistics system of Namibia. Therefore it is crucial to identify and understand the mineral regime surrounding quarrying of aggregate in Namibia.

The (City Of Windhoek's Policy towards Sustainable Sand Mining, 2017, P. 4) has mentioned that to date there has been several permits that have been issued for aggregate quarrying activities by the Ministry of Agriculture, Water and Forestry "MAWF" under the Department of Water Affairs and Forestry. Thus one argues if this is the only government department administering the permitting of aggregate quarrying and if there is others. The findings of the study will give a clear directive as to which government departments are responsible for issuing permits and regulating the quarrying of aggregate in Namibia. Therefore the research can form part of an important document for the construction companies or any other companies interested in quarrying aggregate in Namibia plus government authorities responsible for issuing and regulating natural resource mining rights. Furthermore, the paper will provide a summary of the environmental and socio-economic impacts associated with the quarrying of aggregate and why it is important for it to be regulated. In regards to the above mentioned, it will help the government authorities and private companies or individuals achieve the sustainable development of aggregate quarrying to foster economic growth.

1.6. Chapter overview

The thesis is divided into five chapters that will attempt to answer the primary and secondary questions. This **Chapter (Introduction)** has set out the background, aim, objection and research questions related to the study. Whereas **Chapter two (What is aggregate?)** focuses on two key aspects, firstly giving the characteristics of aggregate as a resource mineral and secondly, partially giving an overview of what the aggregate sector can contribute to sustainable development. The first aspect deduces the aggregates formation, the type, classification and its applications in the civil engineering and construction industry whereas the second aspect list's the key indicators linked to the dimensions of sustainable development which is economic, environment and social and states how they contribute to each dimension. **Chapter three (The regulatory regime governing aggregate quarrying in Namibia)** will investigate the main regulatory regime surrounding the mining sector with the aim of announcing the nature of mining, environmental and land use planning laws, which will than lead to the current licensing procedures applicable to the aggregate sector. The fourth **chapter (An analysis of the state of aggregate in Namibia)** gives a summary of the legislation discussed in chapter four and therefore linking it to what is applicable to aggregate quarrying. This will help answer the secondary question on the legislative framework applicable to quarrying

aggregate. **Chapter five (conclusion and recommendations)** of the study gives an overall conclusion on all the chapters which will than lead to recommendations on how to regulate the aggregate sector to achieve sustainable development.

CHAPTER 2 - WHAT IS AGGREGATE?

2.1. Introduction

This chapter aims at defining the characteristics of aggregate, by focusing on its formation, different types, its classification and lastly its applications in the civil engineering and construction industry. Since aggregate is a broad term, for the purpose of the study it will be defined as a combination of either sand, gravel and crushed rock similar to (Minnesota's Aggregate Resources Road To The 21st Century, 1998). This resource has played a major role in advancing engineering construction projects for the last 100 years (West & Cho, 2006).

The chapter provides a further investigation on how the aggregate quarrying sector deals with the three dimensions of sustainable development, which are economic, environmental and social. Chatterjee (Chatterjee, 2015) lists the key performance indicators of sustainable development as follows:

a) Economic indicators (e.g. GDP growth, gross export and import, mineral reserves, energy consumption, job income distribution and etc.);

b) Environmental indicators (e.g. groundwater reserve, waste water treatment, industrial and municipal discharge, rate of depletion of mineral resources, harmful emissions, use of agricultural pesticides, rate of erosion of top soil and etc.) and

c) Social indicators (unemployment rate, poverty ratio, male-female ratio, fertility rate, infant mortality, incidence of environment-related diseases, adult literacy rate etc.).

A series developed by International Council on Mining and Metals (2012, para. 4) emphasized that an understanding of mining's contribution to sustainable development indicators is the only way to help the industries specialists, general public and government policy makers and regulators to ensure mining and metals related policy development, decision-making and on the ground work performance is directed in the right direction. Accordingly, all Sustainable Development Indicators pertaining to aggregate quarrying in Namibia will be focused on in detail further in this chapter.

2.2. Aggregate as a Resource

2.2.1. What is aggregate

In order to define aggregate we would need to understand what is a rock. Humblet (Humblet, 2014-2015) defines rock as a solid aggregate of mineral grains, or a solid naturally occurring mass

composed of mineral grains, glass, altered organic matter, and combinations of these components. Aggregates are derived from different rock type's namely igneous, sedimentary and metamorphic rocks, of which formation encompasses of weathering, erosion and redistribution of the various rock types to form the primary aggregates or sediments (Colman, 2009).

Colman (2009, para. 5) described the formation of igneous rocks as molten magma that cooled and then rose because of its lower density than the surrounding solid rock, until it is either emplaced below the ground surface as an intrusion or erupted onto the land surface as lava. Good examples of such rocks include granites, basalt, Gabbro, dolerite and rhyolite. These rocks are hard, tough, and strong and are excellent aggregates. With sedimentary rocks the formation process involves accumulation of sediments at or near the earth's surface, whereby different minerals and other rock fragments from pre-existing rocks originating from oceanic basins are consolidated to form a solid rock by the pressure of younger overlying rocks that were deposited later (Humblet, 2014-2015). These rocks are identified by their bedded surfaces caused by successive layers of sediment deposited due to the paleo-currents of prehistoric sea or lake (Tucker, 2003), and the types of rocks are clay, limestone, dolomites, mud rocks, shale and sandstone that make up excellent to poor aggregate. The last rock type which is metamorphic rock is mainly made up of igneous or sedimentary rocks that have changed their original texture, crystal structure, or mineralogy composition due to physical and chemical conditions application of heat and/or pressure below the earth's surface. Good examples are marble, schist, slate, quartzite that are also excellent to poor aggregate material. All these above mentioned rock forming processes may form aggregates which can be extracted from quarries, mining pits, and from sea dredged materials (Miliutenko, 2009).

The above mentioned processes that bring about the destruction of rocks to form aggregates are explained below. Weathering is one of them and during this process rocks are broken down in two ways either by physical weathering or chemical weathering. Humblet (2014-2015) states that physical weathering requires agents like wind (aeolian weathering), water, and ice (glacial weathering) that carries particles to grind on the surface of the rocks to cause destruction. He provided the example of the Grand Canyon, were river waters cut through hard rocks and form V-shaped valleys that have steep flanks. Chemical weathering is not relevant to the formation of aggregates for a mere reason being that it involves weakening and subsequent disintegration of the rock. Whereas erosion involves the sediments being removed from their source area and this process is carried out by physical weathering agents.

Table 1: Listing the types of rocks and their respective composition sourced from the web (https://www.earthlearningidea.com/PDF/211_Roadstones.pdf).

Igneous rocks	**Main minerals**
Andesite	feldspar, hornblende, augite
Basalt	feldspar, augite
Dolerite	feldspar, augite
Gabbro	feldspar, augite
Granite	feldspar, quartz, mica
Rhyolite	feldspar, quartz, mica, volcanic glass
Obsidian	volcanic glass
Pumice	volcanic glass
Metamorphic rocks	
Marble	calcite
Gneiss	quartz, feldspar, mica, hornblende
Quartzite	quartz
Schist	mica
Slate	mica
Sedimentary rocks	
Flint	quartz
Limestone	calcite
Sandstone	quartz
Greywacke	quartz, feldspar, clay minerals
Shale	clay minerals

The quarrying of aggregates entails various processes, according to Langer, Drew, & Sachs (2004) the methods depend on whether the material being excavated is sand and gravel or crushed stone, the natural conditions of the site, the desired final product, and the preference by operator. Gbeve (2013) further states that in most situations stone is obtained in open quarries, whereby it must first be drilled and blasted. In addition to this, it should be processed and it is mostly done in remote locations utilizing a portable crushing and screening machines, or by a plant consisting of a large amount of complex equipment connected by a network of conveyor belts. The initial stage for aggregate quarrying is the removing of overburden top soil by using a hydraulic excavator to expose the stone, the exposed hard rock is than blasted to break it into small fragments of different sizes (Mitchell, 2007). Figure 1 indicates the process after blasting which involves excavator load truck carrying the blasted rock through to several stages, firstly the primary crusher, than its transported by the conveyer belts to the secondary crusher for further crushing, than to the tertiary crushers. It is during this process that causes the environmental issues like dust and noise from the vibrating

machines and haul trucks (Mitchell, 2007). Before delivery the material needs to go through screening which separates small granular substance particles from larger ones (J.F. Sullivan, 2012).

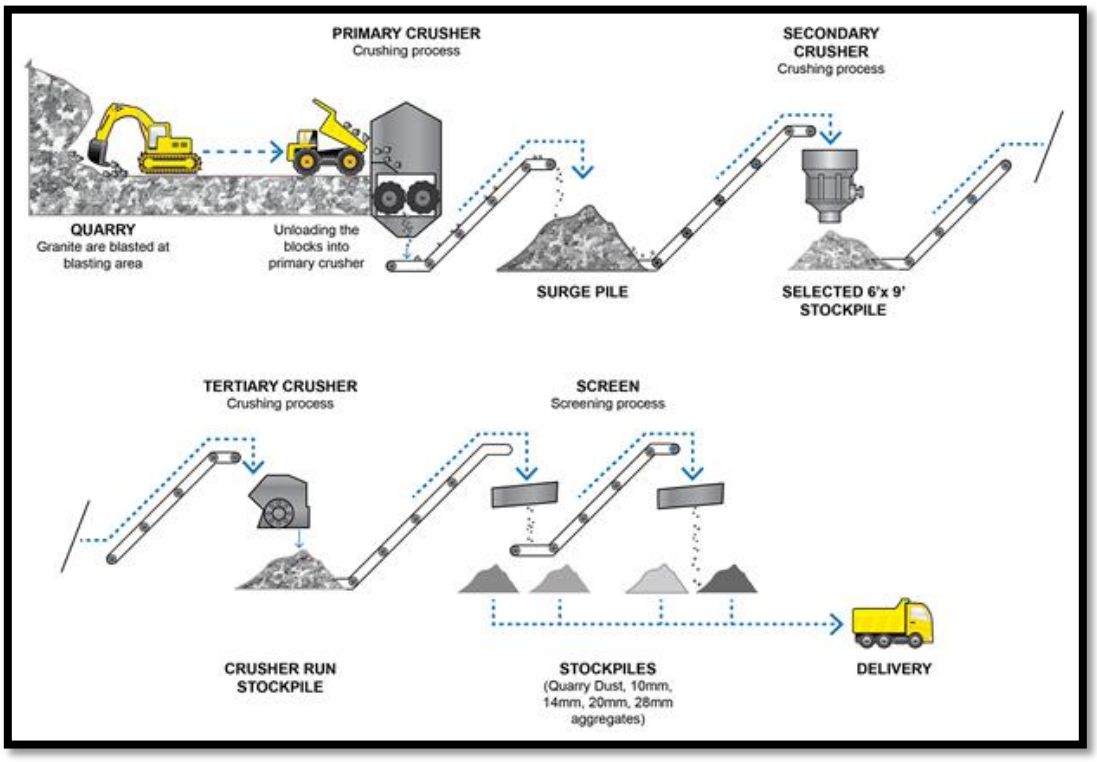

Figure 1: Illustration of the aggregate production process sourced from (http://www.cima.com.my/process_aggregate.aspx).

In regards to quarrying sand and gravel there are various methods, Madyise (2013, P. 13) stated that dry pit quarrying is a method used when sand is extracted above water table from a dry stream bed and exposed bars using conventional bulldozers, scrapers and loaders. Wet pit quarrying involves extraction of sand and gravel from below water table stream channel or a perennial river using hydraulic excavator or dragline. Dewatering can be done in advance to allow easy excavation though this depends on deposit thickness, permeability of the ground as well as after use and restoration requirements. Bar skimming or scalping is a method used when only the top layer of soil is removed by scraping without excavating below summer water table which is the level of underground water in summer season.

2.2.2. Types of Aggregate

The known three classifications of aggregates are according to its originality, though it can be further classified into numerous types primary/natural aggregates, secondary/synthetic aggregates and recycled aggregates.

a) Primary/natural aggregates

A presentation by Al-Neshawy (n.d.) for the Aalto University School of Engineering states that primary/natural aggregates mainly contains rock fragments that are used in their natural state if not they are either used after mechanical processing such as crushing, washing or sorting. According to Miliutenko (2009) these aggregates are extracted from the geological deposits mainly natural occurring mineral deposits, these include all those types of fine and coarse aggregates, that are available in almost ready to use form, from natural resources examples sands and gravel from river beds and river banks, crushed rock aggregate which is derived from a hard strong rock i.e. igneous, sedimentary and metamorphic rocks that has been crushed.

b) Secondary/synthetic aggregates

The published document by the British geological survey (2013) says these aggregates are acquired as a by-product from industries in the non-construction sector from mining operations and quarrying, may also include materials obtained as wastes from some other industries i.e. metallurgical engineering operations, coal-fired power station ash and blast furnace/steel slag which possess suitable properties for being used as aggregate made from industrial by-products and slag that is a thermally processed material.

c) Recycled aggregates

The source of these aggregates is from two primary sources namely (a) road construction and maintenance debris, and (b) structural construction and demolition debris (for example, from demolished buildings, bridges, and airport runways) (Wilburn & Goonan, 1998). Other forms may include burnt clay, removing asphalt from roads by planing, excavations, utility operations, shales, vermiculite's and perlite they are specifically manufactured for use in making quality concretes. Making them essential ingredients of lightweight concrete which forms a special class type of aggregate (British geological survey, 2013).

Figure 2: Illustration of the types of aggregate according to particle sizes (the hammer is for scaling purposes) sourced from (Langer, Drew, & Sachs, 2004).

The aggregates can be further dividend into particle sizes and their unit weights which allows it to be used for different purposes in the construction industry. According to an article titled (Roadstone - which rock? Investigating the best rock type for the wearing course of roads, n.d.) roads are made of crushed rock fragments of various types of rock aggregate from quarries and the rock type has to be carefully chosen so that it has suitable properties for the construction of roads. This properties may involve particle size which is classified by two categorise fine aggregate that is mainly sand derived from pitted natural loose materials, beach sands, dune sands, by crushing rock or by crushing artificial materials such as slag see. Coarse aggregate can be gravel that may occur naturally i.e. glacial, alluvial, beach or marine gravels and it can pitted from the sea bed, pit, river or lake similar to sand (Al-Neshawy, N.d.). Crushed rocks also form part of coarse aggregates formed when rock rubbles of different rock types are mined and have been later crushed and screened. Coarse aggregate has rock particles of $> 5mm$ diameter whereas the fine aggregate has rock particles of $< 5mm$ diameter. Industrial usage separates coarse and fine aggregates since they are used for different purposes (Evans, 1993).

Different types of aggregates pose as a crucial resource for infrastructure development undertakings, such as in concrete production and road construction see figure 3. According to the British Geological Survey (2013) document states that construction aggregate's suitability for a particular purpose mainly depends on its physical and mechanical properties, and in some

applications mineralogical or chemical properties are also important. It also stipulates that high strength and durability with low porosity aggregates are generally required.

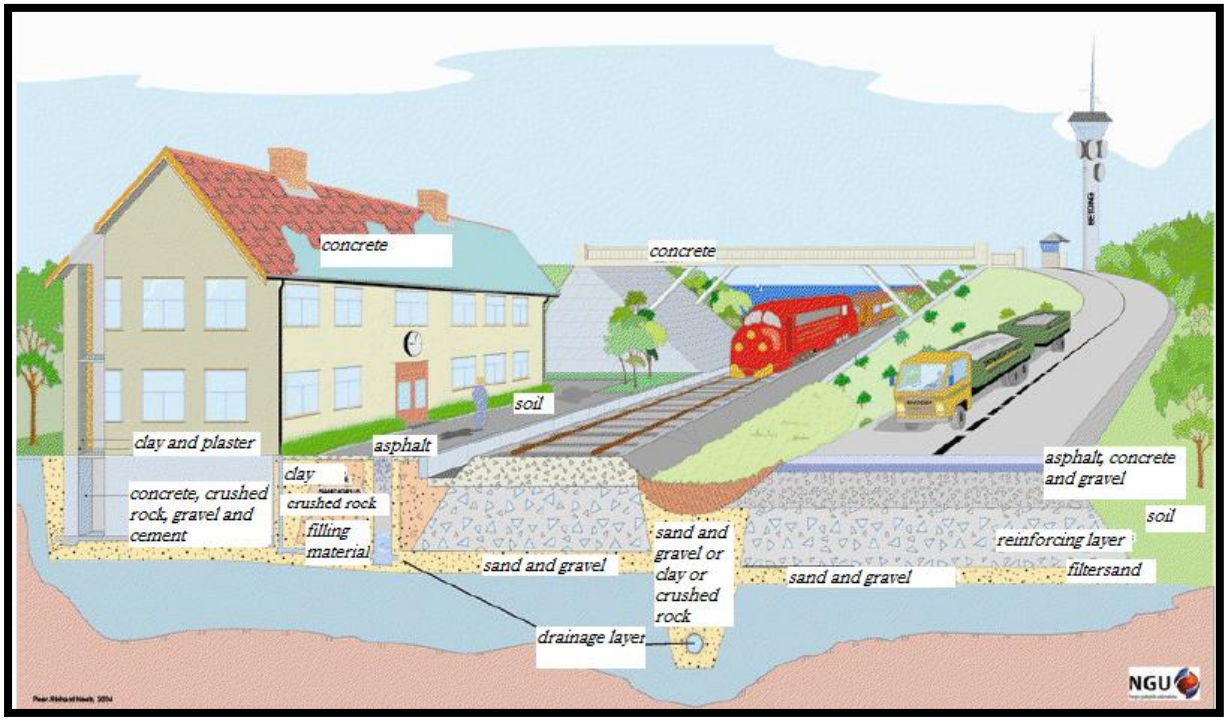

Figure 3: Image showing different kinds of examples of the major consumptions of aggregate in the construction industry (translated after S. Miliutenko, 2009).

A report by the Ad Hoc Aggregate Committee (Minnesota's aggregate resources road to the 21st century, 1998) states that aggregate is a vital raw material used by construction industry and a number of related industries to produce higher value products see figure 3. Evans (1993) says that aggregates must be tested carefully to assess their suitability for various functions. They can be tested for resistance to heavy loads, high impacts and severe abrasion, together with durability which are all important. If they are to be embedded in bitumen or cement they must react favourably with them.

Aggregate materials in Namibia are used in many industries, such as:

- Road construction and rehabilitation
- Railway construction and rehabilitation
- Construction of national ports/harbours
- Construction, expansion and rehabilitation of national Airports
- Construction of concrete structures (dams and bridges)

- Construction industries (building houses and shopping malls)
- Brick making industry

2.3. Sustainability aspects related to aggregate quarrying

2.3.1. Economic

The economic indicator as a sustainability aspect looks at the gross domestic product growth, gross export and import, mineral reserves, energy consumption, job and income distribution etc. According to Bhagwat (2016) the main benefit to the growth of an industry is that it creates jobs, simply because the payroll is a direct economic benefit. In addition to the direct benefits, there is secondary or an indirect benefit that involves goods and services purchased from providers which help create more jobs and more wealth to the economy. These, along with the primary benefits, contribute value to the economy through consumption of food, clothing, appliances, cars, and houses. This leads to the requirement of services such as schools, hospitals, police, firefighters, and many others, to maintain the infrastructure. Altogether, the direct and indirect contributions to the economy are called multipliers see figure 4.

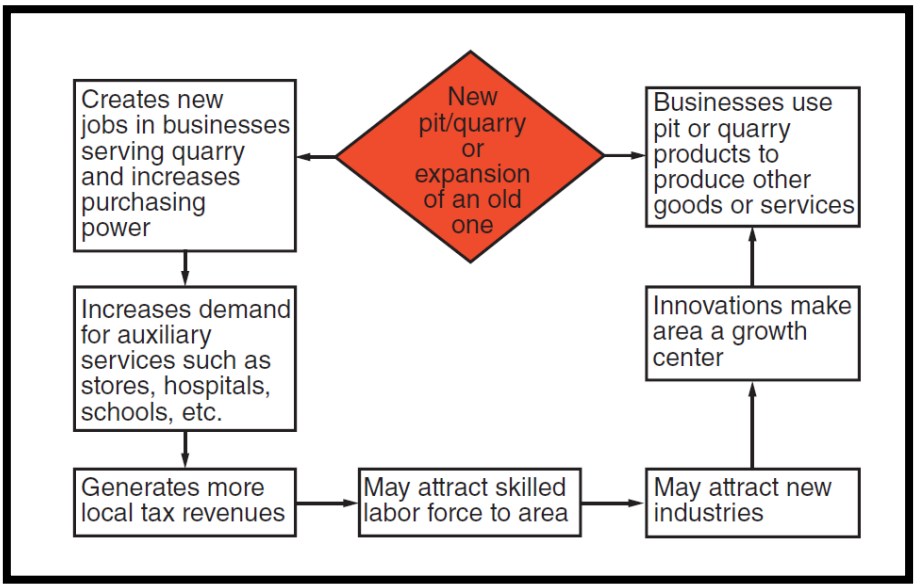

Figure 4: Representation of how the economic multipliers work sourced from (Bhagwat, 2016, Pg. 5).

For a mine/quarry to start operation and create jobs it has to go through a few stages and at each stage it will require certain skills before heading into production. Figure 5 shows the mine/quarry project life cycle from exploration stages which leads to the discovery of the ore reserves, as well as decades of the mine/quarry construction phase which than leads to operations and rehabilitation

before mine closure. During all the above mentioned phases more than one company will likely be involved due to the different expertise needed and the host community as well. It should be noted unlike mining minerals for their metallic purposes aggregate quarries requires less capital for operation since there is not much capital that goes into buying expensive underground machinery, hence it also opens up an opportunity to small scale miners (Motsie & Muravha, 2012).

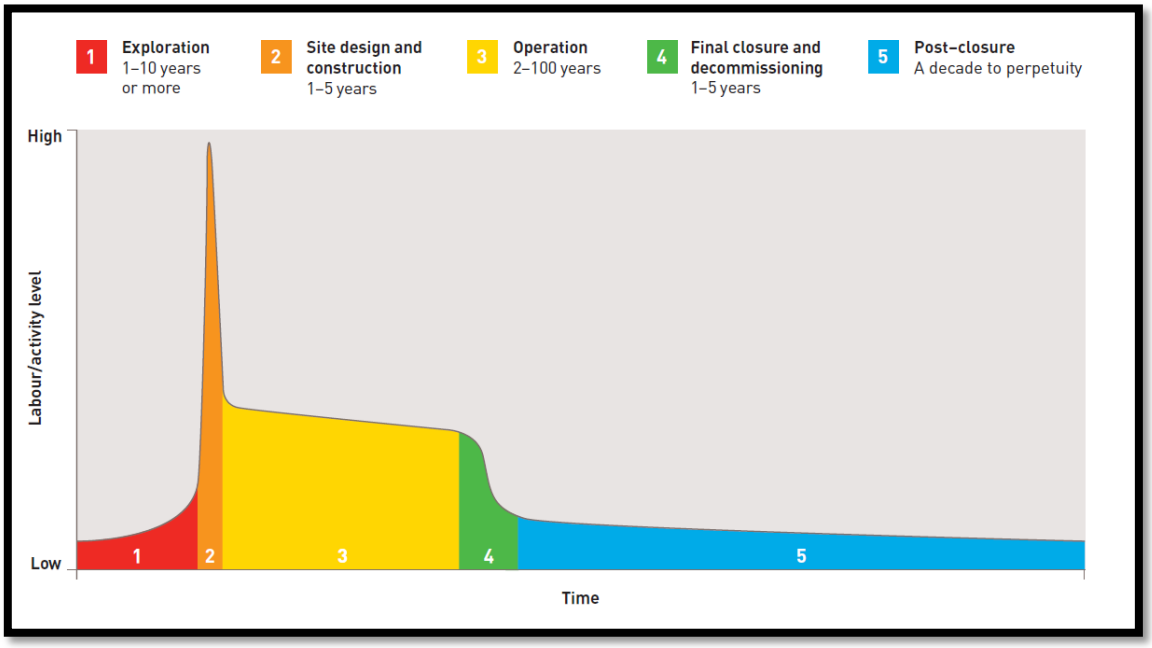

Figure 5: Illustration of the mine project life cycle sourced from (International Council on Mining and Metals, 2012).

Mineral aggregates have played a major role in advancing engineering construction projects for the last 100 years (West & Cho, 2006). Most African countries are still developing and mostly sustain economic development from their natural resources like sand and gravel (Madyise, 2013). The economic aspects of aggregate quarrying in developing countries will be looked at further on in the study based on available data for production or employment figures. Bhagwat (2016) mentioned that even though there is some limitation of the data being available due to some commercial operators and most operators being seasonal and do not report. Further gave a reason that small private aggregate operations are side businesses mainly between landowners and construction contractors for instance, that will generally not require permits and thus remain unreported.

2.3.2. Environmental

The extraction of aggregate does not only have economic sustainable factors but it does come with environmental concerns too. The extraction of aggregates mostly takes place in open pits and

quarries (Bhagwat, 2016). The extraction process is associated with potential environmental impacts of aggregate production by geologic, hydrologic, vegetative, climatic, and man-made characteristics of an area (Motsie & Muravha, 2012). These have damaging effects on the environment and equally it can contribute to biodiversity conservation. Operations need to be carefully planned and operated in order to minimise adverse effects on biodiversity and geodiversity, whereas maximising the optimistic ones (Purkess, n.d.). The potential impacts are long term conflicts of land use and change in geomorphology because pits and quarries remain open long after extraction of aggregates has ceased (West & Cho, 2006). It is further stated that in some of the cases ground water levels were lowered by enhancing quarrying operation by pumping water as secondary effects, such as surface settlement and the occurrence of underground collapse as a consequence. Gbeve (2013) added that they destroyed ecosystems and source water aquifers are irreplaceable because it is not a temporary land use and bears permanent negative impacts.

Ironically, the very items built with the mined materials are homes, commercial and industrial buildings, roads, and highways finally approach the quarries sites as cities grow and the development of suburbs. When this happens, the location of mines near human habitation becomes undesirable because of the truck traffic, leading to increased dust, noise, and vibrations; the visual impaired of quarrying operations, physically disturbed landscapes and habitats (Motsie & Muravha, 2012). Particularly in the densely populated north-eastern countries like Illinois, this phenomenon has resulted in the closing down of quarries and pits over decades and the concentration of more production from fewer remaining operations (Bhagwat, 2016). These remaining operating mines cause disruption to the environment from going deeper for deposits and are often limited by housing right at their edges. Eventually, the deep and closely encircled pits and quarries will stop to operate, either because their reserves are exhausted or because public opinion does not permit continued operation.

An article in The Namibian newspaper titled ‘Sand mining affects food security author Kahiurika (Kahiurika, 2018), a traditional leader Seth Kooitjie and Minister Shifeta commented and I quote:
“We need the stronger arm of the government, and we need them to help us control the Natural resources. Not only sand, but also the environment must be protected”. Minister Shifeta “denounced illegal sand mining, saying it has negatively affects government plans on attaining food security”. With this said the quarrying of aggregates in Namibia is a raising concern for the environment and it will be addressed in the later chapters.

2.3.3. Social

Tiainen (2012) in her thesis, titled "A case study on social sustainability in the Kyrgyz mining industry", outlines that steps towards sustainability must be able to accommodate the individual characteristics of the surrounding society and must be the catalyst of economic wealth by being the purpose of the mineral sector. The thesis further argues that there has been less research on the social sustainability until recent years, although it is an equivalent part compared to the above mentioned parts in sub-sections 2.3.1. and 2.3.2. Social sustainability is more of a prerequisite for achieving sustainable development, by this it means that by overlooking at social issues can obstruct compliance with economically and environmentally sustainable practices and thus, it needs more attention to more quickly gain sustainable development in the future. Littig & Grießler (2005) came up with a definition that is applicable for both developing and developed countries, and puts more emphasizes on work, nature and social needs see figure 6. They define social sustainability as:

"Social sustainability is a quality of societies. It signifies the nature-society relationships, mediated by work, as well as relationships within society. Social sustainability is given, if work within a society and the related institutional arrangements satisfy an extended set of human needs and are shaped in a way that nature and its reproductive capabilities are preserved over long period of time and the normative claims of social justice, human dignity and participation are fulfilled".

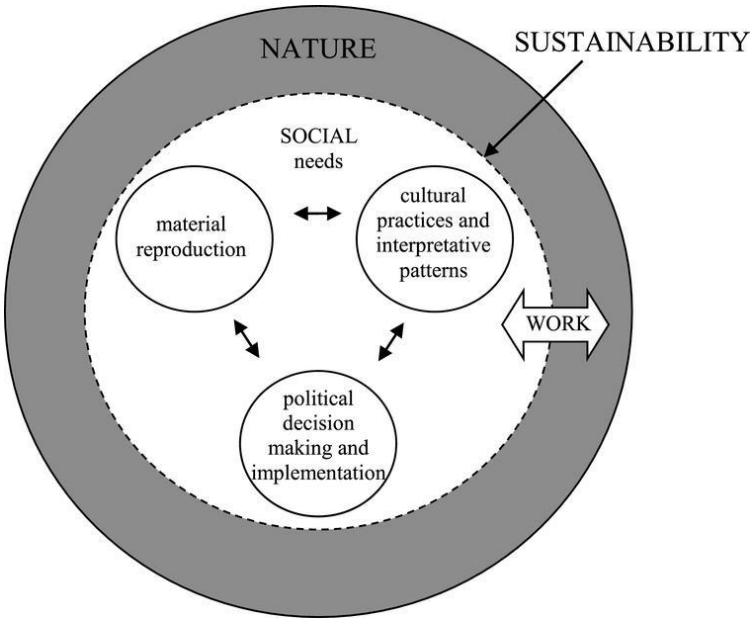

Figure 6: Schematic Portrayal of Sustainable Development and the Relationships between Society and Nature sourced from (Littig & Grießler, 2005).

The sociocultural constraints affecting the aggregate industry are highly intense in developing areas with increasing population density and rapid changes in land use and residential development, are generally driven by public concerns and perceptions about quality of life, health, value of property, aesthetics, environmental quality, and the zoning and regulatory environment according to Nea (Nea, 2012).

Quality-of-life concerns include noise, dust, traffic congestion, and deterioration of highways and bridges due to heavy truck traffic. Aggregate quarrying operations have a variety of noise sources, some of which are mobile and tend to vary as quarrying progresses over the years. Common noise sources to which people object include heavy trucks, other heavy equipment and blasting. Mining and transportation activities create dust that is generally regarded as a nuisance and a possible health hazard. To mitigate some of these problems, the natural aggregate industry has developed guidelines that specify a variety of site management techniques and technologies for noise and dust abatement (Barksdale, 2000).

Property concerns generally involve damage to structures, loss of water supply, land subsidence or other ground failure, and loss of property value due to proximity to quarrying operations. Structures have been reported to have been damaged by ground shaking during blasting in a nearby quarry. Poorly managed quarrying of aggregate can disrupt the groundwater system, causing changes in groundwater flow, yield, and quality. Under certain conditions, land subsidence and slope failures can occur in the vicinity of quarrying operations, causing damage to nearby properties. Aggregates are used in construction to provide drainage, protect pipes, and to provide hard surfaces (Al-Neshawy, n.d.). Although aggregate resources are important to the overall economy of an area, some communities have concerns that living in proximity to an active aggregate production site will depress the value of residential property (Robinson, Jr & Brown, n.d.).

2.4. What distinguishes aggregates from other resources

We may have talked about aggregate being a mineral resource used as a construction mineral, which is derived from different rock types but we really haven't distinguished it from other resources in the mining industry. Although it is a mineral, according to Gbeve (2013) aggregate is known to be a non–fuel mineral resource in the United States and the World in terms of volume and value in comparison to other minerals. Mary Bull & Cory Estrela (Bull & Estrela, 2012) defines it as a natural occurring material which is a non-metallic ore that is quarried instead of the metallic ores such as copper, gold, iron or zinc. Unlike the mining of minerals for their metallic properties which is sensitive to change due to world markets since most of the mined products are exported internationally were the prices are set according to a report by Simonis Storm Securities (2006)

aggregate prices is mainly affected by the aggregate material needed annually to maintain and construct roads, develop infrastructure, support building and construction projects, and for use in industrial applications in the country (Minnesota's Aggregate Resources Road To The 21st Century, 1998). The report further noted that aggregate demand is closely tied to economic indicators. As such, the aggregate industry is subject to cyclic swings in demand.

2.5. Conclusion

The aim of this chapter was to clarify three things. The first thing is defining the word aggregate, of which section 2.2 denotes it as a natural occurring rock material, formed through various rock forming cycles and later crushed, graded and washed during production. This research focuses on the definition of aggregate as normal weight aggregate, which includes sand, gravel and crushed stone used for industrial purposes. The sub-sections looked at the different processes involved in the production of aggregate and the different types that are determined according to the originality as well as the application of the resource in the civil engineering and construction industry. The second part looked at the sustainable development indicators of the economic necessity of the mineral resource in fostering economic growth, the environmental concerns pertaining to mining and its damages to human living conditions if quarries and pits are located near human habitation. The last part mainly focused on what separates the aggregate mineral from other mined minerals focusing on its properties as well as on the supply, demand and market price influences. The following chapter will focus on the legislative framework that governs mining in Namibia mainly looking at mining laws, environmental laws as well as land use planning laws.

CHAPTER 3 – THE REGULATORY REGIME GOVERNING AGGREGATE QUARRYING IN NAMIBIA

3.1. Introduction

As it was noted in Section 1.1. of the study, Namibia's mining sector is governed by limited legislation. The primary legislation that deals with all mineral resources regulation is the Mineral (Mining and Prospecting) Act 33 of 1992 ("Minerals Act") in addition to this there is the Diamond Act 13 of 1999 ("Diamond Act"), Charter For Sustainable and Broad-Based Economic and Social Transformation In The Namibian Mining Sector 2014-2020 ("The Namibian Mining Charter") and the Minerals Policy of 2003 ("Minerals Policy"). Not to forget the fiscal regime and the health and safety laws governing the Extractive Industry "EI" which are governed by the Labour Act 7 of 2007 and the Tax Third Amendment Act 15 of 2011.

Other laws that play an important role within the mining sector as well are the environmental and the land use planning legislation. Therefore the chapter aims at looking at the different types of authorities that governs mining within Namibia. In terms of aggregate quarrying, the regulatory regime governing it will also be looked at later in the chapter. As aggregate is not well defined within the Minerals Act this paper will look at other local, national or international laws which can effect or prohibit any activity undertaken by operating quarries for aggregate. In summary the primary objective of this chapter is to establish the existing procedures in place to acquire permits for the extraction of aggregate within mined pits and quarries.

3.2. The general Legislative Framework governing mining in Namibia

3.2.1. Mining laws

Before the independence of Namibia, the mineral regulation and its administration was governed by the South African government that took over from the German colonial, in the 1915 (Lupalezwi, 2014). This was done through Section 2 (1) of the previous Mines, Works and Mineral Ordinance of 1968 which conferred all the Mines regulation during the South African time. After gaining independence on 21st March 1990, the legislature immediately revised and passed new mining legislation rights that replaced the colonial legislation (Berg, 2009). In post independent Namibia, the ownership of un-severed minerals belonged to the state according to the Constitution of the Republic of Namibia Act No. 1 of 1990 Article 100. The Constitution of the Republic of Namibia allows the government to practice vesting all natural and mineral resources in the state by giving a full expression to the principle of permanent sovereignty over natural resources. In addition to the

Constitution of the Republic of Namibia's article 100, the Minerals Act Section 2 further clarifies on the position of state on its natural resources.

In terms of mining rights, the Minerals Act gives the state power to grant mineral licenses to an applicant for mining activities through six types of licences namely an Exclusive Prospecting Licence, Mining Licence, Mineral Deposit Retention Licence, Mining Claim, Non-exclusive Prospecting License and Reconnaissance License (Lupalezwi, 2014). The report by (Legal Assistance Centre, 2009) highlighted that by vesting all of Namibia's prospecting and exploitation rights in the State, the powers are given to the Minister of Mines and Energy to grant licenses. This gives the Minister the authority to appoint a Mining Commissioner to assist in the licensing process. A mining journal special publication titled Namibia by the (Geological survey of Namibia, 2005, P. 3) elaborated more on the above mentioned licenses as follow:

a) **Mining Claim (MC):** Will be available only to Namibian citizens for the development of small-scale mines and mineral deposits, mining claims are valid for three years. Two year extension periods are possible provided that the claim is being developed or worked.

b) **Reconnaissance Licence (RL):** Are designed for regional, mainly remotely-sensed exploration, a reconnaissance licence is valid for six months on a non-renewable basis. This licence facilitates the identification of exploration targets and is only exclusive in special cases.

c) **Exclusive Prospecting Licence (EPL):** This three-year licence allows systematic prospecting in areas of up to 1,000 km2. It gives exclusive exploration rights to the land and may be extended twice for two-year periods if demonstrable progress is shown. Renewals beyond seven years require special approval from the Minister.

d) **Mining Licence (ML):** This gives the holder the exclusive mining right in the licence area for a period of 25 years or the life of the mine, with renewals valid for 15-year periods. The holder is required to demonstrate financial and technical ability to develop and operate a mine. A mining licence also gives the holder the exclusive right to approve the development of other mines on the same property.

e) **Mineral Deposit Retention Licence (MDRL):** This allows, in certain circumstances, an exploration company to retain tenure on a prospecting licence, mining licence or mining claim without mining obligations. It is valid for five years, with two-year renewal periods. The licence-holder must, however, meet work and expenditure obligations and submit regular project reviews.

f) **Non-Exclusive Prospecting License (NEPL):** Allows a person or company to prospect anywhere in the country including privately owned farms, with the sole exclusion being closed areas such as game reserves. An NEPL lasts for one year, and holders often peg a mining claim onto the NEPL in order to continue prospecting or mining activities.

For all mineral licenses, the applications must be made on forms available at the Ministry of Mine and Energy and accompanied by payment of the license fee (Legal Assistance Centre, 2009). The above minerals rights allow interested applicants to gain access to participating in ownership of minerals in the Namibian mining industry. In addition, depending on the particular mineral license applied for, information regarding existing environmental conditions and the potential for environmental degradation resulting from prospecting or mining operations must be disclosed (Legal Assistance Centre, 2009). In the next sub-section we will be investigating the legislation governing the environmental degradation.

In addition to the mining laws the EI activities are subject to fiscal regime, health and safety. The fiscal regime is the ability of a government to efficiently collect taxes, royalties, duties, and other revenues (Alba, 2009). In many countries, it is known that small scale mining is labour intensive and hazardous which my lead to health and safety risks (Lu, 2012). Author also mentioned that the common occupational health and safety problems within the small scale mining are because of the lack of awareness in the risks of mining coupled with lack of education and training. Lex Africa, (Lex Africa, N.d.) mentioned that health and safety regulations are governed by the Labour Act 7 of 2007, whereas the fiscal instruments are governed by the recent amendment to the Income Tax Act 24 of 1981 (the Income Tax Third Amendment Act 15 of 2011) which introduces a tax on income in Namibia, from the selling of a mineral rights to explore, mine, or retrieve natural resources. This may include the generation of income from the sale of shares in companies that hold such a right. This tax is mainly based on the income of the companies made within Namibia and this basic corporate tax is 34% (Nea, 2012). Alba (2009) stated that these taxes apply to all other sectors of the economy and include taxes that are specific to the petroleum and mining industry. The table below indicated all the relevant mining tax regimes in Namibia.

Table 2: listing the mining tax regimes in Namibia sourced from chamber of mines website (http://www.chamberofmines.org.na/index.php/mining-tax-regime/).

Description	Rate/Remarks
Corporate tax rates	32% - 55%
Royalties on industrial minerals (fluorspar, salt, etc.)	2%
Royalties on non-nuclear fuel materials	2%
Royalties on oil/gas	5%
Corporate tax on oil/gas	35%
Tax holidays	None
Value added tax	15% (see text)
Non Resident Shareholder's Tax (NRST)	20%
NRST-if a Non-resident recipient of dividends is a company which holds at least 25% of the capital of the Namibian company paying the dividend.	10%
Withholding tax	10%
Land tax (on valuation)	Namibian citizens - 0.75%, Foreign Nationals – 1.5%
Provincial taxes	None
Municipal taxes	Services(Rates on Services)
Exploration & Mining Licence Fees	Yes, schedule available from the office of the Mining Commissioner
Surface rent	To landowner, on mutual compensation agreement
Mineral ownership	Vested in the State
Training Levy	1% of payroll

The National Water Policy White Paper (2000) says that water is fundamental to all social and economic activities and is an essential to all food production and agricultural activity including livestock, and plays a part in every industrial process notably mining. Hence the need to regulate water resources, practically the only legislation making reference to sustainable water use at present is the Namibian Water Corporation Act of 1997 (Blackie & Tarr, 1999).

3.2.2. Environmental laws

The environment comprises of all the living and non-living elements, in short this means the environment comprises of the physical context in which elements are located (Pietrzela, 2013). Furthermore, it should be noted that the environment is susceptible to be affected by any change in the physical context which will than hider the living and non-living elements. Therefore it is important to have laws in place in order to protect our environment (Pietrzela, 2013).

In Namibia the environment is protected from prospecting and mining within protected lands through a number of laws and policies (Legal Assistance Centre, 2009). The report further outlines that even though part of the law and policies are not judicially enforceable, the Constitution of Namibia also provides for a constitutional provision on the protection of the environment. These laws and policies consist of non-legal binding laws as well as the statutory laws which will be denounced later in this sub section.

Some of the relevant statutory laws can be found in the Namibian Constitutional Act No. 1 of 1990, which has provisions in terms of the environmental laws that includes the following articles:

a) Article 91 of the Constitution of the Republic of Namibia (1990)

The Ombudsman shall have "the duty to investigate complaints concerning the over-utilization of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia.

b) Article 95 of the Constitution of the Republic of Namibia (1990)

The State shall actively promote and maintain the welfare of the people by adopting policies aimed at the maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future; in particular, the Government shall provide measures against the dumping or recycling of nuclear and toxic waste on Namibian territory.

c) Article 100 of the Constitution of the Republic of Namibia (1990)

Land, water, and natural resources below and above the surface of the land and in the continental shelf and within the territorial waters and the exclusive economic zone of Namibia shall belong to the State if they are not otherwise lawfully owned.

Since the Namibian constitutional act no. 1 of 1990 does not provide much guidelines on the environmental laws as it can be seen in the above articles, the government since independence tried coming up with new ways to regulate environmental concerns. The government adopted the

environmental assessment policy (environmental policy) in 1994, policy for prospecting and mining in protected areas and national monuments (1999) and the Environmental Management Act Of 2007 "EMA". The environmental policy serves as a non-legal binding document for the environmental assessment process and requires applicants implementation environmental management through the proper execution of Environmental Impact Assessments (EIAs) (Stanford law school, striking a better balance: an investigation of mining practices in Namibia's protected areas, 2009). Specifically, it identifies "mining, mineral extraction, and mineral beneficiation" as activities requiring EIAs. (Stanford law school, striking a better balance: an investigation of mining practices in Namibia's protected areas, 2009) reports that the Policy for Prospecting and Mining in Protected Areas and National Monuments (1999) (Mining Policy) establishment was aimed at allowing prospecting and mining in the national interest of Namibia in accordance with the Minerals Act of 1992 within protected areas.

Additionally, it should be noted that there are other important environmental policies, the table below shows the most relevant policies in terms of environmental protection in Namibia; although many have an indirect impact on the environment they are still considered important (Ruppel & Schlichting, 2016).

Table 3: list of the environmental policies in Namibia sourced from (Ruppel & Schlichting, 2016).

Environmental Policies in Namibia

Environment and Wildlife
- Namibia's Environmental Assessment Policy
- Policy for Prospecting and Mining in Protected Areas and National Monuments
- National Policy on Human Wildlife Conflict Management

Water and Fisheries
- Water Supply and Sanitation Policy
- The National Water Policy
- Namibia's Draft Wetland Policy
- Namibia's Aquaculture Policy – towards responsible development of aquaculture

Agriculture
- The National Agricultural Policy
- The National Drought Policy and Strategy
- The Regional Planning and Development Policy
- The National Seed Policy

Land
- Land-use Planning: Towards Sustainable Development
- The National Land Use Planning Policy
- The National Land Policy
- The National Resettlement Policy
- The National Land Tenure Policy

Climate Change
- Namibia's Climate Change Policy

Forestry
- Namibia Forestry Strategic Plan
- Development Forestry Policy

Tourism
- The Tourism White Paper
- The Draft National Tourism Policy
- The Community–Based Tourism Policy
- Revised Draft Tourism Policy

Biotechnology
- Enabling the Safe Use of Biotechnology Policy

According to Ruppel & Schlichting (Ruppel & Schlichting, 2016) EMA is the important statutory tool in terms of safe guarding the environment in Namibia. In terms of EMA in particular Section 2 provides that the objective of the act is to prevent and mitigate environmental impacts, on the basis of the principles set out in Section 3 as listed here below, there are:

a) Ensuring that the significant effects of activities on the environment are considered in time and carefully;

b) Ensuring that there are opportunities for timeous participation of interested and affected parties throughout the assessment process; and

c) Ensuring that the findings of an assessment are taken into account before any decision is made in respect of activities.

Ruppel & Schlichting (Ruppel & Schlichting, 2016) stated that EMA stimulates equality in the exploitation of all natural resources by allowing consultation and EIA to be done whereby communities, relevant regional and local authorities are involved in the monitoring of projects that may have effects on the surrounding environment. Further statements are that Section 38 in EMA stipulates that reviewing of the EIA will be done by the Environmental Commissioner and if necessary external expertise will be sough before he makes a final decision in the awarding of the ECC (Stanford law school, striking a better balance: an investigation of mining practices in Namibia's protected areas, 2009). A draft was made in 2008 on the Procedures and Guidelines for Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) see below figure 7 for the EIA procedures.

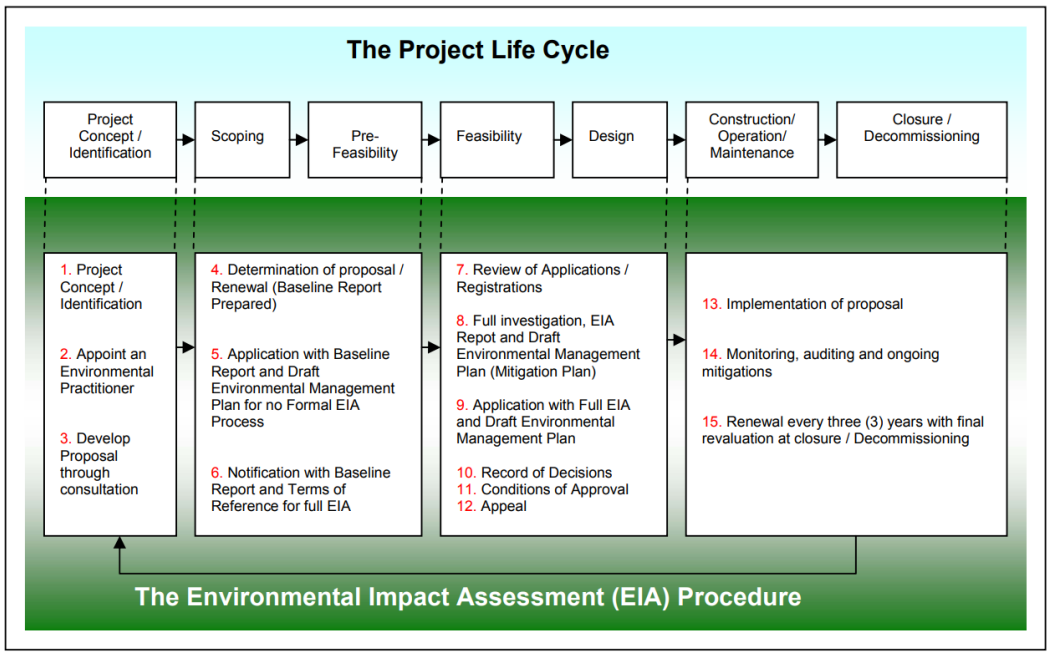

Figure 7: image showing the flow chart of the environmental impact assessment procedures sourced from Draft procedure and guideline for EIA and EMP, by (Ministry of Environment and Tourism April 2008, P. 6).

Table 4: List of some of the applicable statutory laws on the environment for Namibia sourced from (Ruppel & Schlichting, 2016, P. 6)

Selected Environmental Legislation in Namibia

- Agricultural (Commercial) Land Reform Act No. 6 of 1995
- Agricultural Pests Act No. 3 of 1973
- Animals Protection Act No. 71 of 1962
- Atmospheric Pollution Prevention Ordinance No. 11 of 1976
- Atomic Energy and Radiation Protection Act No. 5 of 2005
- Biosafety Act No. 7 of 2006
- Communal Land Reform Act No. 5 of 2002
- Controlled Game Products Proclamation No. 42 of 1980
- Diamond Act No. 13 of 1999
- Environmental Management Act No. 7 of 2007
- Environment Investment Fund of Namibia Act No. 13 of 2001
- Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act No. 36 of 1947
- Forest Act No. 12 of 2001
- Game Products Trust Fund Act No. 7 of 1997
- Hazardous Substances Ordinance No. 14 of 1974
- Inland Fisheries Resources Act No. 1 of 2003
- Livestock Improvement Act No. 25 of 1977
- Marine Resources Act No. 27 of 2000
- Minerals (Prospecting and Mining) Act No. 33 of 1992
- Mountain Catchment Areas Act No. 63 of 1970
- Namibia Wildlife Resorts Company Act No. 3 of 1998
- National Fishing Corporation of Namibia Act No. 28 of 1991
- National Heritage Act No. 27 of 2004
- Nature Conservation Ordinance No. 4 of 1975
- Petroleum (Exploitation and Production) Act No. 2 of 1991
- Petroleum Products and Energy Act No. 13 of 1990
- Plant Quarantine Act No. 7 of 2008
- Prevention and Combating of Pollution of the Sea by Oil Act No. 6 of 1981
- Soil Conservation Act No. 76 of 1969
- Water Act No. 54 of 1956
- Water Resources Management Act No. 11 of 2013

The above table indicates the other statutory laws relevant to environmental protection. Some of the laws regards land use planing and will be looked at in details in the next sub-section.

3.2.3. Land Use Planning Regulation

Land use planning (LUP) usually focuses on optimising land resource use for both now and into the future benefit of surrounding societies (Metal Ores & Industrial Minerals, Mineral Resources in Land Use Planning, 2011).

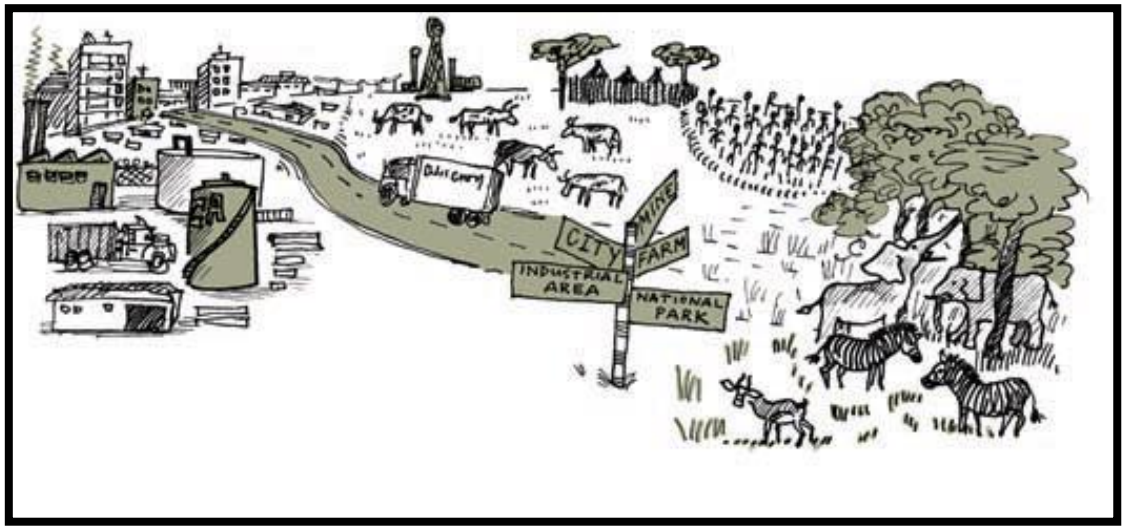

Figure 8: Picture illustrating the different land uses sourced from (Haub, 2009, P. 3).

In order to understand the land use planning regulation in Namibia at different levels of government we will need to understand the land ownership structure, Schwedes and Werner (2010, P. 27) indicated that there are three different land ownership structures which make up the whole of Namibia and they are:

- Commercial (private) land= 44% of the total area.
- Communal land= 41% of the total area
- State land (incl. urban and mining areas and national parks) = 15% of the total area.

The mandate for coordinating Integrated Land Use Planning lies with the Ministry of Lands and Resettlement (MLR) according to the cabinet-approved Strategic Plan 2006 –2010 (Haub, 2009 P. 17), which states that:

> *As custodian of the national land policy, MLR should primarily facilitate the effective allocation of land and create conditions, through dialogue, policies and legislation, for optimal land use in agriculture, shelter, conservancies, reserves and for the creation of strategic linkages and infrastructures that will enhance Namibia's industrial,*

commercial and tourism potential and add meaningful options for the social and economic advancement and livelihood of Namibian citizens.

Within the communal land and state land the guidelines on the land uses are provided to the President through the Traditional Authorities Act 25 of 2000 (Tjiramba and Odendaal, 2005).

In many cases the Traditional Authorities are the key decision makers concerning resource access and use (Zeidler, 2007). The Act stipulates that Traditional Authorities should ensure that natural resources are used on a sustainable basis and in a manner that conserves the environment and maintain the ecosystem.

The Communal Land Reform Act 5 of 2002 works hand in hand with the Traditional Authorities Act 25 of 2000. According to the Communal Land Reform Act 5 of 2002 Section 2(1) and section 30(1) which states that:

"Subject to subsection (4), the Minister must establish Communal Land Boards to perform the functions conferred on a board by this Act within the area for which each board is established in accordance with subsection (2)". And

"Subject to subsections (3) and (4) and section 31, a board may, upon Application, grant to a person a right of leasehold in respect of a portion of communal land, but a right of leasehold for agricultural purposes may be granted only in respect of land which is situated within a designated area referred to in subsection (2)".

This gives power to the Minister of Lands, Resettlement and Rehabilitation to appoint a Communal Land Board. Tjiramba and Odendaal (Tjiramba and Odendaal 2005) says that the board has power over the Traditional Authorities or Chiefs to control the allocation of customary land rights through Communal Land Reform Act 5 of 2002 Section 23 (1). They further said that customary land rights to be allocated under the Act in respect of communal land may include the following:

- The right to a farming unit,
- The right to a residential unit; and
- A right to any other form of customary tenure as recognised by the Minister.

In short this means that the Traditional Authority and Communal Land Boards have the powers on decision making on the type of land uses within the communal and state lands. According to the (Minerals Policy of Namibia, 2003) communities have expressed a need to have a share of the fees paid to Government in respect of communal land used for mining purposes. In terms of land use

planning regulation within the commercial land the legislation that plays a role is the Nature Conservation Ordinances of 1967 and 1975.

3.3. Existing Licensing Procedures applicable to aggregates

Bull & Estrela (2012) highlighted that aggregate operations are subject to numerous statutory and policy provisions governing their establishment, overall operation and discrete operational aspects (e.g. water taking and discharge, fuel storage, or blasting). As referred to in section 3.2 of this paper, all mining operations in Namibia are regulated in terms of section 2 of the Minerals Act. Whereas in terms of environmental impacts regulation is vested with EMA of 2007, Labour Act 7 of 2007,

Namibian Water Corporation Act of 1997 and several other laws. Thus for a quarry to be operational it is therefore the obligation of the miners to adhere to the regulatory procedures laid out. This may include securing the rights to the minerals (rock source) by applying for the necessary mineral rights as stipulated in sub section 3.2.1., completing an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) to mitigate or minimise the resultant environmental impacts as stipulated in sub section 3.2.2.

Aggregate quarrying is not regulated by the Namibian Minerals (prospecting and mining) Act 8 of 1992 as there is a grey area in terms of the listing of what group of commodities aggregate falls under as noted in Section 1.1. It was mentioned that according to the Minerals Act schedule 1 section 1 only silica sand is listed under industrial minerals group of commodities. For land access miners need to enter into a contract with the landowners to gain access for mining purposes according to the Minerals Policy of Namibia sub section 2.2.3. The minerals Act through the Mineral Ancillary Rights committee “MARC” if disputes erupt gives an opportunity to the mineral explorers and landowners to cooperate through a consultative process.

EMA stipulates that the exploitation of all natural resources requires an EIA to be done. In regards to EMA according to Guide to the Environmental Management Act No 7 of 2007 (Ministry of Environment and Tourism, 2008) Sections 27(1)-(2) and 29 lists the activities that may not be carried without an EIA done, the activities are as follows:

a) land use and transformation;
b) water use and disposal;
c) resource removal, including natural living resources;
d) resource renewal;
e) agricultural processes;
f) industrial processes;

g) transportation;
h) energy generation and distribution;
i) waste and sewage disposal; chemical treatment;
j) recreation; and
k) any other area which the Minister considers necessary for the purpose of listing

Aggregate quarrying is listed amongst the activities that require an EIA and the process of acquiring an EIA is indicated in figure 7 of the previous sub section 3.2.2.

There are no existing license procedures for aggregate quarrying through the regions of study apart from the Khomas region. In relation to aggregate quarrying in this region within Windhoek's boundary, there is a provisional policy drafted in June 2017; named "City Of Windhoek's Policy Towards Sustainable Sand Mining" this piece of policy allows the CoW to regulate aggregate quarrying. The City of Windhoek has come up with an application procedure which consists of eleven compliance requirements as listed below (City Of Windhoek's Policy Towards Sustainable Sand Mining, 2017, pp. 8-9):

a) The name of the applicant;
b) Legal agreement, entered into between the landowner or legal custodian of the land and the operator, if the operator is not the owner of the land;
c) The watercourse from which sand will be removed;
d) the location (i.e. coordinated and outer boundary) of the proposed sand mining site, including maps showing the site in relation to the water course and features such as roads buildings (other infrastructure) or boundaries;
e) The names of the owner and occupier of the land on which the proposed sand mining will take place;
f) The proposed volume or quantity of sand to be mined per month;
g) The proposed duration of the sand mining;
h) In the instance of a first time application, the complete Scoping Assessment Report or complete Environmental Impact Assessment Report, which contains as a minimum the following -
    i. Contact details and qualifications of the independent Environmental Assessment Practitioner (EAP) responsible for preparing the report;
    ii. Indicating of the condition of and existing damage to the environment that the application relates to;

iii. A detailed assessment of the potential sedimentation impact, which should provide a good understanding of the theory of sediment transport process, which again will determines the sand replenishment rate and hence the volume of sand that can be extracted from the reach of the river channel.

iv. Assessment of the impacts which the proposed operations may have on the environment (i.e. natural and social environments); and

v. Mitigation measures that should be taken to mitigate the identified impacts;

vi. Proof of notification for comments and objections from Interested and Affected parties

i) In the instance of a renewal, the Construction Monitoring Record and Operational Monitoring Record for the period that has passed since issuing of the first time approval or previous renewal,

j) Proof of adequate financial provision (Bank Issued Guarantee) for the rehabilitation of the mining site; and

k) Any additional information the Strategic Executive may prescribe.

l) In terms of approval from the CoW the policy gives tenure to extract aggregate for three years and the renewal application should be submitted 3 months prior to the expiry date and in consideration of the application the strategic Executive must consider the application using the requirements provided under Section 4.4 and 4.8 in the policy.

3.4. Illegal aggregate quarrying

In South Africa, according to a thesis by Green (Green, 2012) it is hard to define how many aggregate quarries are operational. The thesis mentioned that only the Department of the Mineral Resource has a data base of the legal aggregate quarries and excludes the illegal aggregate quarries, and this data is not available to the public. Seeing that there is a grey area in the Minerals Act in terms of permitting for aggregate quarrying it will thus be difficult to determine the number of illegal aggregate miners within the selected regions apart from Khomas region which has a policy in place. Through this policy, the number of legal miners can be determined but not the number of illegal miners. It was mentioned in the previous section that to quarry aggregate the miner needs to have an environmental clearance certificate failure to do so according to EMA section 4, states that:

> *"Any person who contravenes subsection (3) commits an offence and is on conviction liable to a fine not exceeding N$500 000 or to imprisonment for a period not exceeding 25 years or to both such fine and such imprisonment".*

If a country does not have a regulatory and monitoring framework for excavation of aggregate sustainably this leads to an increase in illegal quarrying activities (Madyise, 2013). The author added that governance and rampant corruption my also contribute to illegal aggregate quarrying posing a threat to the depletion of resources.

3.5. Conclusion

The Namibian legal framework governing the mining industry is very clear when it comes to sovereignty of exploration and mining as well as the laws protecting the environment from natural resource extraction. Lastly, land use planning laws pertaining to commercial land is not clearly mention within the laws looked at in section 3.2. The two previous sections indicated that aggregate permitting within different regions can be regulated by traditional authorities and the communal land board as well as MET. In addition to this within the Khomas region there is a policy in place that deals with quarrying of aggregate which allows the municipality of CoW to regulate the matters relating to various procedures relating to work plans, certain offences as infringement offences i.e. illegal quarrying, etc. The next chapter focuses on the analysis of the legislation and sustainable development of the aggregate sector in Namibia.

CHAPTER 4 – AN ANALYSIS OF THE STATE OF AGGREGATE IN NAMIBIA

4.1. Introduction

Aggregate is quite important as it was discussed in Section 1.5 of this paper, Chatterjee (2015) added that without it there will be no construction of buildings, dams, plants, roads, railways tracks and bridges. Therefore, leading to the analysis of aggregate state in Namibia, which will be the main focus of the chapter. The first part of the chapter will focus on the findings of the legal framework of Namibia's mining sector as outlined in Section 3.2. in relation to aggregate quarrying. Mining or quarrying in nature is a finite activity with an expected time frame of operation, whereas sustainable development refers to a process which ensures that economic activity focuses on meeting the needs of current and future generations, through mechanisms which will see natural resources and ecosystems to continue meeting such needs (Davidson, n.d., para. 1). In order to foster for greater sustainability in the mining sector for future generation, we need to achieve economic growth, protect environment and keep quality of societies as denounced in Section 2.3. Thus the second part of the chapter deals with highlighting the current economic, social and environmental problems in the aggregate sector in Namibia and how each contribute to sustainable development.

4.2 Legislative overview

As discussed in the Section 3.2.1. in terms of mining laws, the Minerals Act Section (2) utters that aggregates are only considered as minerals if used for commercial purposes and this gives the Minister greater authority in terms of applicability to aggregate quarrying (Berg, 2009). Also mentioned in the above mentioned section was that the Minerals Act issues six different mineral rights, of which mining and quarrying of aggregate is restricted to mining licenses and mining claims only (Lex Africa, n.d.). Ruppel & Schlichting (2016) mentioned that to protect the environment from damage or prevent pollution, EMA declares that mining or quarrying processes may not be carried out without an EIA. Therefore it should be noted that in terms of aggregate quarrying an EIA scoping study should be carried out in order to obtain an ECC. In terms of surface land uses the common law states that, holder of a license can exercise any rights granted to him in a way that the rights and interests of the owner of any land to which such licence overlaps are not badly affected, except in cases were such owner is compensated (Lex Africa, N.d.). In terms of the government authorities that have the powers in land use planning laws is the office of the Ombudsman, the Traditional Authorities, the Communal Land Board, municipalities and MLR as stipulated in Section 3.2.3.

In summary, the office of the Ombudsman was referred to in Article 91 of the Namibian Constitution. An article titled the independence of the Ombudsman in Namibia by (Ruppel-

Schlichting, n.d.) says that the office cannot investigate complaints regarding court decisions, or represent a complainant in criminal or civil proceedings. The article further furnished that in the case of the violation of human rights or freedoms private institutions and persons may complain. According to the Traditional Authorities Act 25 of 2000 Section 3(2), in terms of sustainable land use Traditional Authorities have to fulfil the following duties:

a) To assist and co-operate with the Government, Regional Councils and Local Authority Councils in the execution of their policies and to keep the members of the traditional community informed of developmental projects in their area;

b) To ensure that the members of his/her traditional community use the natural resources at their disposal on a sustainable basis and in a manner that conserves the environment and maintains the ecosystems for the benefit of all persons of Namibia.

In regards to Tjiramba and Odendaal (2005) this means that, the above mentioned act states there must be full involvement in the planning of land use and development within communities by the Traditional Authorities. Therefore in relation to land use aggregate quarries may have to get consent from the Traditional Authorities and Communal land Board in addition to mining license or mining claims if these mineral rights fall under the Traditional Authority. Lastly, in terms of municipal land it is only the Windhoek municipality in Khomas region which currently has a policy on the regulation of aggregate quarrying in the regions of study, whereby applicants are required to submit a prescribed form with the CoW Chief Executive Officer as stipulated in section 3.3. To add on, according to the CoW policy Towards Sustainable Sand Mining (2012) the applicants need to obtain a separate permit from the from the Department of Water Affairs and Forestry in accordance with the (Water Resources Management Act No. 11 of 2013), and having to obtain and Environmental Clearance Certificate from the Environmental Commissioner in accordance with the (Environmental Management Act, No. 7 of 2007).

4.3. The need to facilitate greater sustainability of the sector

4.3.1. Economic

The economics of construction materials depend mainly on the sources and its proximity to the point of use since the cost of aggregate materials depends on haul costs including fuel, labour, and maintenance (Gbeve, 2013). A Regulatory Impact Statement by Deloitte Access Economics (2014) states that aggregate is a high volume, low value product hence the reason why quarries are situated close to the source to minimise transport costs.

Because of its weight, aggregate is not economical if it is to be transported long distances. This is due to the high cost of transport relative to the value of the product. This leads to the reasons why quarries tend to be located close to consumer markets to minimise transport costs (Mineral Resources [Sustainable Development] [Extractive Industries] Amendment Regulations 2014 Fees**,** 2014). This makes logical sense simply because the suppliers tend to look for a high "place value" where a close location to the point of use is economically important (West & Cho, n.d.). The report by Naidoo (2008) mentioned that the economic growth driver of the aggregate industry is the sales of aggregate material, which is determined by the supply and demand from the construction industry. To understand the economic growth of aggregate in our regions of study, according to Bhagwat (2016) it is common practice to find studies in the aggregate industry as evidence of the industry's economic significance in describing the drifts in production, the market value of materials produced, and employment. A report by Motsie & Muravha (2012) states that, the demand for aggregate is driven by the construction industry which comprises of residential building, non-residential building and civil construction. To give an overview of the above, Motsie & Muravha (2012) gave statistics for the construction sector in South Africa during the period of the year 2002 to 2011 which experienced a significant growth in revenues in the sales of aggregates in volumes which increased by about six percent and sales values went up by fifteen percent in the same period (figure 9 and 10). The report further denoted that the estimated investment in construction and building in South Africa was N$320-billion in 2011 and it would have been more if it was not for the shortage of bitumen which resulted in a halt of a number of road projects of which would have resulted in an increased expenditure.

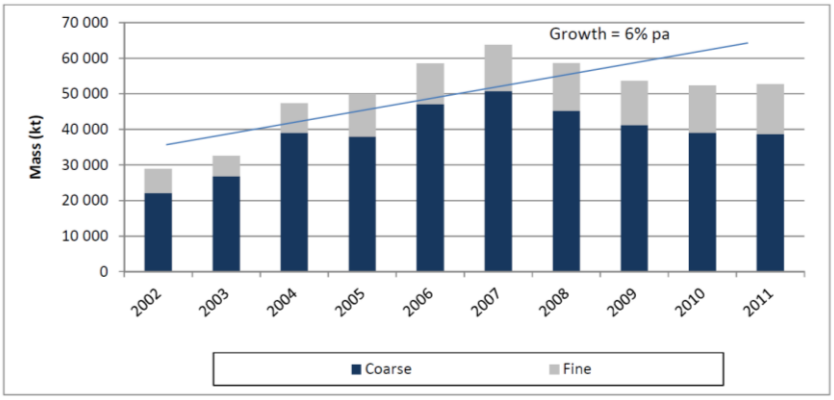

Figure 9: Illustration of the South African sales of aggregate by volumes during the period of 2002-2011 sourced from the Directorate of Mineral Economics report written by (Motsie & Muravha, 2012).

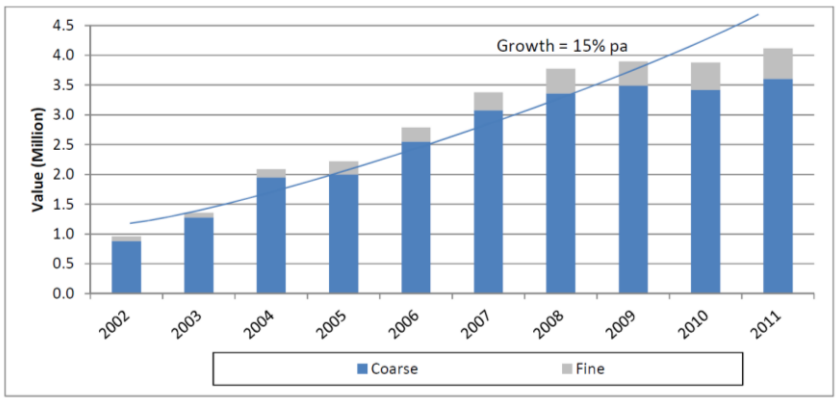

Figure 10: Illustrating the South African sales of sand and aggregate by value during the period of 2002 – 2011 sourced from the Directorate of Mineral Economics report written by (Motsie & Muravha, 2012).

In terms of employment within the aggregate sector, Motsie & Muravha (2012) further stated that in the same period an increment of 8.1 percent of job employment and 16 percent remuneration was observed as a result of increased activity in the construction sector (Figure. 11).

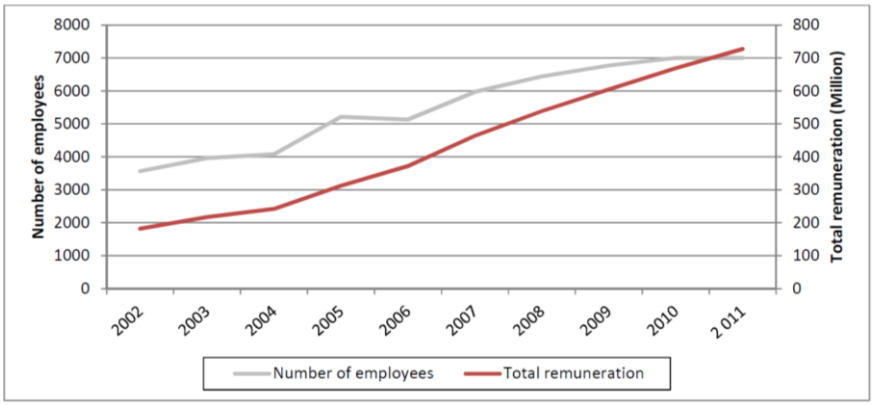

Figure 11: Illustrating of the South African employment and remuneration statistics within the period of 2002-2011 sourced from the Directorate of Mineral Economics report written by (Motsie & Muravha, 2012).

In the Namibia context, Nakale (2016) stated that in the year 2008 to 2009 the construction sector was boosted due to the infrastructural development. According to Nakale (2016), a project called TIPEEG which was aimed at accelerating infrastructural development, was implemented over the years of 2011/12 to 2013/14 financial years and cost the government of Namibia over N$ 14 billion which lead to a construction boom. He also mentioned that this was further reflected by relatively high investment expenditure averaging about 23.7 percent of GDP for the period 2000-2015

compared to just about 14.0 percent for the period 1990-1999. This program undoubtedly stimulated growth, as reflected by the 16.6 percent average growth in the construction sector during the period, with potential to indirectly stimulate growth in the long run. An article in The Namibian newspaper titled No regrets on TIPEEG – Schlettwein by (Nampa, 2018, pp. 1 & 2) the Namibian finance minister said that "the targeted Intervention Programme for Employment and Economic Growth (TIPEEG) by the government intended to create 104 000 jobs over a three year period, between 2011 and 2014, when the programme came to an end in 2014, N$ 11 billion had been spend. Tipeeg has been widely criticised for creating mainly short term jobs, despite the huge budget. Media reports show that in the three years, the programme created 83 000 jobs, of which 15 829 were permanent. The trend in the growth performance of the construction sector reflects the developmental nature state of the Namibian economy".

Anticipated future projects that may increase Namibia's economic growth in terms of civil construction industry, according to the (Roads Authority Strategic Plan 2018/19 – 2022/23) reported that the Roads Authority shall require an estimated N$ 18,765,914,680-82 to execute the strategic plan over the next five years. The proposed strategic targets are relevant to its mandate, for the next five years, aligned to the national strategic imperatives, are:

- To upgrade 800 km of road to bitumen standards.
- To construct 250 km of road to gravel standards.
- To rehabilitate 279 km of road.
- To reseal (preservation) 1,800 km of road.
- To re-gravel (preservation) 6,500 km of road.
- To rehabilitate 9 bridges.
- To contain the percentage of surfaced roads that is in an unacceptable condition at 10%.
- To contain the percentage of gravel roads that is in an unacceptable condition at 40%.
- To ensure that 99.30% of heavy vehicles are within the weight tolerance level.

E. M. Anthon (1993, P. 6) argues that at some point in time during the development of any industrialized country, industrial minerals become more important in terms of value of production than metals. He added that this happened in the UK in the nineteenth century and in the USA in the early twentieth century, in Spain in the early seventies and in younger economies like Australia in

the eighties. To sustain the Namibian construction sector with a constant supply of aggregate to achieve the infrastructure construction national goals as stipulated in section 1.5, Šolar, Shields & Zelič (2012) mentioned that the main elements for supply security are creation or maintenance of production capacity, identification of sufficient reserves and resources, provision of land access (extraction and exploration sites / areas), and development of the country's or region's infrastructure capacity (roads, railroads, power).

4.3.2. Social

The Minerals Act does not have the social dimension that the MPRDA has, so based on this document alone one cannot infer that it is an objective of the Act to promote the exploitation of minerals for the benefit of the nation as a whole (H. Berg, 2009). Although the Minerals Act does not cater in facilitating for greater sustainability, the Ministry of Mines and Energy came up with a Mineral Policy of Namibia (Mineral Policy of Namibia, 2003) which states in its foreword that the vision of the policy is:

> "*to achieve a high level of responsible development of national resources in which Namibia becomes a significant producer of mineral products while ensuring maximum sustainable contribution to the socio-economic development of the country [and] [t]o further attract investment and enable the private sector to take the lead in exploration, mining, mineral beneficiation and marketing.*"

The mission of the policy is stated as follows:

> "*The Ministry of Mines and Energy (MME), as the custodian of Namibia's rich endowment of mineral and energy resources, facilitates and regulates the responsible development and sustainable utilisation of these resources for the benefit of all Namibians.*"

This is the only place in the Namibian context where the word "custodian" is used. Simply because there is a perception that there is an unequal or unfair distribution of income, including benefits in the mineral sector between communities and mining companies (Mineral Policy of Namibia, 2003). This means that the Government recognises the importance of the mining industry in terms of the social and economic development in Namibia, which leads to the formulation of the policy which presents an opportunity for community engagement. The policy further mentions that the engagement encourages the formation of joint ventures; locals receiving preference in allocation of

jobs and tenders; and disadvantaged people being assisted by a transparent and enabling environment. Social down falls of social factors in terms of mining maybe due to small scale mining where by mining practices can lead to a result of health and safety hazards and abuse of children.

Namibia is deemed as a developing country, but it is relatively developed in comparison to other African countries simply because of its high GDP, its measured environmental awareness among the population, modern constitution and a modern infrastructure according to (Nea, 2012). The Vision 2030 statement in terms of non-renewable resources has highlighted some broad strategies and objectives that it wants; mining well planned, resulting in minimal, if any impacts on human health and the environment, all mines rehabilitated after closure. Investments resulting from mining are used to develop other sustainable industries and human capital from long term national development (National Planning Commission Secretariat, 2012). About 70% of Namibia's population is directly dependent on the natural resource base for food, fuel, income, medicinal and health needs, and shelter (Namibian 5th National Development Plan, 2017, P. 83).

In the year 2014 with the adoption of Article 23 of the Constitution of the Republic of Namibia, an effort to readdress the socio-economic imbalances that were created by the racially motivated socio-political and socio-economic policies of the past that limited the creation of wealth to a minority of the Namibian society lead to the creation of the Charter For Sustainable And Broad-Based Economic And Social Transformation In The Namibian Mining Sector 2014-2020 ("The Namibian Mining Charter") . The Namibian Mining Charter objective is to enable Historically Deprived Namibians (HDNs) to take part in the mining industry in terms of the five transformation pillars listed below and summarised from the (Chamber of Mines of Namibia, 2014, P. 3):

a) 1. Ownership - ensure that HDNs participate in the country's mining sector as owners and co-decision-makers, through a minimum of five percent equity available for sale exclusively to HDNs within two years of this Charter being adopted.
b) 2. Education and Skills - to ensure that the mining industry contributes to accelerating transformation by providing opportunities to individual HDNs to improve their levels of education and skills, by Mining companies must invest at least two percent of their annual gross payrolls every year in developing the skills of HDN employees and other HDNs.
c) 3. Affirmative Action - The objective of this pillar is to ensure that HDNs are properly represented at all levels of management so that they acquire the skills and experience needed to successfully help run the country's mining industry.

d) Procurement and Enterprise Development - The objective of this pillar is to ensure that the mining industry's procurement programme is used to promote new and Namibian-owned businesses.
e) Communities and Infrastructure - The objective of this pillar is to ensure that mining companies contribute towards the transformation and up-lift the communities in which they operate as well as the country as a whole.

4.3.3. Environmental

According to Gavriletea (2017) several factors must be taken into account when analysing the environmental impact of quarrying, these factors are:

a) location of quarry;
b) size of quarrying area;
c) time of exploitation;
d) secondary mineralogy;
e) The biodiversity across the quarrying area; and
f) technical conditions for exploitation

Nea (2012) listed a few environmental impacts in Namibia which include limited natural fresh water sources, desertification, wildlife poaching, habitat fragmentation and land degradation. Whereas talking about environmental impacts, we need to mention the fact that aggregate exploitation also has a negative effect on climate change through direct and indirect impacts (Gavriletea, 2017). Indirect impacts are related cement production while the direct impact is caused the extraction process and transportation of the resource. Namibia is very susceptible to climate change, because its economy is so dependent on its natural resources and the dry climate (Nea, 2012). Author further Climate change would lead to an increase in the already hot temperatures, which would in turn lead to droughts adding that drought may lead to livestock losses and reduced crop production. As discussed in Section 2.3.2. aggregate quarrying in Namibia affects food security. Based on the below listed impacts there are a few that may cause major affects to food security directly or indirectly. Section 3.3 mentioned that aggregate quarrying requires completing an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) to mitigate or minimise the resultant environmental impacts. The (Namibian 5th National Development Plan (2017, P. 85) mentioned that the country is one of the most vulnerable to climate change in the world. Thus leading to a demand in submissions of the EIAs, approximately 322 EIAs were processed in 2015/16

compared to 120 in 2012/13. There is however limited capacity in place to enforce and inspect adherence to EMPs with 57% compliance (Namibian 5th National Development Plan, 2017, P. 85).

Due to limitation on the availability of data In Namibia, on the aggregate sectors impacts on the environment, an EIA scoping report by Groot Environmental Engineers (Pty) Ltd (2017, P. 73-78) was used to list the potential impacts based on the proposed site, are as follows:

a) Impacts to soil and geology – which is mainly caused by the site preparation during construction.
b) Impact to water resources – this depends on distance of the site to a water catchment pits/dams and the potential to contaminate underground water by uncontrolled spills of fuels and lubricants during the construction and operational phases.
c) Impacts to flora and fauna – will be due to disturbance, displacement or direct habitat loss.
d) Impacts to heritage and archaeology – Excavations required for the installation of proposed facility, road construction, as well as land clearing, could disturb or destroy features of cultural heritage value, if they exist on the site especially the cemetery and mahangu fields (communal land) found within the site.
e) Impacts to air quality – the construction, operation and decommissioning of the proposed facility will result in emissions to air. The key sources of emissions will result from construction activities, including site clearance activities (dust) and construction traffic resulting in the nitrogen dioxide (NO_2) and particulate matter (PM). The dust from operations might cause silicosis disease to workers and surrounding residents.
f) Waste generation – is during project activities and may arise from a range of sources. Including excavated material (e.g. rock, sand, vegetation, and wood), general waste from construction workers, equipment, materials and vehicles; and general and limited hazardous wastes produced as a result of the production process. Particularly maintenance activities may also result in scrap metals and scrap cylinders, including spent solvents/acids for cleaning purposes.
g) Impact on noise and vibration – noise level is expected to increase due to the use of machinery and vehicle movements. Processing machinery and processes such as the crushing of the aggregate is expected to create a considerable noise level too.

Impacts on the environment caused by aggregate quarrying are similar around the world. The tables below list the environmental impacts associated with each phase during aggregate quarrying.

Table 5: Shows the descending order of vigorousness of different aggregate quarrying processes identified in Ghana, which have severe effects on the environment Ghana according to a survey conducted between Miners/aggregate mining firms and nearby residents (Gbeve, 2013).

Ranking	Miners/ Aggregate mining Firms		Nearby Residents	
1	Blasting	84.8%	Blasting	79.5%
2	Transportation	65.2%	Transportation	74.2%
3	Excavation	50.0%	Clearance	56.1%
4	Crushing	41.3%	Crushing	50.0%
5	Clearance	26.1%	Excavation	50.0%
6	Earthmoving	21.7%	Earthmoving	40.2%
7	Screening	10.9%	Screening	5.3%

Table 6: shows the primarily environmental impacts of aggregate quarrying in Ghana according to a survey figures conducted between Miners/aggregate mining firms and nearby residents (Gbeve, 2013).

Ranking	Miners/ Aggregate mining Firms		Nearby Residents	
1	Disturbed ground areas	78.3%	Degraded air quality from stack emissions	71.2%
2	Degraded air quality from stack emissions	60.9%	Disturbed ground areas	56.8%
3	Impairment of surface and ground water quality	32.6%	Impairment of surface and ground water quality	40.2%
4	Increased traffic on roads	17.9%	Increased traffic on roads	28.0%
5	Use of scarce water	10.9%	Use of scarce water	3.0%

To conclude this sub section West & Cho (2006) says that both environmental and economic complications may develop due to the extraction of construction materials.

4.4 Conclusion

It can be concluded In terms of the legislative overview that if one intends to quarry aggregate in the regions of study, several permits should be applied for with relevant authorities as discussed i.e. CoW, traditional authority, MET, MME, MAWF, office of the Ombudsman and the communal land board. The sustainability development of the sector could not clearly be highlighted due to the fact that there are no official statistics in existence regarding aggregate production in the regions of

study. Although data was a limiting factor it did not completely hamper on foreseeing what the aggregate sector can contribute to the economic, environmental and social aspects. Chapter 5 focuses on the conclusion, recommendation and a few general areas for further study.

CHAPTER 5 – CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The main aim of the research was to determine how aggregate quarrying contributes to sustainable development aspects (economic, environmental and social) in the regions of study. In order to achieve the aim, objectives were laid out to focus on the regulation of aggregate quarrying to foster for the aspects of sustainable development. To analyse the aggregate sector and its contribution to sustainability development, the methodology applied was a qualitative research analysis by literature review of the available data on aggregate quarrying in Namibia. Below are the conclusive findings on the study.

As denoted in Section 2.2.2. (a) aggregate is a natural occurring material which may include sand, gravel and crushed stone used for industrial purposes and it is formed through various rock forming cycles and later processed by crushing than graded and washed during production. It is a significant contributor to the construction of roads, buildings, ports, railways and in the brick making factories. The overall sustainability aspect of the aggregate sector has key indicators for each aspect. The indicators for the economic aspects are creation of job leading to payroll which is a direct economic benefit. In addition to this there is secondary or indirect benefits that may involve goods and services purchased from providers which help create more jobs and more wealth to the growth of economy. The environmental indicators are open pits that stay open for a long time, resource depletion, effects to the agricultural sector, air pollution and lowered ground water tables. This indicators lead to permanent negative impacts to ecosystems and source water aquifers as well as hindering food security. Lastly, the social indicators are driven by public concerns and perceptions about quality of life, health, and value of property, aesthetics, environmental quality, and the zoning of land affected by the aggregate sector. During the past, less research on the social sustainability was overlooking at and it was later discovered that social issues can obstruct compliance with economically and environmentally sustainable practices for quarry operators and thus needs more attention to allow a quick gain to sustainable development in the future. One can conclude this by saying that social sustainability is more of a prerequisite for achieving sustainable development.

There are three main types of legal instruments that can be identified mining laws, environmental laws, and land use planning laws. The mining laws in Namibia came from the colonial times till independence and the only review was made during post-independence in 1992 enacting the Minerals Act. The Act allowed the state to exercise its rights in the ownership over all natural resources. In additional to Minerals Act other mining laws after independence included the Minerals

Policy and the Diamonds Act. For the protection of environment from damage and pollution it is governed by several laws and policies consist of various non-legal binding laws as well as the statutory laws. The government adopted the Environmental Policy in 1994, Policy for Prospecting and Mining in Protected Areas and National Monuments in 1999 and EMA. The mandate for coordinating Integrated Land Use Planning lies with the MLR. Within the communal land and state land the guidelines on the land uses are given by the Traditional Authorities and Communal Land Board through the Traditional Authorities Act 25 of 2000 and Communal Land Reform Act 5 of 2002.

In regards to the regulatory regime governing aggregate quarrying, as discussed in Section 3.2, several permits should be applied with relevant authorities. There are no laws that regulate aggregate quarrying apart from EMA that requires listed activities to submit an EIA and EMP to acquire an ECC. Although there are a few permits that are issued by the MAWF. In addition to this the CoW within the boundary of Khomas region came up with a provisional policy drafted in June 2017, named City Of Windhoek's policy towards sustainable sand mining to help guide operators in applying permits for quarrying aggregate. With the overall contribution of the aggregate sector to sustainable development aspects it can be concluded as follows. There is no official statistics in existence regarding aggregate production in the regions of study and no direct policy directed towards aggregate for Namibia as no direct capabilities in legal terms. Looking at the statistics of production from countries like South Africa and relate it to the contributions to the economic aspects it shows that aggregate as a resource is important for generating revenues. In view of this, the importance of quarrying needs to be recognised by policy makers in relation to individual households and community benefits. Aggregates are particularly important due to their input in into construction and civil engineering sector throughout Namibia and fostering for their regulation is very much needed. The lack of distinct and clear legislative frameworks makes it harder for regulators to execute the regulation of aggregate quarrying. The journey ahead the aggregates contribution to sustainable development is a long one with the current mining laws.

5.2. Recommendations

The writer foresees the possibility of various economic, environmental and social implications leading to the impacts on the construction industry due to availability of aggregate resource due the loss of jobs, depletion of the resource and rejection from the surrounding communities and government authorities. Thus the author listed recommendations for short and long term purposes to mitigate the impacts to the sustainable development of the aggregate sector. This recommendations are directed to the intended quarry owners, mineral regulator and other related decision makers who are directly involved in the review of sector, to come up with ways to regulate

the sector starting from the issuing of licences, mine planning and data collection. An aggregate planning and protection policy is needed to protect aggregate as a resource, to promote orderly and environmentally sound development and to introduce aggregate resource protection into local comprehensive planning and land use controls. Based on the findings on aggregate quarrying regulation and its contribution to sustainable development in the regions of study, the following recommendations are given below.

5.2.1. Short Term Recommendations

a) High level decision making forum involving government authorities is necessary to discuss impacts and mitigation of illegal aggregate quarrying. Select representatives from the following listed government authorities and companies or private persons in the aggregate operation sector should create a committee to address the above mentioned issues;

   i. MAWF
   ii. MET
   iii. MME
   iv. Traditional Authorities
   v. Relevant municipalities
   vi. Office of the Ombudsman
   vii. local government
   viii. General public representatives and
   ix. Quarry owners

b) The relevant government authorities should locate all existing aggregate quarries on the communal land and assess if they operating within the environmental guidelines.

c) All current aggregate quarrying firms should undertake Environmental Impact Assessment (EIA) before their operation begins as stipulated in the listed activities in EMA or face the law as laid out in EMA section 4.

d) Traditional authority should be educated on the environmental impacts of quarrying and are encouraged to report problems arising from quarrying to MET for them to take the necessary action.

e) Other municipalities in regions like Oshikoto, Oshana and Erongo should follow suit like the CoW in Khomas region by coming up with a policy for guiding them in issuing permits for aggregate quarrying within townlands.

5.2.2. Long Term Recommendations

a) Since there is no legislative framework for the quarrying of aggregate which allows the government to regulate the matters relating to royalties, the State owned mining company should collect royalties from these operational quarries.
b) Government should implement principles of sustainable development within the EI.
c) Establish a governing body/department that deals with the matters relating to aggregate quarrying.
d) The Minerals Act needs to be amendments to include gravels and crushed rock in schedule 1 section 1 of the Act.
e) Each aggregate operator in Namibia must submit an annual report to a selected government authority for record keeping.
f) A quantitative analysis study on the sector should be conducted whereby engagement with the relevant government ministries and related offices, as well as aggregate quarrying companies within the Erongo, Khomas, Oshana and Oshikoto region will be conducted.

It is hoped that this study's recommendations contributes towards the regulation and sustainability of the aggregate sector.

5.3. Areas for Further Research

A quantitative study on the aggregate sector should be conducted and should entail a questionnaire survey for the sole purpose of indicating the exact amount of legal and illegal operative aggregate quarries as well as the sales and production of aggregate to determine the contribution of the sector to the Namibia's national economy over annual sales and create source of income through employment.

Word Count: 14 682

CHAPTER 6 – BIBLIOGRAPHY

6.1 Books

A. Jeffery, 2016, *the policy bulletin of the institute of Race and Relation*. British Geological Survey, 2013, *Construction Aggregates*.

C.M. Bristow, 1987, *a Society's changing requirements for primary raw materials*. Ind. Miner.

D. Humphreys, 2001, *Sustainable development: can the mining industry afford it?.*

D.R. Wilburn and T. G. Goonan, 1998, *Aggregates from natural and recycled sources economic assessments for construction applications: a materials flow analysis*.

E.M. Anthony, (1993), *Ore Geology and Industrial Minerals – An Introduction*.

International Council on Mining and Metals, 2012, *mining's contribution to sustainable development – an overview*.

J.F. Sullivan, 2012, *Screening Theory and Practice*.

K.K. Chatterjee, 2015, *Macro-Economics of Mineral and Water Resources*.

Legal Assistance Centre 2009, *Striking a Better Balance: An Investigation Of Mining Practices In Namibia's Protected Areas*, Mills International Human Rights Clinic, Stanford Law School.

M.E. Tucker, 2003, *Sedimentary Rocks in the field,* Third Edition.

M. Bull & C. Estrela, 2012, *Recent Trends and Issues in Aggregate Approvals*.

Ministry of Environment and Tourism Republic of Namibia, 2008, *Guide To The Environmental Management ACT No* 7 of 2007.

O. Haub, 2009, *Understanding of Land Use Planning and its Relevance in Namibia.*

O.C. Ruppel & K.R. Schlichting, 2016, *Environmental Law and Policy in Namibia*, *Towards Making Africa the three of life,* Third Fully Revised Edition.

S. Nakale, 2016, *Determinants of Economic Growth in Namibia*.

W.H. Langer, L. J. Drew, & J. S. Sachs, 2004, *Aggregate and the environment, American Geological Institute*.

6.2 Legislation and Policies

City Of Windhoek, 2017, *City Of Windhoek's Policy Towards Sustainable Sand Mining*.

Communal Land Reform Act 5 of 2002.

Environmental Management Act No. 7 of 2007.

Mineral Policy of Namibia (2003).

Namibia's 5th National Development Plan (NDP5), 2017/18-2021/22.

National Water Policy White Paper, August 2000.

The Chamber of Mines Of Namibia, *Charter For Sustainable And Broad-Based Economic And Social Transformation In The Namibian Mining Sector 2014-2020*, 19 September 2014.

The Constitution of Namibia Act No. 1 of 1990.

The Minerals (Mining and Prospecting) Act No .33 of 1992.

6.3 Online sources

Aggregate chapter 4, n.d. Available at: http://civil.emu.edu.tr/courses/civl284/4%20Aggregates.pdf (download date: 24 September 2018).

Aggregate, Presentation, n.d., slide 6, Available at: http://www.yu.ac.ir/uploads/6-session_2504.pdf (Download date: 18 September 2018).

R. Bleischwitz, B. Bahn-Walkowiak, 2006, *Sustainable Development in the European aggregates industry*: A case for sectoral strategies, Available at: http://userpage.fu-berlin.de/ffu/akumwelt/bc2006/papers/Bleischwitz_Bahn-W_Aggregates.pdf (Download date: 28 October 2018).

Deloitte Access Economics, 2014, *Mineral Resources (Sustainable Development) (Extractive Industries) Amendment Regulations 2014 (Fees) Regulatory Impact Statement*, Available at: http://www.betterregulation.vic.gov.au/files/49314ab2-e173-417e-9689-a3690100b0e0/RIS-Mineral-Resources-SD-EI-Amendment-Regulations-2014.pdf (Download date: 20 October 2018).

Dr. S. Mwiya, 2008, *Draft Procedures and Guidelines for Environmental Impact Assessment And Environmental Management Plan (EMP)*. Available at: http://www.the-eis.com/data/literature/DRAFT%20PROCEDURES%20AND%20GUIDELINES%20FOR%20EIA%20and%20EMP_2008.pdf (Download date: 5 October 2018).

European Association of Mining Industries*, Metal Ores & Industrial Minerals , Mineral Resources in Land Use Planning*, 2011. Available at: http://www.euromines.org/files/publications/mineral-resources-land-use-planning.pdf (Download date: 01 October 2018).

F. Al-Neshawy, *Building Materials Technology*, and Aalto University School of Engineering Available at: https://mycourses.aalto.fi/pluginfile.php/272892/course/section/60458/Lec04_Aggregates.pdf (Download date: 14 September 2018).

Geology And Natural Resource Development, n.d., paragraph. Available at **https://mineralseducationcoalition.org/wp-content/uploads/geologynatresactivity.pdf** (Download date: 4 September 2018).

G. Barbosa, P. Drach and O. Corbella, 2014, *A Conceptual Review of the Terms Sustainable Development and Sustainability International Journal of Social Sciences Vol. III (2),* Available at http://www.iises.net/download/Soubory/soubory-puvodni/pp-01-15_ijossV3N2.pdf (Download date: 17 September 2018).

G.R. Robinson, Jr., and W.M. Brown, n.d., Sociocultural Dimensions of Supply and Demand for Natural Aggregate— Examples from the Mid-Atlantic Region, United States geological survey, Available at: https://pubs.usgs.gov/of/2002/of02-350/aggregate.pdf (Download date: 12 September 2018).

Groot Environmental Engineers (Pty) Ltd, 2017, *Final Scoping Report for the Environmental Impact Assessment and Environmental Management Plan for Groot Silica Sand Mining and the Construction of a Silica Sand Processing Plant in Eeshoke Village, Oshikango of the Ohangwena Region*, available at:
http://grootgroup.com/grootees/eia/oshikango/groot_silica_eia_scoping_report_v2_reviewed.pdf (Download date 27 October 2018).

H. R. West & K. Cho, 2006, *Environmental and social issues associated with aggregate extraction*: *The Lafayette - West Lafayette, Indiana, and other examples*, USA, Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.490.2529&rep=rep1&type=pdf (Download date: 12 September 2018).

International Council on Mining & Metals, *Mining's contribution to sustainable development an overview,* Available at: https://www.cim.org/~/media/Subsites/CSR/Stakeholder_review_panel_documents/ICMM_Mining%20contribution%20to%20SD.ashx (download date: 12 September 2018).

J. L. Lu, 2012, *Occupational Health and Safety in Small Scale Mining: Focus on Women Workers in the Philippines,* Journal of International Women's Studies Vol 13 #3, Available at: https://vc.bridgew.edu/cgi/viewcontent.cgi?referer=https://www.google.com.na/&httpsredir=1&article=1034&context=jiws (Download date: 31 October 2018).

KPMG, Namibia Country Mining Code, 2014, Available at https://assets.kpmg.com/content/dam/kpmg/pdf/2014/09/namibia-mining-guide.pdf (Download date: 24 July 2018).

B. Littig & E. Grieβler, 2005, S*ocial sustainability: a catchword between political pragmatism and social theory*, International Journal of Sustainable Development. Available at: https://www.researchgate.net/publication/5107699_Social_sustainability_A_catchword_between_political_pragmatism_and_social_theory (Download date: 17 September 2018).

K. M. Nemati, 2015, *Aggregates for Concrete*, University of Washington, Available at:

http://courses.washington.edu/cm425/aggregate.pdf (Download date: 13 September 2018).

L. Davidson, n.d., *How can Namibia's mining sector contribute to sustainable development?* Available at: https://www.ean.org.na/wp-content/uploads/2017/03/Mining-Sustainable-Development-final.pdf (Download date 23 October 2018).

Lex Africa, 2017, *guide to mining regimes in Africa 2017/2018*, Available at: http://www.lexafrica.com/wp-

content/uploads/2017/08/103343T_LEX_Africa_Guide_To_Mining_In_Africa_26June.pdf (Download date: 16 October 2018).

Minnesota's Aggregate Resources Road To the 21st Century, 1998. Available at https://files.dnr.state.mn.us/lands_minerals/aggtf98.pdf (Download date: 09 September 2018).

M.D. Gavriletea, 2017, *Environmental Impacts of Sand Exploitation. Analysis of Sand Market, Available at: https://www.mdpi.com/2071-1050/9/7/1118/pdf (Downloaded date: 2 November 2018).*

M. Humblet*, Fundamentals of Earth Science I Notes, 2014-2015*, Available at: http://ocw.nagoya-u.jp/files/526/humblet_full.pdf (download date: 18 September 2018).

M. Purkess, n.d., *Our Nature with Aggregates,* A Strategy to Conserve and Enhance Biodiversity and Geodiversity for the Aggregates and Quarry Products Industry in Northern Ireland. Available at: https://www.qpani.org/ournaturewithaggregates_biodiversitygeodiversity_strategydoc.pdf.pdf (Download date: 25 September 2018).

Namibia, Mining Journal, 2005, Available at: http://www.the-eis.com/data/literature/Mining%20Journal%20special%20publication_2005.pdf (Download date: 22 September 2018).

Namibian Statistic Agency, Monthly Building Plans Report, 2018 available at https://cms.my.na/assets/documents/Building_Plans_-_May_2018.pdf (download date: 09 September 2018).

National Planning Commission Secretariat - Vision 2030. n.d., Available at http://www.npc.gov.na/?wpfb_dl=32 (Download date: 12 September 2018).

Production process of aggregates. Available at: http://www.cima.com.my/process_aggregate.aspx (downloaded date: 15 September 2018).

Roads Authority Strategic Plan 2018/19 – 2022/23, n.d., Available at: http://www.ra.org.na/Documents/Approved%20Business%20Plans/Roads%20Authority%20Strategic%20Plan%20%202018-2022.pdf (Download date: 23 October 2018).

Roadstone - which rock? Investigating the best rock type for the wearing course of roads, n.d. available at: https://www.earthlearningidea.com/PDF/211_Roadstones.pdf (download date: 18 September 2018).

Production & Process Technology, 2007. Available at https://www.bgs.ac.uk/downloads/start.cfm?id=1450 (download date: 22 September 2018).

Production process of aggregate picture, available at: http://www.cima.com.my/process_aggregate.aspx (download date: 22 September 2018).

R. Blackie & P. Tarr, 1999, *Government policies on sustainable development in Namibia*, Available at: http://www.oceandocs.org/bitstream/handle/1834/547/Blackie,%20R1-2.pdf?sequence=1 (Download date: 01 October 2018).

S. Šolar, D. Shields & U. Zelič, 2012, *Sustainable Aggregates Resource Management: experience learnt and shared within South East Europe,* Available at: http://www.rmz-mg.com/letniki/rmz59/RMZ59_0181-0200.pdf (Download date: 25 October 2018).

S. Schwedes and W. Werner, 2010, *Manual for participatory land use planning facilitators*, Available at: http://www.iapad.org/wp-content/uploads/2015/07/Manual_PLUP-Namibia_final_01_09.pdf (download date: 01 October 2018).

Simonis Storm Securities (Pty) Limited, Namibian *Mining: The Economic Stronghold*, February 2006, Available at: http://www.chamberofmines.org.na/files/2914/7092/7973/Namibian_Mining-The_Economic_Stronghold1.pdf (download date: 09 September 2018).

S. Tjiramba and W. Odendaal, 2005, *A review of environmentally sustainable land use practices and their benefit to Namibia's communal communities*, Available at: http://www.lac.org.na/projects/lead/Pdf/envicomm.pdf (Download date: 01 October 2018).

S.B. Bhagwat, 2016, *Construction Aggregates and Silica Sand in the Economy of Illinois*, Available at: http://library.isgs.illinois.edu/Pubs/pdfs/specialreports/sp-05.pdf (download date: 09 September 2018).

S. Miliutenko, 2009, *Aggregate provision and sustainability issues in selected European cities around the Baltic Sea.* Available at: https://www.diva-portal.org/smash/get/diva2:452638/FULLTEXT01.pdf (Download date: 10 September 2018).

T. Colman, 2009, *GEOLOGY – Vol. IV – Types of Non-metallic Ore-Mineral Resources,* Available at http://www.eolss.net/sample-chapters/c01/e6-15-06-07.pdf (Download date: 11 September 2018).

6.4 Thesis

B. Gbeve, April 2013, *Environmental Impacts of Construction Aggregate Mining in the Greater Accra Region, A Case – Study Of Amasaman in The Ga West Municipal.*

H. Tiainen, 2012, *A case study on social sustainability in the Kyrgyz mining industry*, Master's thesis, Environmental policy.

H.M. Berg, 2009, Mineral Rights under Development: *A Comparative Study of the Evolving Nature of Mineral Rights in South Africa and Namibia*.

M. Pietrzela, 2013, *Mining and Sustainability? Systems and Stakeholder Analyses of Uranium Mining in Namibia*.

P. Nea, 2012, *Namibia Country Analysis*.

S. C. Green, 2012, *The Regulation of Sand Mining in South Africa*.

S. W. Lupalezwi, 2014, *A legal Overview of Namibia`s Mining Industry*.

T. Madyise, 2013, *case studies of environmental impacts of sand mining and gravel extraction for urban development in Gaborone*.

6.5 News paper

Nampa, “No regrets on Tipeeg – Schlettwein” *The Namibian newspaper* 12 September 2018. Pg. 1-2

N. Kahiurika, “Sand mining affects food security-Shifeta” *The Namibian newspaper* 14 September 2018. P. 5.

6.6 Reports

D. Naidoo, 2008, *Overview of South African sand and aggregate industry*, Directorate: mineral economics.

R. Motsie & M. Muravha, 2012, *Review of the South African Sand and Aggregate Industry,* Directorate: mineral economics.

J. Zeidler, 2007, *Namibia: Land use planning and environmental sustainability Contributions to an analytical framework for sustainable land management.*