

**SOCIO - ECONOMIC IMPACTS OF SAND MINING ACTIVITIES IN
ZANZIBAR**

ALI SULEIMAN ALI

**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN
NATURAL RESOURCES ASSESSMENT AND MANAGEMENT (MANRAM)
OF THE OPEN UNIVERSITY OF TANZANIA**

2020

CERTIFICATION

The undersigned certifies that she has read and hereby recommends for acceptance by the Senate of the Open University of Tanzania a dissertation entitled: **“Socio - Economic Impacts of Sand Mining Activities in Zanzibar”** in partial fulfillment of requirements for the Degree of Master of Arts in Natural Resources Assessment and Management (MANRAM) of The Open University of Tanzania.

.....

Dr. Anna Wawa

(Supervisor)

.....

Date

COPYRIGHT

No part of this dissertation may be reproduced, stored in any retrieval system, or transmitted in any form by any means, electronic, mechanical, photocopying, recording or otherwise without prior written permission of the author or the Open University of Tanzania in that behalf.

DECLARATION

I, **Ali Suleiman Ali**, do hereby declare that this dissertation is my own original work and that it has not been presented to any other University or Institution of Higher Learning for a degree or similar award.

.....

Signature

.....

Date

DEDICATION

I dedicate this dissertation to my parents Suleiman Ali, Naima Makame and Tatu Abdullah Khamis and to everyone who contributed directly or indirectly in successful writing of this Dissertation. May Allah the almighty richly bless you all.

ACKNOWLEDGEMENT

The greatest of all thanks and appreciations firstly goes to Allah the almighty, for granting me life, good health and knowledge throughout my study.

This dissertation would not have been completed without the help, support and contribution of many people and institutions. I am appreciated to everyone and want to extend my special thanks and acknowledgements. First, I would like to thank my supervisor, Dr. Anna Wawa for her selfless effort and the professional guidance she provided in making this paper a success. I deeply appreciate her time, patience, and support throughout the preparation of this work.

I would also like to thank the people from the Department of Forestry and Non-Renewable Resources Zanzibar (DFNR), and all the staffs who in one way or another provided me with support, encouragement, and guidance as well as friendship.

My most sincere thanks go to Zanzibar Higher Education Loans Board (ZHELB) for financial support they have offered me during the course. I also wish to express similar gratitude to Mr. Abubakari Silima Ame, Village government Officer of Donge village, Mr. Abdullah Haji Juma of Kazole village, and Mr. Massoud Ali Said of Michungwa Miwili village as well as the North 'A' Unguja District Commissioner for providing me with the district information and the permit so that I could conduct research. Mention must also be made of Dr. Abdallah Rashid Mkumbukwa (SUZA Lecturer) for his assistance and guidance during analysis of the dissertation.

My appreciation is also extended to all participants who in one way or the other shared their experiences with me to accomplish this research. To all of them, I say

thank you. I really appreciate your time and effort. A word of gratitude goes to Mr. Mohammed Haidar Kessi, Mussa Hassan Adhan, and Hamza Abdallah who assisted me in the data gathering process.

In addition, I would want to acknowledge the contributions of my family members and friends who contributed in diverse ways towards the successful completion of this course. I cannot forget the contributions of my wife, Hamisa Mohammed Ali, I thank you and appreciate all that you did especially, for moral support and taking care of home as I spend time at the Open University of Tanzania; both Kinondoni and Zanzibar OUT Regional Centres to finish the course.

ABSTRACT

A sand mining activity plays important roles in the development of socio-economic infrastructures of communities and comprises an essential component of materials in the construction of roads, hospitals, schools and housing. At present, sand is widely used all through the Islands and it is viewed by numerous individuals as the key component in the urban development and expansion in Zanzibar. This study was conducted in Zanzibar Unguja Island, North 'B' Unguja District at Kazole, Michungwa Miwili, and Donge. However, in the North Unguja District, the activities of sand extraction constitute a major threat and challenge to the socio – economic activities of the people in the area. Sand extraction also has considerable effects on the air, water and biodiversity. It causes land degradation, biodiversity loss, soil pollution, and reduction of essential nutrients and organic matter of the soil. This study was undertaken to assess the socio-economic impacts of sand mining activities in Zanzibar. Specific objectives were to: examine peoples' perception on impacts of sand mining on socio – economic activities; assess the impacts of sand mining activities on biodiversity (vegetative biomass) and lastly assess the rehabilitation measures towards the abandoned sand mines. Through the administration of structured questionnaires, focus group discussions, face to face interviews and field observations, information was gathered on respondents' perception of sand mining impacts while soil and vegetation samples were collected and analyzed. Data from current and abandoned sand mined sites of more than ten years as well data from an un-mined sites as standard reference were compared. Respondent's perceived sand mining to have brought the significant decrease of farmlands, loss of biodiversity, caused significant land degradation, and led to poor relationship between residents and sand miners, and promoted to the widespread incidence of communicable diseases such as malaria, dysentery, and typhoid fever among others. The study however, recommends to have effective collaboration among key stakeholders in sand mining sector such as governmental and non-governmental agencies. These include the Environmental Protection Agency (EPA), Forestry Commissions (FC), Regional-District Assemblies (RDA) as well as the Zanzibar Ministry of Agriculture, Natural Resources, Livestock and Fisheries (Z-MANRLF) in order to regulate and control Sand Mining; while improving the availability of productive agricultural lands; residents land for the communities should be enhanced their commitments toward reclamation of abandoned sand pits; tree planting and agro-forestry practices to speed up the slow rate of natural succession by reduction of negative activities such as perennial bushfires, over-cultivation of lands, over-grazing to reduce nutrient depletion rates and finally compliance with statutory laws in order to regulate the conduct of sand mining on sustainable basis for the sake of reducing its negative effects on the socio-economic status of the people but also for the general environment.

TABLE OF CONTENTS

CERTIFICATION	ii
COPYRIGHT	iii
DECLARATION.....	iv
DEDICATION.....	v
ACKNOWLEDGEMENT.....	vi
ABSTRACT	viii
LIST OF TABLES	xiv
LIST OF FIGURES	xv
LISTS OF ABBREVIATIONS AND ACRONYMS.....	xvii
CHAPTER ONE	1
INTRODUCTION.....	1
1.1 Background of the Research Problem	1
1.2 Statement of the Research Problem	6
1.3 Objectives of the Study.....	8
1.3.1 General Objective	8
1.3.2 Specific Objectives	8
1.4 Research Questions.....	8
1.5 Significance of the Study	8
1.6 Limitation of the Study	10
1.7 Organization of the Study	11
CHAPTER TWO	12
LITERATURE REVIEW	12
2.1 Introduction.....	12

2.2	Conceptual Definitions	12
2.2.1	Land Use	12
2.2.2	Mining.....	13
2.2.3	Types of Mining.....	13
2.3	Theoretical Review	13
2.3.1	Malthusian Theory of Population	13
2.4	Empirical Literature Review.....	15
2.4.1	Supply of and Demand for Sand.....	17
2.4.2	Sand Mining.....	18
2.4.3	Legal Framework and Guidelines for Sand Mining Activities in Zanzibar	18
2.5	Impacts of Sand Mining.....	19
2.5.1	Conflicts in Mining Communities	19
2.5.2	Soil Physical Properties	20
2.5.2.1	Soil Bulk Density.....	21
2.5.2.2	The Soil Texture	21
2.5.3	Impacts of Sand Mining on Soil Chemical Properties.....	21
2.5.4	Land Degradation	22
2.6	Rehabilitation of Mined Sites	22
2.6.1	Forestation and Tree Planting.....	23
2.6.2	Agro-Forestry.....	23
2.8	Conceptual Framework.....	23
2.9	Research Gap	25

CHAPTER THREE	26
RESEARCH METHODOLOGY	26
3.1 Chapter Overview	26
3.2 Research Design	26
3.3 Location of the Study Area	26
3.3.1 Geographical Context	28
3.3.2 Household Characteristics	28
3.3.3 Economic Activities.....	29
3.3.4 Climate Characteristics	29
3.3.5 Geology and Soil	30
3.3.6 Relief and Drainage	30
3.3.7 Agriculture	30
3.3.7.1 Primary Production	30
3.4 Sample Population and Sampling Procedures	31
3.5 Data Collection Techniques/Instruments.....	31
3.5.1 Face-to-Face Interviews.....	32
3.5.2 Focus Group Discussion	32
3.5.3 Direct Observation	33
3.5.4 Questionnaire as Tool	33
3.6 Sample Size.....	34
3.7 Analysis of Socio-Economic Data	35
3.8 Data Processing and Analysis.....	35
3.9 Validity and Reliability.....	36
3.10 Permission for Study and Ethical Consideration	36

CHAPTER FOUR.....	38
FINDINGS AND DISCUSSION.....	38
4.1 Chapter Overview	38
4.2 Presentation of Findings	38
4.2.1 Socio-Demographic Characteristics of Respondents.....	38
4.2.1.1 Age Distribution of Respondents.....	39
4.2.1.2 Sex Distributions of Respondents.....	39
4.2.1.3 Distribution of Respondents by Positions in the Village.....	40
4.2.1.4 Principal Occupation of Respondents.....	41
4.2.1.5 Visits to Sand Mining Sites	42
4.3 Impacts of Sand Mining Activities on Socio-Economic Changes.....	43
4.3.1 Positive Impacts of Sand Mining Activities on Socio – Economic Changes.....	43
4.3.2 Negative Effects of Sand Mining on Socio-Economic Changes	48
4.4 Impacts of Sand Mining Activities on Biodiversity	55
4.4.1 Soil Erosion.....	55
4.4.2 Loss of Trees and Vegetation Cover.....	56
4.4.3 The Eruption of Diseases Caused by Sand Mining	57
4.4.4 Destruction of Natural Habitats	58
4.4.5 Sand Mining Contributing to Land Pollution	59
4.5 Rehabilitation Measures of Sand Mined Sites.....	59
4.5.1 Respondents’ Suggestions Towards Resolving Sand Mining Problems in the District	59
4.5.1.1 Solutions at Community Level	61

4.5.1.2	Solutions at National Level.....	62
4.6	Summary of Findings.....	64
CHAPTER FIVE		67
CONCLUSION AND RECOMMENDATIONS		67
5.1	Introduction.....	67
5.2	Conclusion	67
5.3	Recommendations.....	69
5.3.1	Recommendations to Decision Makers	69
5.3.2	Recommendations to Local Government and the Responsible Community ..	70
5.3.3	Recommendations for Future Research.....	71
REFERENCES.....		73
APPENDICES		76

LIST OF TABLES

Table 3.1: Category of Sample Population and Size.....	34
Table 4.1: Respondent's Responses on the Benefits of Sand Mining to the Residents	46
Table 4.2: The Responses on the Negative Impacts of Sand Mining	50
Table 4.3: The Respondents' Suggestions About the Rehabilitation Measures to Sand Mined Sites	60
Table 4.4: Respondents' Suggestions on Sand Mining Effects at the Community Level.....	62
Table 4.5: Respondent's Suggestions Towards the Impacts of Sand Mining Activities at the National Level in Zanzibar	63

LIST OF FIGURES

Figure 2.1	Conceptual Framework of Socio-Economic Impact of Sand Mining in Zanzibar Based on Malthusian Theory	24
Figure 3.1:	A Map of Zanzibar Island Showing the Location of North ‘B’ Unguja District.....	27
figure 4.1:	Age Distribution of Respondents.....	39
figure 4.2	Sex Distribution of Respondents	39
figure 4.3	Distribution of Respondents by Position in the Villages.....	40
figure 4.4	Principal Occupation of Respondents.....	41
figure 4.5	Respondents’ Visits to Sand Mining Sites.....	42
Figure 4.6	Youth as Drivers and Manual Loaders Employed Themselves in Sand Mining	44
Figure 4.7:	A Sampled Villager who Mine Near his House to Make Blocks for House Construction at Site E.	45
Figure 4.8:	Two Little Boys at Sand Mined Site ‘B’ Fishing in the Abandoned Sand Mine Pit Covered with Rain Water	51
Figure 4.9:	Sand Miners at Site ‘F’ Loading the Trucks with Sand using Excavator Machine	51
Figure 4.10:	The Truck and the Sand Loaders Extracting Sand Manually at Site ‘C’.....	52
Figure 4.11:	Awareness on the Occurrence of Accidents Due to Sand Mining Activities.....	53
Figure 4.12:	Sampled Abandoned Sand Mined Site ‘A’ with Lack of Tree Cover.....	56

Figure 4.13: Sampled Standing Water in Sand Mined Site ‘B’ Communities.....	57
Figure 4.14: The Michungwa Miwili, an Example of Human Destruction on Natural Habitats	58

LISTS OF ABBREVIATIONS AND ACRONYMS

FASS	Faculty of Arts and Social Science
S M	Sand Mining
Z-MANRLF	Zanzibar Ministry of Agriculture, Natural Resources, Livestock and Fisheries
DFNR	Department of Forestry and Natural Resources
ZHELB	Zanzibar Higher Education Loans Board
MUMKI	Mtandao wa Uhifadhiwa Mazingira Kiwengwa
SUZA	State University of Zanzibar
OUT	Open University of Tanzania
URT	United Republic of Tanzania
ANGOZA	Association of Non-Government Organizations in Zanzibar
ASDP-L	Agricultural Sector Development Programme - Livestock
CBO	Community Based Organization
DMD	Disaster Management Department
FAO	Food and Agriculture Organization of the UN
GIS	Geographical Information System
HBS	Household Budget Survey
HEA	Household Economy Assessment
MACEMP	Marine Conservation and Environmental Management Project
MKUZA	Mkakati wa Kukuza Uchumina Kupunguza Umasikini
MWCEL	Ministry of Water, Construction, Energy and Lands

CHAPTER ONE

INTRODUCTION

1.1 Background of the Research Problem

Sand mining, among other natural aggregates represent the main source of construction aggregates used throughout the world. However, the process of sand mining activities, whether small or large scale, are inherently destructive to the natural environment chiefly because sand is considered and being grouped into non-renewable resource.

Sand is a crucial source to economic development to both the poor countries of the world and to the developed nations. Development means a process of gradually expansion, becoming bigger, better, more advanced in business, industrial and trade activities. The growth of towns and cities demand more infrastructures and construction of strong structures such as roads, commercial shopping malls and accommodation for ever-increasing population (Lorenzo G. Bellu, 2011). Hence as a result of such socio - economic development, there is probably going to be disturbance of the natural environment.

United Nations Conference on Environment and Development Report (2002) supported appropriate utilization of the environment and insisted government to develop but recognizing conservation and rehabilitation of natural resources. The report revealed that over extraction of sand for urban development is an ecological problem around the world. The use of sand as source of developmental construction material is depleting the resource and has adverse impacts.

The adverse impacts of sand mining can be either of physical impacts such as general alteration of soil morphology. It can also result into biological impacts such as reducing water quality and Ecological impacts including loss of habitats and species disturbance, eruption of diseases among others are the results of sand mining.

Nevertheless, mining of sand often generates land use conflicts (social conflict) in populated areas due to its negative effects including loss of biodiversity, truck traffic congestions, destruction of soil physicochemical arrangement and properties, pollution, destruction of the natural habitats, accelerates the rate of erosion, and visually unpleasant landscapes.

It also represents a conflict with competing land uses for activities such as farming, especially in the areas where high – value farmlands are extremely inadequate. This is where the exact “problem of scarcity” is coming into real sense; and especially when post – mining restoration maybe difficult (Zanzibar Revolutionary Government, 1992). However, with the rapid increased population in the recent years as it stimulated by the high fertility rate among other factors, the process of mining activities ultimately results into decreased farm land availability, which further reduces farm yield something appears to be a grave concern for the today’s world and for the people of Zanzibar Island and the North-Unguja Region in particular where the activity is to a great extent carried out.

Sand mining as a worldwide economic activity has both positive and negative impacts to the environment. Schaetzl (1990) noted that United States of America, many states such as California and Michigan rely on mining of sand for road and construction of many other infrastructures. The same activity is carried out in the developing

countries taking an example from India where abundant supply of sand is rapidly diminishing (Simeipiri W. Johnbull and Ibama Brown, 2017). Bagchi (2010) exposed illegal sand mining going on in India, mostly done on rivers.

Lawal (2011) examined sand mining in Nigeria and highlighted that the activity is rapidly becoming an ecological problem as the demand for sand expands every day. Sand resources are used in construction of strong structures which improve the socio – economic lives of most Nigerians however with notable negative environmental effects.

Mwangi (2007) demonstrated the rate of sand mining in Kenya which is disturbing to the point that the government had to draft the national Environment management Authority (NEMA), with a policy to apply so as to control all mining activities in the country. As more impacts are felt, there is a need for immediate environmental control and restoration. There is a need to consider sustainable use of sand resource in projects development with minimum environmental destruction for the benefit of not only the present but also for the next generations (Simeipiri W. Johnbull and Ibama Brown, 2017).

Tanzania, with the rapid population increases, have been experiencing many of the above mentioned environmental resource's challenges such as resources conflicts, resources overconsumption as well as environmental pollution related problems. In recent years, Tanzania mainland experiencing much of sand mining occurs along riverbanks, while in Zanzibar occurs along riverbanks, on the open farmlands and

along the coasts. The increased human activities over the years, have significantly contributed to the soil erosion issues evident throughout Zanzibar (Masalu, 2001).

According to Ladlow, (2015) sand mining activities are widespread in North 'B' Unguja District and to a large extent contribute to deforestation and land degradation among other notable environmental impacts. These practices often leaves behind bare soils and large areas of gullies which usually collect water during rainy seasons while others are being permanently flooded. Water collected in these abandoned sand mined pits result not only in health related problems for neighborhood communities, but also causes several other negative impacts on the biodiversity and ecosystems (Caroline Ladlow, 2015).

Historically in Zanzibar, majority of farmers were given three acres of land soon after the 1964 Zanzibar revolution so as to intensify the agricultural practices to produce both food and cash crops. These farmers are small scale farmers because they have smaller farmlands (Jack Duane Devine, 1973). This may be partly population pressure in some areas resulting into land fragmentation as people expand areas for settlement and urbanization. The process of expansion of human settlement in the islands intensified sand mining activities taking agricultural lands become areas for mining.

In addition to the steady increase in human population versus high demand for economic development has led to increased environmental degradation like deforestation, water pollution, and excessive consumption of natural resources continue (Kombo, 2010). The economy of Zanzibar, until the mid of 1980, depended heavily on the exportation of cloves. However, as other countries of the world began

producing the same crop more efficiently, the price for Zanzibar cloves decreased by 60% and thus Zanzibar's economy was weakened. This downturn caused Zanzibar to turn towards tourism as a quick replacement for cloves production. The Zanzibar economy is now primarily dependant on tourism, then manufacturing, fisheries, forestry, and marine and coastal resources (United Republic of Tanzania. 2014). With these activities and the increase in population therefore, there rise a large demand for construction materials such as sand, coral rag and limestone (Social Security Department, 2010).

In Zanzibar islands; the control, maintenance, and management of non-renewable natural resources are under the Department of Forestry and Non-renewable Resources. The principal aim of the department's policy is to "protect, conserve, and develop natural resources for the social, economic and environmental benefit of present and future generations of the people of Zanzibar".

If adhered to, this stated aim and the policy would create an ideal environment for the conservation of the Zanzibar's both renewable and non-renewable resources. The non-renewable resources in Zanzibar include sand, gravel, rocks, stones, limestone, and soil but the exploitation of these resources is unsustainable and is resulting in less productive arable land as well as lowered biodiversity in certain areas (The Revolutionary Government of Zanzibar, 2013).

Furthermore, apart from biodiversity loss, during the rainy seasons the abandoned sand mining pits often fill with stagnant water, which provides an ideal breeding place for mosquitoes. This trend of increase in standing water could lead to elevated level of

malaria across Zanzibar if continued (Stich A. H R., Maxwell C. A., Haji A. A., Haji D. M., Machano A. Y., & Curtis C. F., 1994). The government of Zanzibar therefore has agreed to attempt to minimize land degradation caused by overconsumption of sand non-renewable resources, and to promote the rehabilitation measures to the mined sites through means such as replanting trees.

Therefore, the aim of this study was to investigate the socio-economic impacts of sand mining activities in Zanzibar because of its additive and adverse impacts the process of sand mining can have on the island's soil erosion, local economies, and community safety and the environment in general.

1.2 Statement of the Research Problem

Zanzibar is being faced with environmental challenges, which in turn results into many serious crises and disasters such as food insecurity, widespread malnutrition, and risk to floods, drought, soil erosion, intensive beach and coastal erosion, diminishing renewable natural resources, declining fresh water resources, poor waste management and increased pollution and the eruption of communicable diseases (United Nations Tanzania, 2019). The DFNR report shows that Zanzibar has been witnessing the fastest growing rate of human population (by means of increased fertility rate and immigration) within these recent years (The United Republic of Tanzania, 2012). Rapid population growth has led to an increase in demand for sand materials for housing and for other infrastructural needs in the islands. Because of sand resource inadequacy, the communities usually once used all means to acquire land including agricultural reserve lands for sand mining.

In the North 'B' Unguja District alone the farmers constitute about more than 60% of the total population their number has been always increasing while the land resource is shrinking as much of these lands are devoted to the mining activities. These lands at once were mostly occupied by highly productive grown local food plants, and cash crops trees as well as medicine plants of highly economic value and which serve as important means of livelihood for people. Notable among these trees are coconut trees, mango trees, orange trees, breadfruit trees, jackfruit trees, cassava, sweet potatoes, banana and pineapples. Most of these areas which were reserved for agriculture are now turned into unproductive land of sand mining abandoned pits.

Unfortunately private individuals and groups involved in the sand mining activities engage in destruction of the economic trees which apart from denying farmers of their productive land can also affect the natural balance of the environment. Sand mining in Zanzibar has considerable effects on the water and air, loss of biodiversity, land degradation and soil pollution. It also results in reduction of essential organic matter and the nutrients of the soil, reduces biological activities and decrease productivity of the soil. Though sand mining has become an important economic and developmental activity in Zanzibar, its effects on the average household farmland and people's livelihoods cannot be estimated (Marius Dan Gavriltea, 2017).

Therefore, because of scarce of study on the possible causal – effect analysis on socio-economic dynamism and the sand mining activities in Zanzibar; this study therefore seeks to fill this gap focusing to the social life of the people, their economic status and to the general environmental consequences as a whole.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this study is to assess the socio-economic impacts of sand mining activities in Zanzibar.

1.3.2 Specific Objectives

Specifically, the study aims to:

- (i) Examine the impacts of sand mining activities on socio-economic changes in the study area.
- (ii) Assess the impacts of sand mining on biodiversity in the study area.
- (iii) Evaluate the rehabilitation measures of abandoned sand mined sites.

1.4 Research Questions

- (i) What are the impacts of sand mining activities on socio-economic changes?
- (ii) What are the impacts of sand mining on biodiversity?
- (iii) What are the rehabilitation measures of sand mined site?

1.5 Significance of the Study

Sand mining has considerable effect on people's livelihood, on land, air and water. Primarily, it causes soil erosion, soil pollution, land fragmentation and degradation and loss of biodiversity. As sand mining activities have been carried out on good farmlands, the practice terrifies the health of the environment and the ecosystem balance in terms of natural food chain and food web among living organisms. For although the activity has become an important economic activity in Zanzibar for most

of the poor people, there is little study that had been done about its possible impacts on the socio – economic status of the people in the current rapid rate of population growth.

The outcome of this study will come up with useful and sustainable ways of practicing sand mining such that people lives and environment will not be endangered to be utilized by both the existing and the future generations to come. This is to provide a source of data on socio-economic impacts of sand mining activities in the study area. Appropriate recommendations also suggested on reclamation of sand mining pits based on the results obtained. This will not only ensure sustainable mining of sand in the district, but as well to improve agriculture and reduce poverty in Zanzibar. Also, it however, helped to improve Environmental Protection Agencies such as the Department of Forestry and Non-renewable Resource's data base as well as assist in its awareness creation programs not only in the North 'B' Unguja District where the activities are being carried out but, the country as whole.

This study therefore is useful as can provide a framework and baseline point to the government to show how the communities and the ecosystems are being affected and come up with policy, rules and regulations rules and regulations recommendation to control excessive extraction of sand resources and mismanagement. Besides that, the study is important as it provides the information about environmental changes in relation to sand mining activities. It also intended to provide awareness to the society especially the villagers, conservationist groups and many other stakeholders on the role of each citizen on the preserving and sustainable utilization of the sand resources

for the benefits of today's and the future generations. Furthermore, the findings can be used as a reference material for those who need to conduct research on the management of sand resources as well as to help Geographers in different fields of specialization.

1.6 Limitation of the Study

- (i) This study focused on examining the socio – economic impacts of sand mining activities in Zanzibar. Therefore the following were taken to be the limitation faced the researcher in conducting this study.
- (ii) The interview administration was conducted during the harvesting season and this discouraged respondent's interest since they were too busy during the day time. Therefore, this problem was solved through meeting the respondents for the face-to-face interviews at evening and night time.
- (iii) Time limitation: The time was too limited for some respondents especially the government officials (at the DC's office and the Department of Forestry and Non-renewable Resources Office) to meet and provide the required data to the researcher. Hence, most of time the researcher communicated with them through mobile phones.
- (iv) Poor perception of some respondents towards the study. Some respondents were not open and confident to answer the questions particularly those questions touching the illegal sand mining. This limitation was solved through assurance for their security and confidentiality.

- (v) Insufficient fund. The researcher selected few areas (three sand mining areas) as to accomplish the study due to limited budget. However, there was a need to broaden the area of research so as to obtain very wide and actual information.

1.7 Organization of the Study

This dissertation is presented I five chapters. Chapter one introduces the study by giving the background of the research problem, statement of the problem, objectives of the study, and research questions. It also presents the significance of the study. Chapter two presents literature review, theoretical review, empirical review, conceptual framework, and research gap. Chapter three describes research methodology, research design, sampling technique, data collection methods as well as data analysis techniques. Chapter four presents the research findings and discussion. Chapter five gives the conclusion and the recommendation of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examines the literature relevant to the case study. It focuses on the general concept of mining as an economic land use with particular reference to sand extraction activities, policy and regulations issues related to sand mining in Zanzibar. It also focuses on the causes behind for the sand mining. The impacts of sand mining on socio-economic status of the population, land use conflicts, agricultural development, biodiversity and biodiversity habitats loss, and finally it focuses on highlighting the potentials for the rehabilitation on the abandoned mine sited among other issues.

2.2 Conceptual Definitions

2.2.1 Land Use

Land use is referred to a real management, utilization and modification of natural environment (land) for human needs such as agricultural fields, forms of urban, industrial setting, pastures, aquaculture, as well as managed forests. Land use involves the application of human controls, in a relatively systematic manner, to the key elements within an ecosystem in order to derive benefits from it (Feras Ziadat, S. Bunning and E. Pauw, 2017).

Land use practices differ considerably across the world. According to the United Nation's Food and Agriculture Organization Water Development Division report explains that "Land use concerns the products and or benefits obtained from use of the

land as well as the land management actions (activities) carried out by human being to produce those products and benefits. Therefore, land use and land management practices have a major impact on natural resources including water, soil, nutrients, plants and animals (Feras Ziadat, S. Bunning and E. Pauw, 2017).

2.2.2 Mining

Mining is defined to as the extraction of valuable mineral or other geological materials from the earth (*Wikipedia, the free encyclopedia*). The term also includes the extraction of soil for various human uses. Materials extracted through mining include base metals, precious metals, iron, uranium, coal, diamonds, limestone, oil shale, rock salt, potash, petroleum, natural gas, soil and even water.

2.2.3 Types of Mining

Mining can be categorized into several types depending on the nature of the materials extracted from the ground. This may include sand mining, stone mining, gravel mining, base metal mining, and precious metal mining, which include gold, iron, uranium, coal, diamond, limestone, oil shale, salt, and potash mining. The other literatures have classified mining activities into two; surface mining which is usually associated with gravel, sand and sometimes minerals; while the underground (deep) mining is mostly associated with pure mineral such as petroleum, natural gas, uranium and so forth (W. Scott Dunbar, 2012).

2.3 Theoretical Review

2.3.1 Malthusian Theory of Population

This study was guided by the Malthusian Theory of Population (Malthusianism). Malthusian theory of population was advocated by Thomas Robert Malthus and it

derived from his political and economic thought in his 1798 writings, *An Essay on the Principle of Population*. The theory states that the population growth is potentially exponential while the growth of the food (resources) is linear. Malthus believed there were two types of population checks that in all times and places kept population growth in line with the growth of food supply (resources).

He suggested preventive checks such as moral restraints including abstinence and delay marriage. While the positive checks, which lead to premature death such as disease, starvation and war, resulting in what is called a Malthusian catastrophe. The catastrophe would return the population to lower, more sustainable, and level. Thus, Malthusianism has been linked to a variety of political and social movements, but always refers to advocates of population control.

With the relation to the stated theory some reviews drawn from the existing literature reviews justify the study. Sand mining activities has received a great attention from many scholars, with both natural and social scientists having written about the subject. One such scholars is Ashraf (2010), who observes in his book *Sand Mining Effects, Causes and Concerns* that the worst impacts of sand mining activities in the world have been experienced in the less developed countries because people to a great extent live depending solely on the surrounding natural and environmental resources. This suggests that the developing world experiences rapid population growth versus poverty situations resulting into improper utilization of its natural resources, sand being amongst.

Another scholar who studied sand mining is Daniels (2003). In his book, *Chemical and Physical Properties of Mineral Sand; Mine Soil in South-east Virginia*, he

examined different characteristics and types of sand found in the mined sites. He described the general effects of sand mining activities on soil formation, soil layer arrangement and soil productivity. He informs that there are almost the same driving factors for and effects of sand mining in Asia, in Latin America as well as in Africa. The African area includes Zanzibar Islands in particular.

Scholars including Gavriletea & Johnbull (2017) have examined the sand mining issues in terms of its impacts on general environment. They also put analysis on sand market and socio-economic effects of sand mining along the river valley sites. In their study, they established that sand resources should have balanced management between its sustainable utilization and conservation to better maintain relationship between human behavior and soil ecosystems. This is mainly because soil health environment is affected by human activities but at the same time the peoples' livelihood depends upon a good condition of the soil resources. Therefore, sand exploitation, sand management and soil resource cannot be considered in isolation. In deed this is a very important point in term of community-based environmental conservation practices.

2.4 Empirical Literature Review

Many scholars such as Ladlow, Nyandwi and Muzuka have written about sand mining and its socio-economic significance in Zanzibar and the East African coast in general. Such scholars have examined the use and conservation of natural resources (sand) as well as the way in which people in Zanzibar perceived their use and sustainability. For instance, according to Jafaru (2013), poverty situation among the population is considered as both a cause and impact of environmental degradation anywhere in the

world, which also affects the sand resources. He stated that, the intensive use of sand resources cause a decline in agricultural production which in turn leads to a decline of the farmer's earnings. The scholar calls for better ways of sand exploitation to conserve the environment.

In her study on *Assessment Of The Impacts of Sand Mining In Unguja, Zanzibar*, Ladlow (2015) shows that, the people in Zanzibar constructed houses using traditional technologies and use local raw materials such as coconut palm fronds, sand, coral rag, lime and mangrove poles. Ladlow (2015) advocates that there is rapid population growth in Zanzibar which necessitated the urbanization processes to take place at very fast rate. This resulted in the cutting down of many trees and clearing of forests for sand mining which are chiefly being used for construction purposes. Therefore, Zanzibar is directly affected by sand mining activities as people meet their demands.

Nyandwi and Muzuka (2007) have also conducted a study on the use of sand resources in Zanzibar. They contend that sands have been used over time as source of construction works. They mention Zanzibar as one among the places that are in danger of land environmental degradation in Tanzania, stating that "it is currently suffering measurable degradation". These scholars have also raised their concern about the increased pressure of commercial demand for sand, which if not checked, poses a threat to the future sustainability of the sand resources.

These scholars, therefore, did not disclose about the in depth of causal-effects analysis of sand mining in Zanzibar and the ways in place used to conserve the resources and the environment for their sustainable use. Hence, this study aims to analyze socio-

economic dynamism and sand mining activities focusing on the causes and effects of the problem in the island of Zanzibar.

2.4.1 Supply of and Demand for Sand

Potential mining sites are typically chosen based on the natural supply of and type of sand materials available, its quality, and land ownership. The demand of sand material relates to the increasing need for construction materials caused by an abrupt demographic characteristic changes which approximately use 96% of the total amount of mined sand. Of the sand used in the construction, approximately 53% is used for residential and non-residential buildings.

More than 60 to 70 tons of sands are needed to construct a single regular 6-rooms house, and approximately 8,000 tons of sand aggregate needed to construct a social infrastructure such as school or hospital. On top of that more than 10,000 tons of sand being used to construct physical infrastructures such as roads and bridges. For although these values are rough approximations but give some indication of the volume of materials used in daily building construction (Jafaru M., 2013).

Currently North 'B' Unguja District being a solely supplier for sand in the Unguja-island due to high demand for sand for housing construction; this in turn has resulted into a relevance of the theory of basic economic problem of 'scarcity' whereas the demands of natural good (human wants) far exceed its supply. There then, in order to maintain sustainability for sand resource, the decision was made in the recent years leading into the governmental interventions on sand resource management.

2.4.2 Sand Mining

Sand mining is defined as the extraction of sand, mainly through open pits but sometimes mined from beaches and inland dunes or dredged from ocean and river beds for various uses, such as road construction material, housing material, filling materials and landscaping. Sand extraction often occurs at multiple times and at multiple sites from an open land resulting into impacts that are likely to be both chronic and cumulative. When the rate of sand mining exceeds the rate of natural deposition over an extended period of time, numbers of remarkable problems occur due to the cumulative loss of sand (Muhammad Aqeel Ashraf, *et al*, 2010).

2.4.3 Legal Framework and Guidelines for Sand Mining Activities in Zanzibar

Sand extraction is regulated by law in many places, but is often done illegally and in traditional ways. In Zanzibar, sand mining activities are under the directions and supervisions of the Zanzibar-Ministry of Agriculture, Natural Resources, Livestock and Fisheries (Z-MANRLF) whereas Department of Forestry and Non-Renewable Resources (DRNR) is in-charge for the entire activities. Land degradation and other environmental burdens resulted from the extraction of sand have been significant and remarkable.

Sand mining activities create potential negative impacts at multiple times on the environment both during the mining operations and years after the mines are closed. These impacts have led to most of the world's countries opting regulations to moderate the negative effects of mining operations. Various environmental regulations, laws and guidelines enacted by the government of Zanzibar for the control and management of the environment and natural resources.

Under the sand mining law of 2016 all mining groups are supposed to submit for their requests to the Department of Forestry and Non-Renewable Resources (DFNR). The DFNR is a responsible government organ for directions and decision makers though for long it mistakenly in the exercise of their duties since often the activity is carried out illegally. Consequently, massive Environmental Impact has been detected out in respect of sand mining (The Revolutionary Government of Zanzibar, 2013).

It must therefore be noted that sand mining law of 2016 forms the basis for the environmental regulation. The guiding principles used in the preparation of these guidelines were as follows:

- (i) Proper planning and management can minimize environmental impacts.
- (ii) To ensure balance between environmental protection and the demand for sand as significant socio-economic item.
- (iii) Making compensation for and or replacement of resources and progressive reclamation of disturbed land.

General speaking from the above law statements Zanzibar in recent years, land degradation and environmental burden caused by the extraction of sand resources activity has been significantly checked.

2.5 Impacts of Sand Mining

2.5.1 Conflicts in Mining Communities

It is considered that, conflicts resulting from natural resource exploitation anywhere in the developing countries are typically severe, resulting into violence, resource over-exploitation and degradation, and if not addressed they can threaten the entire

communities' life. However, in the North 'B' Unguja District, it is usually perceived that except some of the village elders and few district leaders, majority of other community members are usually not consulted in respect of the lands (usually farmlands) that are released for sand mining activities. Such perceptions have been over decades now having massive effects leading to social conflicts over the lands uses.

Sand mining activities generally has both negative and positive impacts on the local communities. Individual groups engaged in sand mining may contribute to the development of key socio-economic infrastructures, revenues collection; sand mining acts as a basic source of employment for local people, and triggers the establishment of a wide range of small businesses such as catering and soft drink services. In Zambia for example, mining activities employs about 15% of the country's workforce.

According to Weigand (1991), sand extraction activities negatively affect ecosystem balance. Some other adverse impacts of sand mining in the island may include: Loss of ability to hunt and gather, increased risk of flood and soil erosion, loss of soil fertility, loss of biodiversity, shortage of water resources, decreasing yields in agricultural production, loss of freedom of movement of animals; plants and people, relocation of settlements, health hazards, and land use disputes between community members and mining groups, individuals and the government (Muhammad Aqeel Ashraf, *et al*, 2010).

2.5.2 Soil Physical Properties

Biomasses of both plants and trees have the ability to maintain or improve soil physical properties and characteristics. Sand mining results into clearing of vegetation

cover; reduces essential nutrients; and organic matter of the soil, as well as biological activities, leading to adverse effects to the soil physical property such as loss of biodiversity leading to land fragmentation and degradation (W. L. Daniels, Z. W. Orndorff, and P. D. Schroeder, 2003). All these, therefore may cause low soil productivity in the areas affected by sand mining in Zanzibar.

2.5.2.1 Soil Bulk Density

Soil Bulk Density (SBD) is defined as the mass per unit volume of dry soils (Ahmed Abed Gatea, 2018). Sand mining decreases the soil bulk density of abandoned sites since it involves removal of topsoil (soil organic matter) from the land. The soil bulk density is regarded as a key factor that is correlated with soil compaction and many chemical, physical and biological properties of soil (Ahmed Abed Gatea, 2018).

2.5.2.2 The Soil Texture

Soil texture is composition of size of soil particles that is sand, clay, clay and. Therefore, soil texture is defined as the particle size distribution of the fine earth fraction of less than 2mm. The texture of soil determines the nutrient supply ability of the soil as well as the ability of the soil to hold and conduct air necessary for plant growth. With the sand mining the land lost its ability to support the growth of tree leading to failure of agricultural activities and instead the abandoned sites turn into either temporary or permanent waterlogged grounds or depressions (R. B. Brown, 2004).

2.5.3 Impacts of Sand Mining on Soil Chemical Properties

Sand mining activities affect the soil chemical properties which play very significant roles on the growth of trees. Sand mining activities depletes calcium minerals in the

soil which may affect tree growth directly, simply by becoming deficient for growth. With the absence of tree cover in the mined areas as a significant factor for soil formation, the rate at which the soil naturally formed decreases respectively. Again, the destruction of soil pH balance leads to the total deficiency in the soil and the productive capability of the soil.

2.5.4 Land Degradation

Land degradation is the changes occur within the land which negatively affect the structure or function of the land and thereby lower the capacity to supply its goods and services (*Environment Resources Assessment – FAO, 2001*). Among other factors sand mining activities worsen the burden of serious land fragmentation. Estimates indicate that about 25% of cropland in the Zanzibar will lose 2cm³ of soil every 30 years as a result of soil degradation and erosion (*Department of Forestry and Non-Renewable Resources, 2016*). This results in shortage of land and thereby escalating the problems of soil scarcity (Ntahondi Nyandwi & Alfred N. N. Muzuka, 2007).

2.6 Rehabilitation of Mined Sites

The rehabilitation of drastically disturbed terrestrial systems, such as land mined for sand, coal and minerals requires site-specific knowledge to ensure that reclamation strategies chosen will be sustainable. In South Africa, a large proportion of post mining landscapes are rehabilitated to forest. Therefore the rehabilitation practices and measures included forestation, agro-forestry, replanting vegetation on mined areas to prevent further damage and use of open pits as dumping sites and landfills.

2.6.1 Forestation and Tree Planting

Natural regeneration of secondary vegetation on degraded mined site lands are often a slow and uncertain process, impended by a combination of factors including human, recurrent fires, livestock pressure, and unfavorable micro-climatic conditions, soil infertility, soil profile disturbance and exhaustion of soil seed bank among others. Therefore, the deliberate tree planting and forestation efforts are needed to reverse further erosion.

2.6.2 Agro-Forestry

Agro-forestry is a collective name for land use systems and technologies in which trees, shrubs, palms, bamboos and other plants species are deliberately are grown around or among crops or pastureland. In agro-forestry systems, there are both ecological and economical interactions between the different components. Reclamation through agro-forestry can be used to restore sand pits after abandonment since the technology involves planting of trees on degraded land with the objective of checking erosion and restoring soil organic matter and fertility status of the soil. Agro-forestry, being one of the several approaches for improving land use, is also frequently cited as an answer to shortage of fuel wood, cash income, animal fodder and building materials in Sub-Saharan Africa (Om Prakash, R. Kaushal, J. M. S. Tomar, and A. K. Prandiyal, 2014). Thus, agro-forestry appears to have an enormous potential for reclaiming the abandoned sand mined sited.

2.8 Conceptual Framework

A conceptual framework represents the researcher's synthesis of literature on how to describe a phenomenon. In other words, the conceptual framework is how the

researcher understands the particular variables in his study connect with each other. Therefore, it identifies the variables required in the research investigation. It is the researcher's map in pursuing the investigation.

Many parts of the Island have been experiencing the impacts of sand mining. These impacts are soil erosion, water pollution, loss of biodiversity, and destruction of river banks, deforestation, and soil exhaustion. The study has independent and dependent variables. The independent variables in this study include; causes of sand mining activities include (the rise in the social and economic status of the people and the demographic characteristic changes). The dependent or outcome variable depended on what the independent variable did to it (*Fraenkel and Wallen, 2000*). The dependent variable in this study were the impacts of sand mining activities to the people's livelihood and environment in North 'B' District Unguja – Zanzibar.

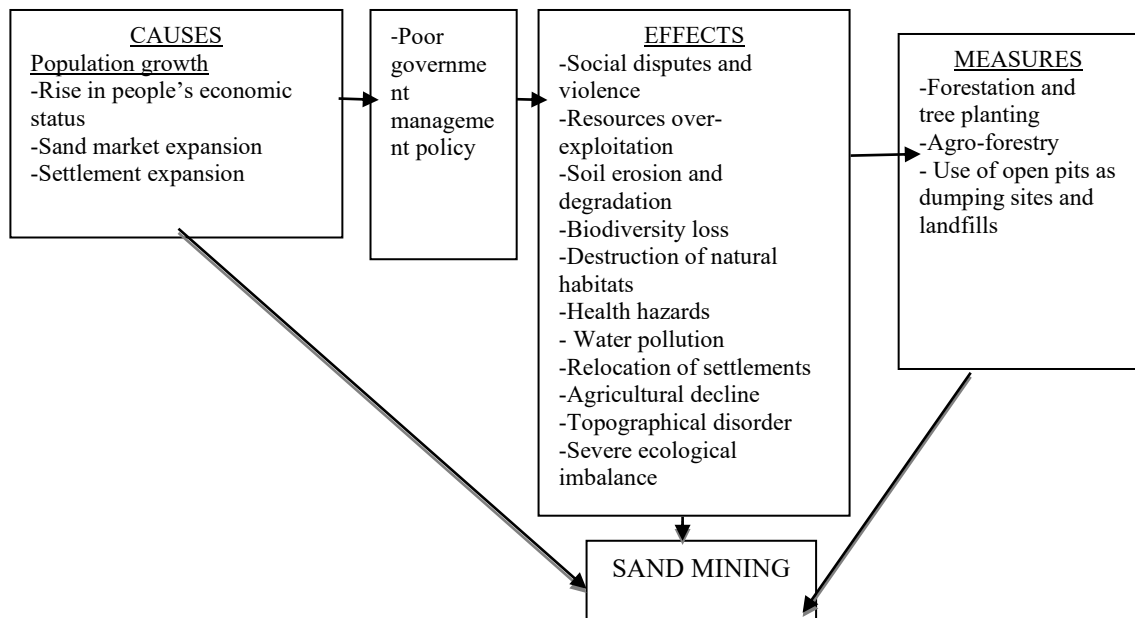


Figure 2.1 Conceptual Framework of Socio-Economic Impact of Sand Mining in Zanzibar Based on Malthusian Theory

2.9 Research Gap

Many studies have been conducted to investigate on the issues relating to the causes and effects of sand mining activities in Zanzibar. The revolutionary government of Zanzibar, non-governmental organizations and other stakeholders from different groups are in struggle to and some have already developed comprehensive environmental laws that can support the management of sand resources. In spite those efforts, it is not yet clear that Zanzibar had already develop a control for all percent over the problem of sand mining activities and its negative effects. This study therefore, intend to fill the gap by providing the insight causal - effect analysis on the socio-economic dynamism and sand mining activities in North 'B' District, Unguja Island as an area of case study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Chapter Overview

This chapter discussed methodology employed in data collection process on the research to analyze the causal – effect of sand mining activities. This chapter also describes fully the overall plan on how the whole research was carried out including research designs used, methods of data collection and analysis of the results.

3.2 Research Design

A research design is the arrangement of situations for collecting and analyzing of data for the sake of combining relevance to the research purpose with economy in procedure (Kothari, 2004). In fact a good and well organized design considers that the information met is reliable with study objectives and data are collected by accurate methods. Therefore, research design is simply a map that is usually developed to guide the researcher (Pandey, 2015). Definitely, this qualitative study used descriptive design. Descriptive design normally explains phenomena as they exist, it is used to identify and obtain information on the features of a particular issue like community, group of people, and also it is used to study the current situations (Akthar, 2016). Therefore, this study gained information and analysis on the causes and socio-economic effect from selected respondents.

3.3 Location of the Study Area

The study was conducted in North ‘B’ District in the Northern Region Unguja – Zanzibar. This district is one of the two (2) administrative districts of the Northern

Unguja Region. It was established by the “Local Governance in Zanzibar” Legislative Regulation; Article 128, Chapter 12, Section 2 of the 1984 Zanzibar Constitution which specifically called for the establishment of local government (Othman, Mukandala and Robert Makaramba, 2003). It has total population of eighty one thousand, six hundred and seventy five (81,675) people with a growth rate of 3% per year based on the 2012 population and housing census.



Figure 3.1: A Map of Zanzibar Island Showing the Location of North 'B' Unguja District

Source: www.google.com

As per the 2012 Population and Housing Census Report, the male population is 49.64 and that of the female population stands at 50.35%. Thus, the district is a female dominant population. There are 29 wards or “shehia” in the North ‘B’ Unguja District in which the communities are administratively demarcated into village government; ward government and District council (The United Republic of Tanzania, 2012) (see Figure 3.1).

3.3.1 Geographical Context

Zanzibar is a part of the United Republic of Tanzania (URT), and comprises of the two main Islands Unguja and Pemba (and many small islets). They lie about 40 and 60kms km off the East coast of Mainland Tanzania respectively. The total land area of Zanzibar is 2,643 km² (Unguja has 1,658 km² and Pemba occupies 985 km²). Based on the 2012 Population and Housing Census has a growth rate of 3.1% per annum and the current population (2019) is estimated to be 1,303,569 of which two-thirds live in Unguja. With around 500 persons per square kilometer, Zanzibar is the most densely populated part of East Africa (Azzan & Rashid Mohammed, 2016). Administratively, Zanzibar has been divided into five regions; three in Unguja and two in Pemba. Each region is further divided into two districts except Urban – West Region divided into three districts, totaling eleven districts for the whole of Zanzibar. The climate is of a lowland tropical humid type dominated by bimodal pattern averaging 1500 mm per year. Mean temperature lies around 22 °C (H. I. Majamba, 2005).

3.3.2 Household Characteristics

Households are predominantly male headed. The proportion of female headed households was 3.0% as at year 2012. In the year 2015, it rose to about 3.6% and

subsequently to about 5.5% in the year 2017. The average household size is 4.7% with the smallest household consisting one (1) member and the largest household having twenty three (23) members (H. I. Majamba, 2005).

3.3.3 Economic Activities

The economy of the North 'B' Unguja District is based on agriculture, trade, tourism, and fishing. The agricultural sector engages about 60% of the labour force, majority of who produce staple crops at subsistence level. The cash crops production is minimal and includes cloves, pine apples, water melons, and seaweed. There are however, extra efforts by external support agencies to upgrade technologies, especially for women economy is constantly taken.

3.3.4 Climate Characteristics

Zanzibar has a tropical climate, with fairly constant average temperatures across the year. It has relatively high levels of average precipitation, and experiences strong rains (spring) in March to May, with shorter rains (autumn) in September and November. The dry season lasts from December to February. Annual rainfall ranges from 600-1200mm per year with uneven distribution. Monthly temperature averages 32°C and ranges between 18°C and 37°C annually. However, there is variability throughout and between the two islands (Unguja and Pemba), and substantially variability across years. Zanzibar is also periodically affected by major East African local weather extremes, related with El Nino and La Nina years. These regional occasions lead to large climatic variability, with heavy precipitation (floods) and dry spells (droughts). These intense occasions have fundamental economic costs on the islands, which are

significant threats on tourism, agriculture, health, energy supply and demand, infrastructure, water resources and ecosystem services (Paul Witkiss, *et al*, 2012).

3.3.5 Geology and Soil

Various types of limestone form the base of Zanzibar islands with sedimentary formation characterize the geology of the district. It comprises of sand stone, shale and siltstone to the almost district though some few land characterized by mudstone. Extensive weathering of the limestone combined with erosion and earth movements have resulted in a variety of soils including read earths, loams, clays, and sands. Flat areas of coral limestone occur to the East, South and North of Zanzibar and on the western side of the islands.

3.3.6 Relief and Drainage

The North 'B' Unguja District is generally flat with gentle undulating low relief. The altitude ranges between 112 to 224 meters above the sea level with the eastern part being slightly hilly and gently sloping towards the west. The main drainage system in the District is made up of rivers and its streams; and few lakes. The effects of this drainage system is felt mostly in the central and western parts of the district covering the area surrounding Kitope, Mahonda, Mto Mchanga, Zingwezingwe, Upenja, Donge and Kiongwe. These areas are prone to periodic flooding during the wet seasons, thus making them suitable for rice and sugarcane cultivation.

3.3.7 Agriculture

3.3.7.1 Primary Production

According to the District Commissioner's Office (DCO), North 'B' Unguja District is predominantly agricultural with about 95% of the district's economically active

population (18-54 years) being involved in farming. The major subsistence crops include cassava, maize, rice, yams, coconuts, pineapples, beans, millets, sweet potatoes, bread fruits, and bananas. However, the sector encounter problems such as low soil fertility and small farm size per head which usually are a result of factors such as sand mining, high costs of agricultural input, post – harvest losses and reliance on rain fed agriculture. Agriculture is mainly dependent on rainfall which is erratic. Thus there is great seasonal unemployment for many household members.

3.4 Sample Population and Sampling Procedures

The sample frame of this study consisted of communities close to major abandoned sand mining sites in the North ‘B’ Unguja District. In view of the vast nature of the area, a three-day reconnaissance survey was carried out in the area. In all, forty (40) communities were visited based on the presence of abandoned sand mines close to them. Most of these abandoned mines are large in sizes. Out of this, ten (10) communities were purposively selected for the study on the basis of their proximity to abandoned mining sites. The reconnaissance survey helped in determining the sand mining sites in respect of their age groups. These sites were identified to measure both their short and long term environmental impacts of the sand mining activities. The sites were located in the following communities: Donge, Kazole and Michungwa Miwili villages.

3.5 Data Collection Techniques/Instruments

A combination of quantitative and qualitative data collection techniques namely face-to-face interviews, focus group discussion, and direct observations were employed.

The instruments used in the process were structured and semi-structured questionnaires.

3.5.1 Face-to-Face Interviews

Face to-face interview is a data collection method, which involves the interviewer directly communicating with the respondent in accordance with the prepared questions. This method enables to acquire factual information, resource consumer evaluations, attitudes, preferences and other information coming out during the conversation with the respondent. Thus, face-to-face interview method ensures the quality of the obtained data and increases the response rate. Using this technique the information was obtained from household heads, farmers and women as respondents in the study communities in the study area.

3.5.2 Focus Group Discussion

A focus group discussion involves gathering individuals from similar backgrounds or experiences together to discuss about a specific topic of interest. It is a form of qualitative research where various questions are asked about their perception, attitudes, beliefs, and ideas about the problem studied. In focus group discussion participants are allowed and free to talk with other group members; unlike other research methods or technique it encourages discussions with other participants. It generally involves group interviewing in which a small number of usually 8 to 12 people taken into account. It is led by a moderator (interviewer in a loosely structured discussion of various topics of interest.

Two Focus Group Discussions (FGDs) were held in Donge, two in Kazole, and two in Michungwa Miwili communities in the district. The purpose of this was to validate

some of the pertinent responses given during the interview administration. Also, during this organization of FGD the researcher gathered unbiased and balanced views from all segments of the adult population with regards to current realities in the localities. It also provided the opportunity to directly observe the group process and actions.

3.5.3 Direct Observation

Direct observation data collection method only involves the researcher making observation. Observational research findings are considered strong in validity because the researcher is able to collect a depth of information about the problem studied. This technique was applied because it often overcomes the problem of external validity. The researcher travelled to the mining sites observing the continuation of the sand mining activities. Both descriptive, and or imagery information were collected which were very constructive to the development of this research paper.

3.5.4 Questionnaire as Tool

A questionnaire is a research data collection instrument comprising of a series of questions (or other types of prompts) that the respondents has to answer in a set format for the purpose of gathering information from respondents. In a questionnaire, distinction is made between open-ended and closed-ended questions. An open-ended question asks the respondents to formulate his own answers, whereas a closed-ended question demands the respondent to pick an answer from a given number of choices or options. Questionnaire data collection instrument was applied in this study because it is cheap, which do not requires as much effort the questioner like face-to-face interview method, and mostly important has standardized answers that make it simple to assemble data.

3.6 Sample Size

Sampling size is a research concept, which means selection of a given number of subjects (respondents) from a defined population in the area of study as representative of that population. Based on purposive sampling fifty three (53) respondents were included, nine (9) were sand miners; three (3) were school teachers and three (3) university instructors; two (2) were member from the Department of Forestry and Non-Renewable Resources, six (6) were from the Office of the North 'B' Unguja District Commissioner; and ten (10) ward leaders.

A total of twenty (20) households were involved; one respondent was obtained from each household. These respondents were usually those whose farms and settlements were located close to sand mining sites. Also, ten (10) near the mines communities apart from the above stated households were involved in which a total of five (5) respondents were obtained from each of the communities; making seventy (50) respondents in total (see the Table 3.1).

Table 3.1 Category of Sample Population and Size

Sample	Respondents	Percentages
Ward leaders	10	9.7
Households	20	19.41
Government officers	6	5.82
Sand miners	9	8.73
School teachers	3	2.91
University instructors	3	2.91
Community respondents	50	48.54
Members from DFNR	2	1.94
Total:	103	100

3.7 Analysis of Socio-Economic Data

The researcher employed statistical tools in the data analysis; these were IBM Statistical Package for the Social Science (SPSS) and Excel Software Package. While descriptive analysis was used to describe the socio-demographic characteristics mainly in the form of bar graphs, and pie charts for the purpose of visual expression.

IBM Statistical Package for the Social Science (SPSS) and Excel software packages analysis were also carried out to assess the significance of residents' perception of the impacts of sand mining in the district. They were also used to determine homogeneity of respondents from different sand mining communities and to assess the significance of the impacts of sand mining on peoples' livelihoods.

3.8 Data Processing and Analysis

This study involved both qualitative and quantitative analysis. Qualitative data were collected through interviews (face to face and questionnaire); focus group discussions and direct observation were subjected to content analysis. According to Cohen *et al*, (2007) content analysis is a research technique for making valid inferences from the meaningful matter to the contexts of their uses. Therefore, its use enabled the researcher to summarize data from the field and report them as findings. In the second stage the summarized data from tables, bar graphs and pie charts, as well as taking photographs, were analyzed and interpreted as findings.

This managed with the support of both Microsoft Excel's Software and Statistical Package for Social Science (SPSS) which were applied to obtain sum, mean and

frequency distributions which then computed and data were tabulated to summary the raw data in compact form. The information gathered was used to suggest solutions and make recommendations for mitigating negative impacts.

3.9 Validity and Reliability

The study used data collection instruments including questionnaires, face-to-face interviews, and direct observation and focus group discussions in order to ensure effective data collection and the validity of the data. The use of quantitative approach helped to demonstrate validity and open up new perspectives about the topic under investigation. The data obtained was also compared to similar data available to ensure reliability.

3.10 Permission for Study and Ethical Consideration

The aim of this research was to analyze the causal – effect analysis of sand mining activities on socio-economic patterns of the population in Zanzibar, North ‘B’ Unguja district. Written permission to conduct this study was sought and obtained from the Department of Forestry and Non-renewable Resources – Zanzibar and the office of the DC’s North ‘B’ Unguja District as well as from the Faculty of Arts and Social Sciences (FASS), Department of Geography, The Open University of Tanzania.

The consent of the respondents was bargained physically to discuss verbally before involving them in the research. It was included briefing to the respondents about research objectives and how they are going to be benefited from the research. The respondents were assured about the confidentiality in the information, which may be collected from them. The interview with respondents were set to be in privacy way.

Recorded information, photos and narrations from respondents were used only for the purpose of this study. Respective all local government authorities where the study was conducted were consulted for permission of to conduct this study.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Chapter Overview

This chapter presents the findings and discussions for the causal – effect analysis of socio - economic dynamism and sand mining activities in North ‘B’ District Unguja, Zanzibar. The chapter is divided into the following sections: the socio-demographic characteristics of the respondents (Age distribution of respondents; sex distribution of respondents; principal occupation of respondents; and distribution of respondents by their positions in the villages), the effect of sand mining activities on socio-economic changes, the impacts of sand mining on biodiversity and finally the rehabilitation measures towards sand mined sites.

4.2 Presentation of Findings

4.2.1 Socio-Demographic Characteristics of Respondents

Social demographic characteristics of the respondents included the description of age, gender, position in the villages, principal occupation of the respondents and visit to sand mining sites attitude.

Figure 4.1 shows the dominant age group of 31 - 40 years of age. This is because the respondents in this age group were readily available and willing to take part in the study since they are affected most when sand is mined in or near their agricultural lands. This age group is however, the one which is highly involved in the sand mining activities. The next large age group is 41-50 years.

4.2.1.1. Age Distribution of Respondents

Figure 4.1 shows the age distribution of the respondents for the study.

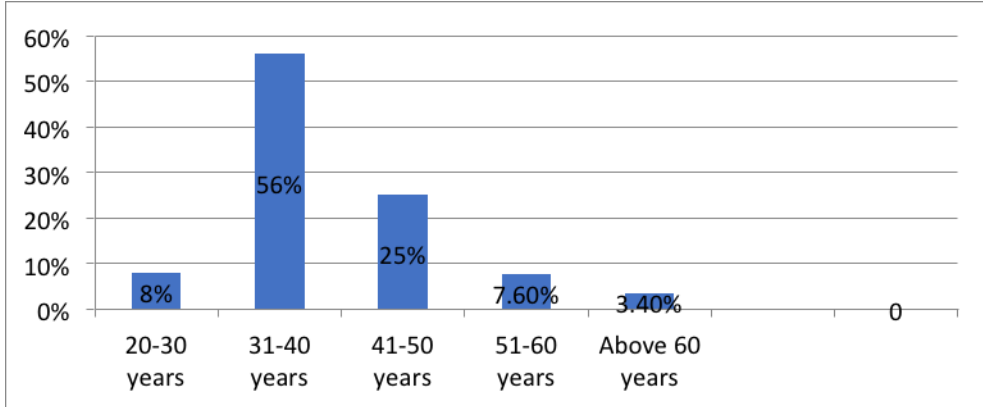


Figure 4.1: Age Distribution of Respondents

The data shows that there were fewer respondents for age group between 20 and 30 years of age because they were almost not present in the villages at the time of study and most reside in town where they work. This age group had high frequency and consisted of young literate adults who could understand the questions and are aware of environmental issues.

4.2.1.2 Sex Distributions of Respondents

Figure 4.2 shows the sex distributions of respondents for the study.

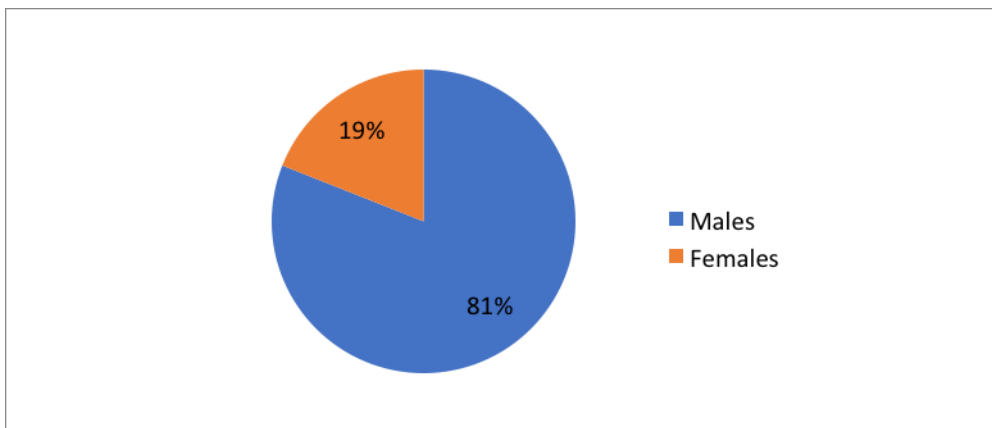


Figure 4.2 Sex Distribution of Respondents

Figure 4.2, shows that male respondents have the majority and implies that they were the main active respondents responsible for sand mining in Zanzibar compared to the female respondents. Male being the majority also implies that in Zanzibar's societies, households are headed by male and made male a dominant sex tendency in term of economic activities. On the other hand, the female were also responsible and contributing to the sand mining processes though not directly. They work in selling food and soft drinks to the male sand miners; this takes leads to the continuations of environmental degradation through sand mining activities. Therefore, the ongoing high rates of an environmental degradation in Zanzibar as a result of sand mining are the actions of both male and female sex categories.

4.2.1.3 Distribution of Respondents by Positions in the Village

Figure 4.3 shows positions of respondents in their villages. The sample represented most positions in the villages including those in leadership.

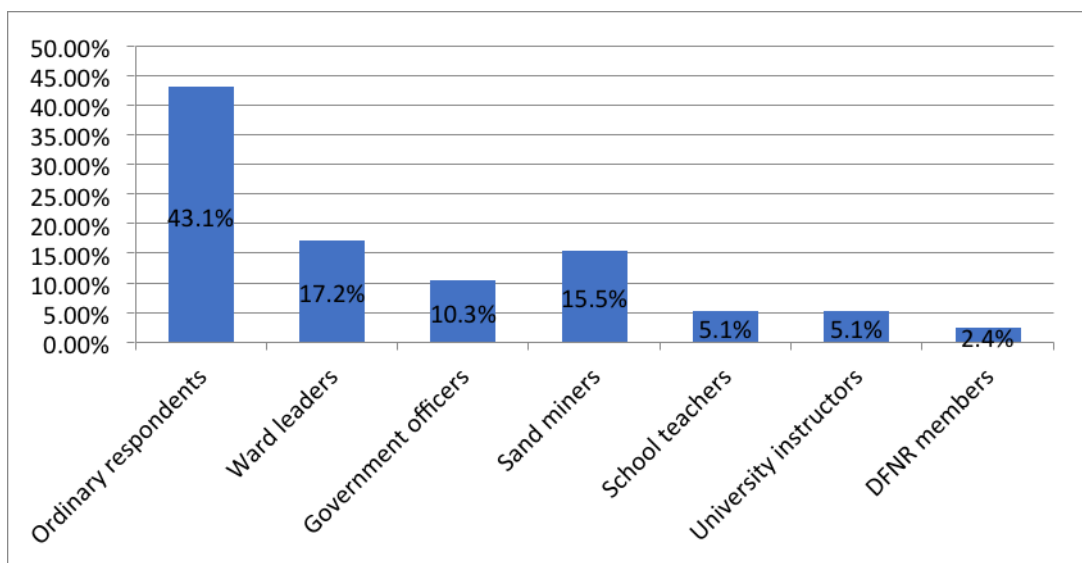


Figure 4.3 Distribution of Respondents by Position in the Villages

The highest percentage of respondents of about 43.1% consisted of ordinary villagers who form the majority of the population and are the owners of agricultural fields where sand is mined. For although in the beginning the respondents were not willing to spend their time being interviewed because they were busy in rice harvesting but later on with the help of a villages chairmen they voluntarily took part in the study because they were not happy with sand mining in their areas and were willing to suggest solutions and make recommendations to law makers, communities and to the local governments.

4.2.1.4 Principal Occupation of Respondents

Figure 4.4 shows the principal occupational distribution of the respondents of the communities near the mining sites in the North 'B' Unguja district as a whole. One occupations type influences the others, for example, the study revealed that farming is the main economic activity for the livelihood of the large portion of population in the communities near the mining sites. It is followed by the group of miners which negatively affect the other occupational groups.

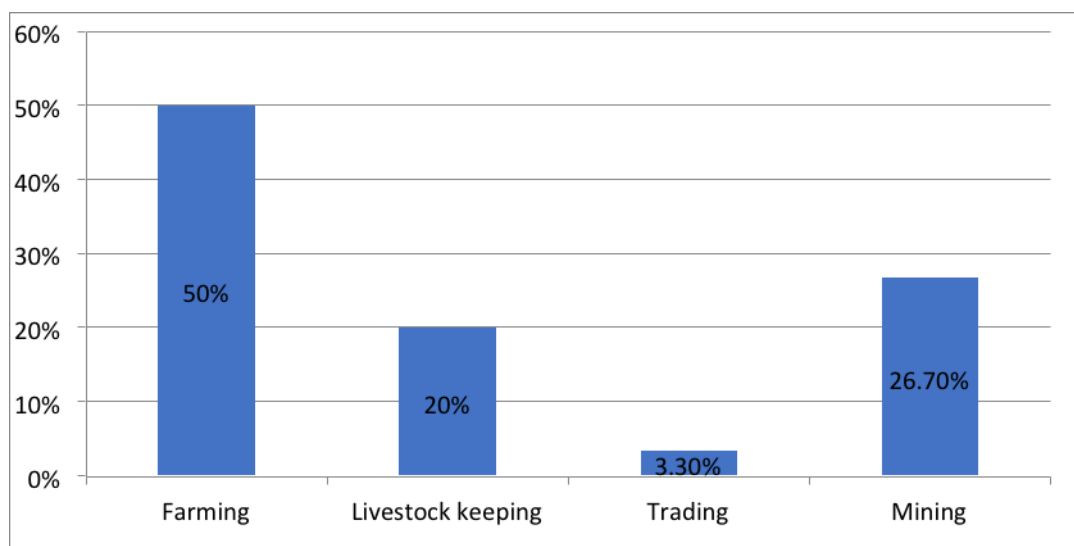


Figure 4.4 Principal Occupation of Respondents

Land fertility is declining due to the removal of top soils and land degradation leading to a decline in farming activities. Trade is declining and being at risk of infectious diseases of air and water born diseases, Livestock rearing also is affected because the herds lack pastures to feed though these particular herds are responsible for the illegal small scale sand mining as they are being used to carry sand resource by using carts.

4.2.1.5 Visits to Sand Mining Sites

Figure 4.5 shows that many villagers visit sand mining areas regularly for various reasons.

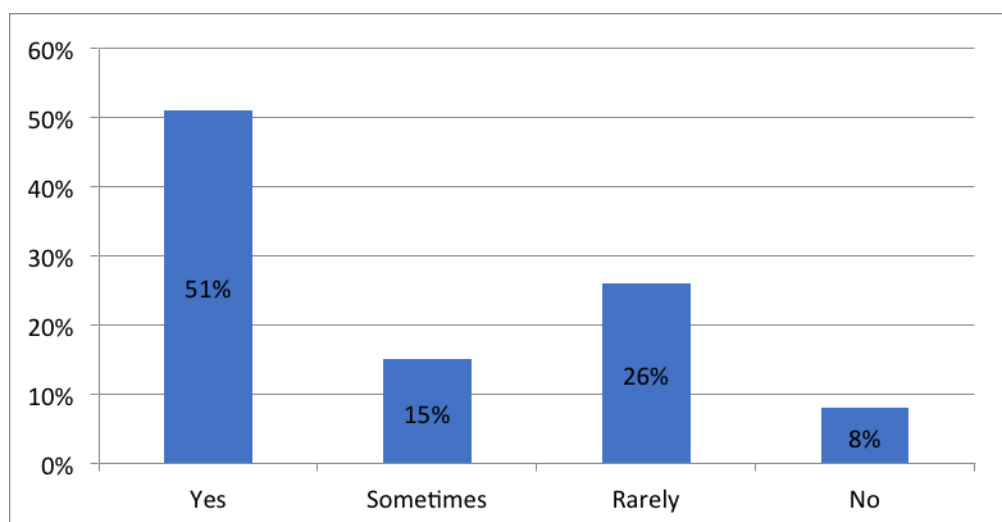


Figure 4.5 Respondents' Visits to Sand Mining Sites

In Figure 4.5 most respondents who indicated that they visit sand mining sites regularly were men. Some respondents indicated that they visit mining sites because they are seeking jobs to load tipper trucks and Lorries manually or illegal mining. Women rarely visited mining sites probably because they are occupied by other duties in homes and are not involved much in sand mining activities except for those who went to sell food and soft drinks.

4.3 Impacts of Sand Mining Activities on Socio-Economic Changes

Extraction of sand natural aggregate has recently expanded across the world and is fuelled by construction boom in both developed and developing world (Schaetzl, 1990). Zanzibar is not an exception with this expansion of human settlement and urbanization process. Impressive development of new urbanized and mushrooming residential areas has increased the demand for pit and river sand as miners are eager to cash on these resources (Mbaiwa, 2008). There is rampant sand mining by both licensed and unlicensed (illegal) groups. Therefore sand mining activities in Zanzibar has both positive and negative impacts on socio-economic changes of the population.

This study was carried out to find the socio-economic effects of sand mining activities in Zanzibar. Respondents had realized both positive and negative impacts of sand mining activities and were asked to give general views on the impacts of sand in their localities.

4.3.1 Positive Impacts of Sand Mining Activities on Socio – Economic Changes

The study revealed some positive impacts of sand mining activities for Zanzibar through face to face interviews and questionnaire survey. Respondents were asked to outline the advantages of extracting sand from the environment and these were responses obtained:

Respondents through face to face interview addressed a number of issues about benefits delivered from the extraction of soil. From the field study (Table 4.1), about 24.2% of the respondents said that many people are affording to build modern, durable and strong houses at cheap costs as sand are readily available locally. Meanwhile 20.3% of the respondents said that the sand mining activities create

employment opportunities for youth as truck's drivers and manual loaders. Sand mining acts as sources of employment for many youths in and out of the North 'B' District. Many residents benefited from sand mining as highlighted through face-to-face interview results that the resources are cheap and accessible. Youth and children are also often the people illegally mine because it is widely available way to help their family income. This is simply a new way for youths to make money relatively easily. The average cost for an ox-cart of sand was reported to be approximately 4,000 to 7,000 Tanzania shillings, while a truck with three tons of sand costs anywhere from 200,000 to 300,000 Tanzania shillings (personal communication of a respondent September 13, 2019).



Figure 4.6 Youth as Drivers and Manual Loaders Employed Themselves in Sand Mining

Source: Field Survey, (2019)

It was also from their responses; about 17.4% of the respondents addressed the development of infrastructure as one of the significant benefits sand extraction using

cheap and readily accessible resources in Zanzibar. 12.6% of the respondents observed that there is utilization of abundant high quality of pit and river sand in building durable structures in Zanzibar. 6.7% of the respondents said that villagers mine or rarely buy sand at cheap prices since they reside near mining areas (Table 4.1). Some villagers said that this way reduced the construction costs at the expense of the environmental destruction (Figure 4.7).



Figure 4.7: A Sampled Villager who Mine Near his House to Make Blocks for House Construction at Site E.

Source: Field Data, (2019).

It is however, 7.7% of the respondents addressed that sand mining acts as a source of income to individuals who mine and sell sand or transport for people on small scale using small trucks, donkey and ox-carts. Lastly 10% of the respondents observed that making of bricks for sale is cheap small scale businesses for individual villagers. The Table 4.1 summarizes the results.

Table 4.1: Respondent's Responses on the Benefits of Sand Mining to the Residents

Benefits of sand mining	Frequency	Percentage
Creation of employment opportunities	21	20.3
Utilization of abundant high quality river sand and pit sand in building durable structures	13	12.6
Development of infrastructure	18	17.4
Villagers buy sand at cheap prices	7	6.7
Many people are affording to build modern houses at cheap cost	25	24.2
Sand mining acts as a source of income to individuals who mine and sell sand on small scale	8	7.7
Making of bricks for sale	11	10.6
TOTAL	103	100

Source: Field Study, (2019)

Respondents through face to face interview and questionnaire administrations realized that sand mining activities have a lot of benefits to the community. The majority of the respondents observed that sand mining activities provide an opportunity for the community affording to build modern houses at cheap costs because sand aggregate being mined in or near to their areas of residence. While the second highest percentage of the respondents observed that sand mining created employment opportunities in and outside the mining areas communities. This is because the youths are employing themselves in manual trucks loading, and drivers for sand transportation. Lastly, a good percentage of the respondents saw that sand mining led to the expansion of Zanzibar city in form of infrastructures such as malls, schools, hospitals, and residential houses which may standardize the social welfare of the population.

“.....sand mining activities have brought several benefits not only in our villages but also the communities. We are able to earn income to be used in various social and economic development, our sons have employed themselves into this sector, and most important sand mining near our residential areas simplified the house contraction at very low costs....” said one among the respondents (13th September, 2019).

Generally, the villagers were well aware of sand mining and the benefits of the activities. Development of infrastructure, use of cheap resources in building, employment creation and source of income for Village Development Committees (VDCs) were noted as positive impacts of sand mining activities.

With regard to positive effects of sand exploitation to the socio-economic changes, the researcher put emphasis on the fact that this industry has to be operated in a sustainable way that the present communities benefited from the utilization of sand resources but without compromising the future generations. Many researchers outlined that sand mining processes have positive impacts on society, but the negative effects are much disastrous.

Taking into consideration that this study is referring to the socio-economic effects of sand mining, a causal – effect analysis; several other studies revealed these issues in detail. Caroline Ladlow, (2015) has revealed the same positive impacts of the sand mining activities in some areas based on her areas of study in Unguja Island. She mentioned few positive effects but the major ones were the negative effects such as loss of vegetation cover, soil erosion, absence of trees, ground water intrusion, loss of biodiversity, and the destruction of the natural habitats. Ladlow, (2015) did her research at different mined sites in Zanzibar included Donge, Kwarara, Mwanakwerekwe, Mangapwani, and Saateni.

However, for the case study of China, Marius Dan Gavriltea, (2017) in his writing “Environmental Impacts of Sand Exploitation; Analysis of Sand Market”, described that “.... *Worldwide sand resource’s exploitation has considerable impacts on environment...*” he further put an emphasis on the negative impacts rather than the positive impacts of sand mining activities.

4.3.2 Negative Effects of Sand Mining on Socio-Economic Changes

Respondents were also asked to share their views on the negative impacts of sand extraction in their lives as well as to their socio – economic changes. Findings in Table 4.2 indicated that, the majority of the respondents observed that serious deforestation and loss of vegetation cover are direct economic impacts of sand mining activities in Zanzibar. Continuous clearing of vegetation exposes the land to erosion which in turn causing a decline of agricultural crop yields and grazing lands carrying capacities.

This, however, cause natural ecosystem’s imbalance that may have consequences to humans, other animals, plants and insects. Nevertheless, the second group of respondents complained about the prevalence of both communicable diseases such as cholera, malaria as well as bilharzias and sexual transmitted diseases and HIV/AIDS. While another high percentage of respondents said that; sand mining is usually associated with pollution (land and noise pollution). For example, the uses of heavy machines, tipper vehicles, and excavator loaders produce a lot of noise when loading and transporting soil processes are carried out; this aspect has something to do with health of the residents in nearby communities where sand is being mined. From these

negative effects, over-exploitation of sand in regard to a lack of control and proper sand regulations in Zanzibar, the activities may result into a worse if not disappearances of the island.

Meanwhile the rest respondents observed much ugly deep sand depressions left uncovered. During the rainy seasons these pits are filled with rain water and become dangerous zones to both people and livestock. These areas are also breeding grounds for mosquitoes which spread malaria.

It is however, many accidents had been reported in and around sand mining areas. Children visit to sand mined pits covered with water to swim or fishing and end up drowning. Residents (respondents) who took part in the study indicated that the activity had caused many accidents and some leading to deaths in their communities involving both humans and livestock (Figure 4.8).

The land degradation was also noted during the study. Lands for grazing and crops production (fields) turning into gullies as more sand are mined, this negatively affect the economic status of the population. Sand mining is reported to have increased crimes in the villages as many young people come to wait for trucks going to collect sand to be hired as manual loaders but when not hired they resort stealing in households and crops at night.

Lastly many road accidents have been reported as caused by slow moving tipper trucks and they also cause traffic congestion. These trucks carry uncovered sand when being transported; it may cause accident to other vehicle and pedestrians (Table 4.2).

Table 4.2 The Responses on the Negative Impacts of Sand Mining

Negative effects of sand mining on socio – economic aspects	Frequency	Percentage
Many uncovered ugly deep sand pits filled with water	9	10.2
Prevalence of communicable and sexual transmitted diseases and HIV/AIDS	16	15
Prevalence of accidents	13	12.3
Land degradation and soil erosion	12	11.2
Serious deforestation and loss of vegetation (Loss of biodiversity and loss of natural habitats)	17	16.3
Pollution (land and noise pollution)	15	14.4
Sand mining is increasing crimes in the villages	5	4.6
Shortage of water in rivers for watering livestock	12	11
Moving tipper trucks cause traffic congestion	6	5
TOTAL	103	100

Source: Field Data, (2019)

Findings of this study tally with Ashraf *et al*, (2010), in their study who stated that “...the mining of sand resources from rivers and open land areas in Selangor state is a common practice and have resulted to the destruction of public assets as well as increase stress on commercial and noncommercial living resources that utilize these areas. The other effects included health hazards, destruction of riparian vegetation, pollution, instability of structures and the physical disturbance of the habitats...”



Figure 4.8: Two Little Boys at Sand Mined Site ‘B’ Fishing in the Abandoned Sand Mine Pit Covered with Rain Water

Source: Field Survey, (2019)



Figure 4.9: Sand Miners at Site ‘F’ Loading the Trucks with Sand using Excavator Machine

Source: Field Data, (2019)

Figure 4.9 shows licensed sand miners loading sand into their trucks ready to sell it to the individuals and companies. The Figure above demonstrates a real condition at the sand mining site causing a number of negative impacts to the peoples' socio – economic changes as mentioned by respondents in the Table 4.2.



Figure 4.10: The Truck and the Sand Loaders Extracting Sand Manually at Site ‘C’.

Source: Field Data, (2019)

A researcher (through Figure 4.10 above) shows serious deforestation and loss of vegetation cover which in turn may lead to land fragmentation and the destruction of natural habitats as indicated by the respondents.

Respondents were aware of negative impacts of sand mining activities with the majority complaining of serious deforestation and loss of vegetation (Loss of biodiversity and loss of natural habitats) while the second group of respondents complaining of diseases eruption in their areas basically malaria and cholera from

accumulated water in the sand mined pits. More effects highlighted were land degradation, pollution, road accidents and increased rate of crimes.

Accidents were reported during sand mining activities

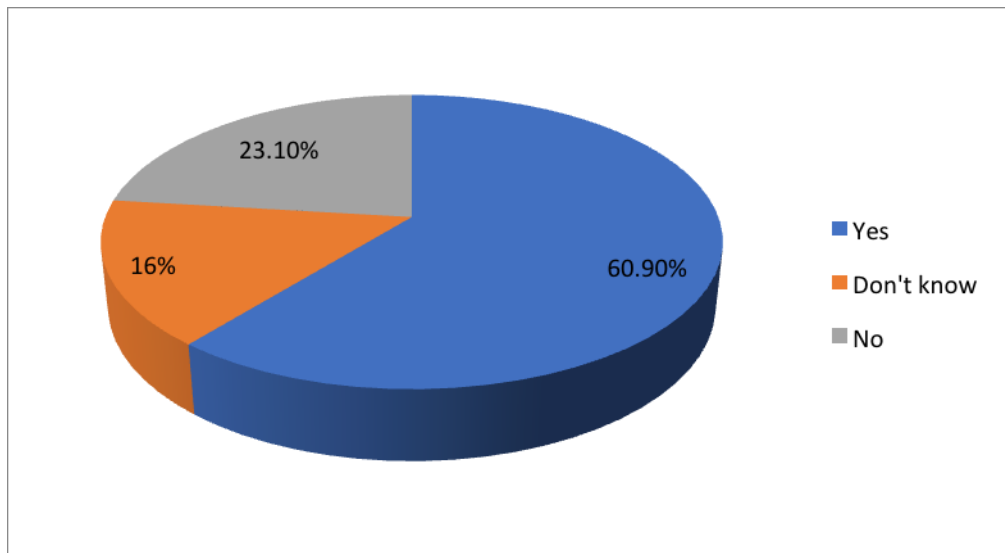


Figure 4.11: Awareness on the Occurrence of Accidents Due to Sand Mining Activities

Source: Field Data, (2019)

Figure 4.11 indicates respondents' responses on the accidents reported due to mining activities. The majority (60.9%) of the respondents who participated in the study were aware of accidents occurring in both deep pits where sand is extracted and on the roads caused by truck transporting it. According to Regional Police Commissioner (RPC) accidents report for North Unguja Region; he stated that:

...“there were noted about 26 to 40 accidents per a period of past two years (2017/2018 and 2018 and 2019) caused by sand mining and its related activities in the North Region Unguja only region. These accidents are causing deaths mainly among men and children; the police force then is in efforts to supervise the traffic orders and regulations....” (Source: Zanzibar Broadcasting Cooperation (ZBC) Radio on 28th September 2019).

Respondents through Focus Group Discussion (FGD) had revealed kinds of accidents that had been reported in their villages which involved both the humans and the animals. One respondent argued that:

“...in relation to this, many cows and other animals have been killed in the sand mining sites when it floods during the rainy seasons. Approximately four years ago, there was a flood that killed a large quantity of the community’s livestock. There were also an increased number of deaths among the children attempting to swim and drown in deep pits covered with rain water left by sand miners. Nevertheless, there noted an increased number of car accidents during the period of mining, this was due to the number of trucks and Lorries passing our villages. These accidents have killed and injured children, peoples, and animals in the communities around Donge Village but the same incidents experienced in Michungwa Miwili and Kazole...”

From the FGD the respondents said that they were not pleased and disturbed by the sand mining activities which destroy their agricultural land, cause many accidents leading to deaths of people in the surrounding communities, cause unpleasant topographical appearance and various types of pollutions. Therefore, the appropriate mining sites should be chosen with the suggestions of the villagers. Respondents suggested that miners should ask for the permission from village leaders and be given a limited and controlled area to mine. Respondents proposed that villagers have to report to the village leaders and police so that such illegal sand mining activities can be stopped by the law makers. Respondents also suggested that miners (illegal miners) to be jailed in not less than ten years.

Lastly, they proposed that the trucks should be serviced in every period of time in order to avoid unnecessary accidents. Many residents indicated that they are aware of and not happy with the accidents occurring which involving children, livestock, and miners themselves due to sand mining activities. The accidents are often on the roads

and on open pits left by miners. They realized that there should be more police patrols, and provision of public education specifically for children on dangers of swimming and fishing in stagnant water.

4.4 Impacts of Sand Mining Activities on Biodiversity

Respondents who participated in the study were asked to share their views through questionnaire and focus group discussion methods about negative effects of sand mining on biodiversity (however direct observation method was applied), these were the responses:

4.4.1 Soil Erosion

The respondents addressed the problem of soil erosion which has become a great environmental issue near the mining sites, and has caused trees to begin falling as their rooting structures and become less stable. Many of the economic and social issues are also have been destructed due to the environmental degradation that it has taken place during after mining. The most surprising trend found was that while approaching Donge, the opinions of sand mining were expected to become worse and worse day after day.

On the contrary, some of the respondents interviewed agreed that it was having negative impacts on the environment, but that people were in need of money and the sand mining industry provided that. The people of the village would be paid to go out into the mining sites and shovel the sand into the trucks, making them feel blinder about the negative impacts it has on the environment.

4.4.2 Loss of Trees and Vegetation Cover

Respondents participated in the study and the majority of them were aware of sand mining activities in the district. A significant proportion observed lack of trees and vegetation cover at various abandoned sand mining sites. The respondents were predominantly farmers who cultivate food crops (mainly cassava, maize, rice, yams, groundnuts, beans and fruits) on one side and the livestock keepers on the other. Respondents within the study areas normally assessed the negative impacts of SM by loss of tree cover, low yields of crops after harvest and lack of vegetation on soils.

There were few (usually economic trees such as *clove tree*, *mango tree*, *coconut tree* etc.) but no trees were present on abandoned mining sites as compared to un-mined sites. This could simply be deduced that sand mining may have contributed to low numbers of trees as most of the trees were removed before the sand is mined. These massive losses of vegetation cover in and around the mining sites also negatively affect the socio - economic aspects of the people whose livelihood largely depend on these trees (Figure 4.12).



Figure 4.12: Sampled Abandoned Sand Mined Site ‘A’ with Lack of Tree Cover

Source: Field Data, (2019)

The researcher observed that no more mining is going on as the depth, width and length were increasing due to the erosion. The area is now a huge water logging site with no economic importance, affecting a lot the lives of terrestrial biological diversities of plants, animals and micro-organisms.

4.4.3 The Eruption of Diseases Caused by Sand Mining

Respondents gave their views about some diseases eruption influenced by sand mining in the district. In the study area, the majority of respondents principally attributed the prevalence of some diseases such as dysentery, typhoid, bilharzias, cholera and malaria to sand mining. They observed that over the years, abandoned sand mined sites are used as damping grounds, which collect water during the rainy seasons. These, therefore, serve as breeding grounds for vectors and/or parasites responsible for transmission of the above-mentioned water borne diseases.



Figure 4.13: Sampled Standing Water in Sand Mined Site ‘B’ Communities

Source: Field Data, (2019)

In agreement with this finding, Stich *et al.*, (1994) who have reported that, water collected in sand pits result in health-related problems for neighborhood communities. Similarly, in Urban West Region - Zanzibar, Ladlow (2015) found that, sand mining cause diseases especially malaria, bilharzias and other waterborne diseases (Figure 4.13). Opinions of the respondents through focus group discussion revealed that sand mining could be the possible sources of diseases such as dysentery, cholera, typhoid, bilharzias and malaria because sand pits are usually used as wastes dumping grounds close to the communities and water logged areas.

4.4.4 Destruction of Natural Habitats

The respondents showed depressions left by sand mining activities were turned into unpleasant topographical landscapes. Mining in Figure 4.14 was in progress, trees residues were seen on the ground as evidence. Some miners were seen but the depression was enlarging in length and depth due to continuous mining.



Figure 4.14: The Michungwa Miwili, an Example of Human Destruction on Natural Habitats

Source: Field Data, (2019)

There were massive destruction of vegetations and land natural structures (natural habitats) leading to unprecedented loss of natural habitats for hundreds of amphibians, mammals, reptiles, birds and insects in the area (Figure 4.14).

4.4.5 Sand Mining Contributing to Land Pollution

On several visits, illegal miners were found disposing wastes in the sand mined pits. Some of these wastes were being plastic bags and bottles. Some of these materials contained chemical toxics, which are harmful to the biodiversity and for a general environment. A researcher observed continuous sand extraction from inland fields had resulted in incidents of land pollution. Respondents sampled from Donge, Michungwa Miwili and Kazole villages showed dissatisfied over sand mining activities in their areas. They saw that sand mining activities were being done on rivers valleys and open areas of land; either the licensed or illegal mining practices are ultimately ending with waste disposal that destroying the general environment.

4.5 Rehabilitation Measures of Sand Mined Sites

The study required respondents to suggest rehabilitation programs, which could be implemented in their communities in order to mitigate the impacts brought by sand mining activities.

4.5.1 Respondents' Suggestions Towards Resolving Sand Mining Problems in the District

Respondents through face-to-face interviews offered several suggestions that they thought could address problems posed by sand mining in North 'B' Unguja District.

Findings in Table 4.3 showed that about 32% of the respondents suggested that sand miners should be given with environmental education on short and long-term negative impacts of continuous mining from the same areas. About 19.4% of the respondents suggested that replanting of vegetation on mined areas can prevent further damage. Also, respondents of about 17.4% saw that special sites for sand mining should be allocated to reduce multiple sand mining sites which destroy large area of land in the district. Also, perpetrators must be stopped from mining in the residents' fields. While 11.6% of the respondents suggested that close monitoring and evaluation of sand mined areas to be done intensively, this can reduce the severe environmental impact. 10.5% proposed that construction of regular roads for tipper trucks to the mining sites is a suitable way to reduce accidents and further erosion. It is however; about 5.8% of the respondents suggested the setting out punishment to offenders of the crime and illegal sand miners. Lastly about 3.8% of the total respondents suggested that the use of open pits dumping sites and landfills will reverse the severe ugly landscape resulted from sand mining activities in Zanzibar (Figure 4.3).

Table 4.3: The Respondents' Suggestions About the Rehabilitation Measures to Sand Mined Sites

Rehabilitation measures to sand mined sites	Frequency	Percentage
Replanting vegetation on mined areas	20	19.4
Construction of regular roads for tipper trucks to the mining sites	11	10.5
Special sites for sand mining should be allocated	18	17.4
Provision of education on negative impacts of continuous mining from the same areas	33	32
Closed monitoring and evaluation of sand mined areas	12	11.6
Use of open pits as dumping sites and landfills	4	3.8
Setting out punishment to offenders of the illegal miners	6	5.8
Total	103	100

Source: Field Survey, (2019)

Several rehabilitation programs were suggested by the respondents which can be implemented in their communities. Replanting vegetation on mined areas was the general consensus of villagers because of the problem of loss of vegetation cover which possibly can trigger the other environmental disasters. Respondents were very co-operative and willing to suggest on what can be done to reverse environmental damage caused by sand mining.

When asked about what they can recommend as the immediate solutions to the negative effects of sand mining, respondents gave suggestions at the community and national levels.

4.5.1.1 Solutions at Community Level

Respondents through face-to-face interviews gave the following suggestions at community level to reduce negative effects of sand mining activities:

The majority of respondents of about 24.2% suggested that there should be twenty four hours security to apprehend illegal miners on daily basis. Meanwhile 14.56% proposed that there must be regular formal meetings between miners and other sand stakeholders to discuss the impacts and come up with a way forward to the issue. Also about 12.6% of the respondents suggested that all trucks transporting sand should pass through police stations for inspection and verification of licenses since some miners use fake documents. Others suggested that villagers should be volunteered to form committees in order to monitor, supervise and guard mining areas with help of trained Community Police Groups. Consultations should be done by land boards with the help of village leaders on issuing sand mining permit so that they may be involved in surveying land and recommend on where to mine. The community members must

cooperate and report illegal miners to the responsible authorities instead of harboring them as well as the mining activities should be only controlled by the Government authorized Agent (See Table 4.4).

Table 4.4: Respondents' Suggestions on Sand Mining Effects at the Community Level

Solutions of sand mining effects at community level	Frequency	Percentage
Volunteering to form committees to monitor, supervise and guard mining areas	11	10.67
Mining should be controlled only by the Government authorized Agent	13	12.6
Twenty four hour security	25	24.2
Consultations between land boards with village leaders	9	8.7
Reporting illegal miners	10	9.7
Trucks transporting sand should pass through police stations for inspection	15	14.56
Regular formal meetings between miners and other sand stakeholders	20	19.4
TOTAL:	103	100

Source: Field Data, (2019)

4.5.1.2 Solutions at National Level

Respondents suggested the following to be done at national level to prevent or reduce the negative effects of sand mining:

About 34.95% of the respondents suggested that the public should be educated and be informed about the negative impacts caused by sand mining through media for example radios; television and newspapers. Also 24.2% of the respondents proposed

that strict laws should be passed to prohibit and control mining, buying and selling of sand which include severe punishment, heavy fines and penalties, and long imprisonment sentences such as up to 10 years jail term. Respondents of about 16.5% suggested that there should be regular meetings between Land Boards, the Department of Forestry and Non-Renewable Resources and village leadership to discuss the sand mining activities and its possible impacts. While some other percentage of the respondents proposed that there should be a special minimum number of permits and licenses to be issued per day; sand mining must not be done on one area but altering sites to reduce over extraction which destroy the environment beyond rehabilitation; and finally the Department of Non-Renewable Resources Department should compensate the sand mining affected citizens for their loss (Table 4.5).

**Table 4.5 Respondent's Suggestions Towards the Impacts of Sand Mining
Activities at the National Level in Zanzibar**

Solutions of sand mining at national level	Frequency	Percentage
Enacting of strict laws and legislature to prohibit illegal sand mining	25	24.2
Setting regular meetings between Land Boards, Department of Non-Renewable Resources Department and village leadership	17	16.5
Educate and inform public about the negative impacts of sand mining activities	36	34.95
Number of permits and licenses issued must be very minimal per day	7	6.7
Sand mining must not be done on one area but altering sites to reduce over extraction	12	11.65
Department of Non-Renewable Resources Department should compensate affected citizens	6	5.8
TOTAL:	103	100

Source: Field Study, (2019)

4.6 Summary of Findings

The main objective of this study was to investigate the cause and effects of sand resource extraction in North 'B' District as a major supplier of sand materials, which in one way or another linked to the weakness of Zanzibar Environment Policy. The study was conducted in North 'B' Unguja District at Kazole, Donge and Michungwa Miwili mined sites where severe deterioration of land resources have increased to an alarming rate while the restoration and conservation measures are at minimal level. The study employed a multi-stage sampling procedure involving purposive selection of the study villages which are much more affected. The study adopted both qualitative and quantitative approaches for data analysis concerning mismanagement and overexploitation of sand resources.

The study was guided by three specific objectives; the first objective was to examine the effects of sand mining activities on socio-economic changes (socio-economic livelihood) of the communities; the second objective was to assess the effects of sand mining on biodiversity; and finally the evaluation of the rehabilitation measures to the abandoned sand mined sites.

North 'B' Unguja district is the solely district in Zanzibar which its land has been changed to non renewable natural resource extraction area. The district provides about 90% of the total sand materials used in different construction public and private where extracted areas were not yet rehabilitated. The findings have also identified number of factors including: The absence stable of policy statements regarding sand management in Zanzibar Environmental Policy (ZEP), sand being a common property resource,

lack of EIA for many projects, lack of coordination between law enforcing body and ministry of agriculture have negatively influenced implementation of various activities and enforcement of laws.

Interviewing key people directly or indirectly involved in sand mining activities was one of the methods used to compile data in this research. The researcher interviewed various respondents from Kazole, Donge and Michungwa Miwili villages. The researcher however, interviewed head of these villages on the background of sand mining activities in their communities and discovered that the activity started around 1997 when Zanzibar started to demographic expansion at a very fast rate. Since then the miners were extracting mainly river sand and the open areas for construction of residential houses, hotels and several other structures.

From this study the researcher discovered that Donge and Michungwa Miwili have been heavily impacted by the sand mining and have had very similar impacts on the surrounding communities. The loss of coconut and mangoes trees, less fertile lands, loss of farms, an increased diseases, loss of life, and car accidents were reported as the most common impacts caused by sand mining activities in the areas. The effects of mining at Michungwa Miwili and Donge are overall more extensive and severe of all the current mining sites in Zanzibar.

Nevertheless, villagers from Donge, Michungwa Miwili and Kazole gave many suggestions as solutions to sand mining. Strict laws, regular meetings and consultations, restriction of mining time were some of the solutions provided. All

these means that, the residents were aware of the environmental impacts and were willing to be involved in reducing the negative effects of sand mining over-exploitation.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The research was carried out to investigate the causal – effects analysis of sand mining activities on the socio-economic changes in Zanzibar: a case study of North ‘B’ District where sand resources are extracted for development of the city. The specific objectives were to assess and expose the impacts of sand on socio-economic changes of the population; assessing the impacts of sand mining on biodiversity and lastly the identification of the rehabilitation measures over the sand mined sites and as well as recommendations to decision makers, local government and the responsible community.

5.2 Conclusion

The study on socio – economic effects of sand mining activities has revealed both positive and negative impacts of sand mining activities. It highlighted the views of affected people through questionnaires, face-to-face interviews, focus group discussions and direct observation. Though the activities have positive effects (such as building strong structures, plastering, making foundations and bricks) but the majority of the respondents were not happy with the severe environmental degradation, accidents caused, wastes disposed by miners, threats from illegal miners, the prevalence of some mining related water born diseases; loss and/or reduction of farmlands; existed poor relationship between residents and sand miners; and low agricultural productivity. It is however sand mining activities resulted into general

damage to the biodiversity and general ecosystems such as a significant reduction in above-ground plant biomass; and loosing of natural habitats.

The need for sand for construction purposes across Zanzibar has been increasing exponentially without any change in the availability of the sand resources supply. Utilizing of non-renewable natural resources is one of the most challenging problems for a government to address, and the Revolutionary Government of Zanzibar has made policy developments that would lead to the successful management of this resource use if once strictly put in action. The land policy in place suggested moderate consumption and rehabilitation of the area after use, which would be an effective method of utilizing sand resource in the most beneficial way for all parties involved.

However, it seems that the real management of sand mining industry has become increasingly difficult. The Revolutionary Government of Zanzibar lacks key enforcement capabilities that could successfully control the issue of non-renewable resources uses. Possibly the most difficult aspect of attempting to manage sand mining is that the industry has become a vital component throughout Zanzibar and is a part of so many people's livelihoods (Masalu, 2002).

Overall the social, economic and environmental impacts of sand mining are more severe as the scale is exponentially larger. Without a managed and well controlled system for the Revolutionary Government of Zanzibar to sand mine, the severe effects it is having on the community will escalate more and more. The sites should have more controlled methods of mining ensuring that only a certain amount is removed per day, and a fence or protective structure could be put in place at all legal sites to prevent any more illegal mining and unnecessary accidents to the community.

Further investigation of the impacts of sand mining is necessary because currently little is being done to mitigate the problems. Severe socio-economic harm and permanent environmental damages being incurred on the people of the Zanzibar needs to be noticed and managed because the industry has become so extensive severely impact the communities. Without the implementation of mitigation practices, the communities across Zanzibar will begin to be permanently suffered from chronic environmental problems.

5.3 Recommendations

From the major findings and conclusion of the study, the researcher included the following recommendations to be taken into accounts in order to minimize the effects of mismanagement of sand resources in Zanzibar.

5.3.1 Recommendations to Decision Makers

To address the impacts of sand mining activities the following under-listed recommendations are were suggested:

- (i) Village's committees should be made to benefit directly from sand mines opened in their areas through community participation to the mining activities. This could improve their socio-economic livelihoods and also enhance their commitments toward reclamation of abandoned sand depressions.
- (ii) Also, opening sand pits should be done far from community's residential areas so as to reduce the prevalence rate of sand mining related diseases in the communities.

- (iii) The DFNR should be given signatory status in the permission and distribution of sand to the community. It can also help DFNR to regulate opening and closure time of sand mines.
- (iv) Agro-forestry practices and tree planting in degraded sand mining sites should be encouraged as this has proven to be dramatically increasing the otherwise slow rate of natural vegetation succession.
- (v) The Department of Forestry and non-Renewable resources should provide education to the public including miners on the negative impacts of continuous mining through media such as national television, radios and national newspapers.
- (vi) The Zanzibar government through the Department of Forestry and Non-Renewable Resources should call for a high level decision making forum involving all stakeholders to discuss the problems associated with sand mining activities and come up with immediate solutions which curb environmental damages.

5.3.2 Recommendations to Local Government and the Responsible Community

- (i) Adoption of specific Land (soil) Policy Statement: There is a need for local government to adopt a new directive and effective land policy which can state and address clearly the challenges regarding sand management and exploitation. So there should be a specific soil resource policy statement bearing that sand is among the threatened resources.

- (ii) Providing Restriction for Endangered Species (plants and animals): There is a need for providing as restrictions that can safe guide native species which could reduce the impacts. For example, plant species such as mongo trees, coconut trees and other fruit plant species were mostly at the danger of sand mining.
- (iii) Delegate Power to Shehias and Village Leaders: Political and religious leaders have more influence to the people. Village leaders and Sheha should be given power to work closely and have a mandate and power to charge and penalize all people who committing any mistake which relate to mismanagement of soil resource.

Conducting EIA for Developmental Projects: the district government through Environmental department should strongly focus to assess on Environmental Impact for mining projects. Frequent EIA could minimize or eradicate possibilities for mismanagement of sand resources while ensures the sustainability of the people and their resources.

5.3.3 Recommendations for Future Research

The following recommendations for further research were suggested:

Any future study of sand mining in Zanzibar would benefit greatly from more extensive interviews with government officials at the beginning of the research. An awareness of the impacts requires about sand mine and knowing more of the process of sand mining would allow better and more specific questions for interviewing throughout the research. In future studies, an in depth survey of the communities

around sand mining sites would prove critical information about the more aggressive effects of sand mining.

Another locations to be studied would be the sand mining occurring along the mangroves from Maruhubi to area further south, and the east coast of the Zanzibar Island as the environmental impacts on the mangroves and the erosion of the coastline are likely severe.

One future study that needs to be done is a comparison of the construction materials used throughout Zanzibar such as coral rags, limestone, and sand. A comparison of the environmental and social implications of each of these materials would prove most beneficial to the communities of Zanzibar because it could impact future construction.

REFERENCES

- Anderson, J. & J. Thampapillai. (1990), *Soil Conservation in Developing Countries; Project and policy Intervention- Policy and Research Series No. 8*
Washington: Policy Research and External Affairs, The World Bank.
- Anderson, J.M. & Ingram, J.S.I. (1989), *Tropical Soil Biology and Fertility: A handbook of methods*. C.A.B. International Centre for Research in Agro-forestry,
Nairobi, Kenya.
- Ashraf, M. A., Yusoff, I., Wajid, A. & Mahmood, K. (2010), *Sand Mining Effects, Causes and Concerns: A Case Study From Bestari Jaya, Selngor, Peninsular Malaysia*. Kuala Lumpur: University of Malaya.
- Azzan & Mohammed, R. (2016), *The Effects Of Climate Change On Land Tenure in Zanzibar Islands*. New Zealand.
- Bellu, L. G. (2011), *Development and Development Paradigms; A Review of Prevailing Visions*. Rome: Food and Agriculture Organization of the United Nations.
- Brown, R. B. (2004), *Soil Texture*, Florida: University of Florida.
- Daniels, W. L., Orndorff, Z. W., & Schroeder, P. D. (2003), *Chemical and Physical Properties of Mineral Sand Mine Soil In Southeast Virginia*. Virginia: Polytechnic Institute and State University.
- Devine, J. D. (1973), *A Case Study of Revolution, Zanzibar and Tanganyika Compared*. University of Arizona. <http://hdl.handle.net10150/554536>
(accessed June 17, 2019).

- Dunbar, W. S. (2012), *Basics of Mining and Mining Processing*. University of British-Columbia.
- Gatea, A. A. (2018), *Soil Bulk Density Estimation Methods: A Review*. Soil Science Society of China, Published by Elsevier B. v. and Science Press.
- Gavriletea, M. D. (2017), *Environmental Impacts of Sand Exploitation – Analysis of Sand Market*. Romania: Babes – Bolyai University.
- Johnbull, S. W., & Brown, I. (2017), *Socio-Economic Consequences of Sand Mining along the Victory River in Port Harcourt*. Nigeria: River State University.
- Ladlow, C. (2015), *An Assessment Of The Impact Of Sand Mining; Unguja, Zanzibar*. Independent Study Project (ISP) Collection 2048.
https://digitalcollections.sit.edu/isp_collection/2048.
- Jafaru, M. (2013), *Assessing the Socio-Economic and Ecological Impacts of Sand and Gravel Mining in Zanzibar*. Dar es Salaam: Ministry of Water, Construction, Energy and Land.
- Majamba, H. I. (2005), *An Assessment of the Framework Environmental Law of Zanzibar*. University of Dar es Salaam, Tanzania.
- Nyandwi, N., & Muzuka, A. N.N. (2007), *Rates and Causes of Coastal Erosion on the Zanzibar Island*. Zanzibar: Institute of Marine Science – University of Dares Salaam.
- Othman, S., Mukandala, R., & Makaramba, R. (2003), *Local Governance - Zanzibar Good Governance Strategy*. Dar es Salaam: UNDP Trust Fund Programme.
- Prakash, O., Kaushal, R., Tomar, J. M. S., & Prandiyal, A. K. (2014), *Agro-forestry for Wetlands Rehabilitation: Mined, Ravine and Degraded Watershed Areas*. Kota: Training Institute of India.

- Stich, S., A. H, Maxwell C. A., Haji A. A., Haji D. M., Machano A. Y., & Curtis C. F. (1994), *Insecticide Impregnated Bed Nets Reduces Malaria Transmission in Zanzibar*.
- The Revolutionary Government of Zanzibar. (2013), *Zanzibar Environmental Policy*, Zanzibar: Department of Environment – The First Vice President’s Office.
- The United Republic of Tanzania. (2014), *Basic Demographic and Socio-Economic Profile – Population and Housing Census*. Tanzania National Bureau of Statistics.
- Witkiss, P., Pye, S., Hendriksen, G., & Maclean, A. (2012), *The Economics of Climate Change in Zanzibar*. Zanzibar: The State University of Zanzibar - UK aid.
- Zanzibar Revolutionary Government. (1992), *National Environmental Policy For Zanzibar; Commission for Lands and Environment* – Ministry of Water, Construction, Energy, Lands and Environment.

APPENDICES

Appendix I: Interview Guide

**THE OPEN UNIVERSITY OF TANZANIA, FACULTY OF ARTS AND
SOCIAL SCIENCES (FASS), DEPARTMENT OF GEOGRAPHY**

**“Socio - Economic Dynamism and Sand Mining Activities in Zanzibar: A Causal
– Effect Analysis”**

**INDEPTH INTERVIEW GUIDE FOR THE COMMUNITY, FARMERS, AND
TO THE SAND MINERS**

Interviewee's name: _____

Date of interview: _____

Place of interview: _____

Interviewer's name: _____

Position/Status: _____

The researcher is a final year student of the above University who is pursuing a Masters in Arts in Natural Resources Assessment and Management of the Faculty of Arts and Social Service (FASS) at The Open University of Tanzania. He is conducting a study on the topic: **Socio - economic dynamism and sand mining activities in Zanzibar: a causal – effect analysis**. This study is solely meant for academic purpose only, and any information obtained would be treated with all the confidentiality that it deserves.

**SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF
RESPONDENTS**

(1) Age: (put tick)

- | | |
|---------------|---------|
| a) 20-30 | [] |
| b) 31-40 | [] |
| c) 41-50 | [] |
| d) 51-60 | [] |
| e) > 60 years | [] |

(2) Sex:

- | | |
|-----------|---------|
| a) Male | [] |
| b) Female | [] |

(3) Marital status:

- | | |
|-------------------|---------|
| a) Married | [] |
| b) Single | [] |
| c) Divorced | [] |
| d) Widow | [] |
| e) Other, specify | |
-
-

(4) Educational background of respondents:

- | | |
|-----------------------------|---------|
| a) Primary Education | [] |
| b) Ordinary Level Education | [] |

- c) Advanced Level Education []
- d) Certificate Education []
- e) Diploma Education []
- f) University Degree []
- g) Masters Degree []

(5) **Number of children** _____ if necessary.

(6) **Ethnicity** Migrant []; Indigene []

(7) **Principal occupation:**

SECTION B: PERCEPTIONS AND THE SOCIO-ECONOMIC IMPACTS OF SAND MINING ON LOCAL COMMUNITIES IN THE DISTRICT

(8) What are the major income generating /economic activities in the district in order to sustain?

- a) Livestock production []
 - b) Cultivation of food crops []
 - c) Petty trading []
 - d) Fishing []
 - e) Rice processing []
 - f) Hunting []
 - g) Others specify
- _____

(9) Is there any evidence of people in the community engaging in sand mining in this community?

a) Yes []

b) No []

(10) Was the sand mining site once used for farming activities?

a) Yes []

b) No []

(11) If yes, what was the approximate average yield per acre?

(12) Which crops were being cultivated?

(13) What are your current average yields per acre?

(14) It can be observed that trees are mostly not found on the sand mining sites, is it that they have been destroyed through the sand mining?

a) Yes []

b) No []

(15) If yes, what tree species were found there?

(16) Can sand mining create a reliable and alternative job opportunity for inhabitants in the district?

a) Yes []

b) No []

(17) Have you ever paid a visit to the site of sand mining in the community /district?

a) Yes []

b) No []

(18) If yes, how can you describe the methods used in the sand mining activity in terms of its impacts on the soil and environment?

a) Very good []

b) Good []

c) Very bad []

d) Bad []

e) Not certain []

(19) Methods used by sand miners are responsible for the degradation of land in the area.

a) Strongly agree []

b) Agree []

c) Strongly disagree []

d) Disagree []

e) Not certain []

(20) The activities of sand miners are contributing to the scarcity of agricultural lands.

a) Strongly agree []

b) agree []

c) strongly disagree []

d) disagree []

e) Not certain []

(21) What is the current relationship between those sand miners and the residents in the area?

a) Very cordial []

b) Cordial []

c) Very bad []

d) Bad []

e) Not certain []

(22) Give reason(s) to support your answer in (25) above

(23) Have there been any conflicts between miners and community members in the past?

a) Yes []

b) No []

(24) If yes, what were the causes of the conflict?

(25) As a result of water collecting in sand pits in the rainy season, do you have occurrence of diseases in the area?

a) Yes []

b) No []

(26) If yes, what are the common diseases?

a) Malaria []

b) Dysentery []

c) Typhoid []

d) Bilharzias []

e) Airborne []

f) STD/HIV []

g) Worms []

(27) Do you have the following other impacts of sand mining in the area?

(Tick as

many as possible)

a) Deforestation []

b) Diseases []

c) Shortage of water resources []

d) Reduced farm size []

e) Destruction of natural habitats []

f) Increased risks of floods and erosion []

g) Loss of biodiversity []

h) Disturbance in the soil composition and stratification []

i) Loss of farmland []

j) Others []

Mention

(28) Are farmers able to put abandoned mine sites into agricultural use after some time?

a) Yes []

b) No []

(29) If yes, after how many years of abandonment are such lands put back into agricultural use?

(30) Can soil fertility improvement methods to increase farmers' yields or support their socio-economic status be possible if the indiscriminate sand mining continue to exist?

a) Yes []

b) No []

(31) What do you think can be done generally to solve problems of the harmful effects of the phenomenon and to improve upon it

**SECTION C: ROLE OF STAKEHOLDERS IN ENSURING
LIVELIHOOD SECURITY**

(32) Who are the usual owners of the sand mining sites in this community?

(Tick as

many as possible)

a) Individuals []

b) Governments []

c) Companies []

d) Others, specify

(33) What institution regulates the activities of sand mining in this area?

(34) What kind of help have you received from any level of government to

mitigate the

adverse effects of the sand mining in your community

(35) Indicate level of government that provided the assistance

a) District Assembly []

b) Regional Administration []

c) Central Government []

d) Others, specify _____

THANK YOU FOR YOUR CONCERN