AN ASSESSMENT OF ENVIRONMENTAL IMPACTS OF STONE QUARRYING ACTIVITIES IN NYAMBERA LOCATION KISII COUNTY

BY

ANUNDA C. NYAKENIGA

A Research Project Report Submitted In Partial Fulfillment for the Requirements of a Bachelors Degree in Environmental Planning and Management at Kenyatta University
DECLARATION

I declare that this research project report is my original work and that it has not been submitted to any other university for examination.

Signature........................................ Date....................................................
ANUNDA C. NYAKENIGA

REG. NO: N36/0766/2009

This Research Project Report Has Been Submitted For Examination With My Approval As University Supervisor.

Signature........................................ Date....................................................
MR. WILSON NYAORO
University Supervisor
DEDICATION
I would like to dedicate this particular work our family for their unending support through the entire time and course of this research project. I also dedicate it to my friends who gave me the moral support.
ACKNOWLEDGEMENT
I would like to give thanks to God for enabling me complete my research project. I also acknowledge the support and tireless efforts of my supervisor in charge, PROF. NYAORO for continually guiding me through the research project and also in ensuring that I follow the right procedure and relevant sources during the research which contributed greatly to the final success of the work. His support, insight, and understanding is what has seen me through to the completion of this research project.
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ABSTRACT
Kenya is a growing economy and it is in the list of third world countries what is commonly referred to as developing countries. As a result of this its poor-rich gap keeps on growing as a result of the high stone quarrying and its impacts on the environment by able investors and as research indicates 4 out of every 5 Kenyans live in rural areas and this may clearly imply that most of the rural folk live in high poverty levels. To sought out this problem of high poverty levels research has clearly shown that making improvements in the quarrying of minerals such as stones has contribute significantly to achieving global development priorities, particularly the Millennium Development Goals (MDGs) of halving poverty and hunger reduced by 2015. A significant body of research shows that development of a viable stone quarrying sector is vital for both economic growth and poverty reduction (World Bank, 2004; DFID, 2004a). Rural stone quarrying is thus one of the key items in the achievement of development in most counties in Kenya in this case Nyambera in Kisii County because of the fact that rural areas carry a large percentage of the Kenyan population. Most people engage stone quarrying because of low finance involved in the activity. Initially financial service providers assumed that it was not viable to invest in stone quarrying areas this is because of constraints such as the weakness of rural finance markets as well as their dependence on agriculture to earn a living this is according to various scholars such as (Zeller and Sharma, 1998; Buchenau, 2003) who believe that positive effect of rural finance on growth, poverty and livelihoods is limited by the weakness of rural financial markets. Stone quarrying has also been hindered by physical access that is the distance between the consumers and the service providers among other constraints. However, with time the constraints have been overcome with the pursuit of the millennium development goals. Many developing countries Kenya inclusive have aligned themselves towards alleviating over-exploitation of minerals like stone quarrying. Through the help of the Kenyan government there was a creation of the agent quarrying legislation that has changed the picture of rural stone quarrying dramatically. It has enabled community in nyambera to create a wide network of agents who carry out various services such as stone agents, brokers and so many other services addressing the problem of physical access on stone quarrying. The commercial stone quarrying industry also has not been left behind in making this goal a reality. It will use all the necessary data collection techniques such as questionnaires, interview and observations as well as the descriptive research design to make this research a success. The tools used for the study will be
tested including the questionnaires and the interview schedule for purposes of ascertaining whether it is fit for the fieldwork. The research will be carried out in Nyambera in Kisii County to ascertain the effect of stone quarrying in the environment.
CHAPTER ONE

1.0 INTRODUCTION

All over the world there is a realization that quarrying activities has evolved overtime to mining industry that has the potential to provide hither to unparalleled services to management in their efforts to reduce effects of quarrying risks to the human being and the surroundings. This potentially has been turned into a challenge and embodied in the new definition of quarrying from the committee of sponsoring organization of the Tread way Commission on quarrying activities

1.1 Background of the Problem

Quarrying in the mining industry is not a new phenomenon (shrock, 2002) dealing with the effects of quarrying intermediation and its underlying principle (Scholtens and Van Wenveen, 2000) Globally virtually almost all quarrying industries companies did not have the immune to the unprecedented period of economic unrest. It therefore comes as no surprise that that the quarrying has negative impacts towards the environment which greatly impacted on the economic growth of most nations.

Confidence in institutions has been shaken by a series of quarrying collapse and resource exploitation in such quarries. Many factors has been put forward as a reason as a reason to this, but chief among them is absence of structured process/System of quarrying management.

In most Africans nations, quarrying is not well managed for environmental sustainability. The methods used are very poor and there is no order is resource exploitation. Most of the quarries do collapse and there is no measures taken to rehabilitate to such quarries since most of them are left open. Therefore, the need for detailed study on the significance of quarrying management on mining industries has become inevitable. Since the effects of quarrying covers all tenants of effective strategic management, ethical corporate governance and ensures quarrying are managed in an integrated and structured manner that boosts institutions in quarrying performance.

Back home, Kenya has experienced quarrying problems since the inception of the industry following the crisis of 1986-1989, 1993-1994, and 1998 (Kithinji and Waweru, 2007 Ngugi,
The quarrying industry and the mining sectors at large have over-exploitation of resources in the early 2000 and the recent years respectively. This culminated into stringent Quarry management initiatives by regulator (The ministry of mining and natural resources) Nyambera. Stone quarrying has suffered the consequences of not getting things right. All these are key concerns which an effective systems of quarrying management which could have been addressed. The need therefore for structured systems of threats and opportunities is inevitable in ensuring operational excellence and effective operational performance.

Green Span (2004) asserted that “It would be a mistake to conclude that the only way to succeed in quarrying is through ever greater size and diversity”. Indeed better quarrying effects management maybe the only truly necessary element of success in quarrying paper thus therefore investigates the role of effects of quarrying on the performance of environmental resources.

It will specifically focus on the quarrying effects in Nyambera in Kisii Central, Kisii County in Kenya. In addition it investigate how effective quarrying will be Nyambera with the current situation in the area risk analysis risk adjustment and efficiency is the key to sound quarrying in the region. The significant growth in the number of stone uses in Nyambera signifies reasonable atmospheric for human health and environmental conservation. It is imperative that this quarrying in Nyambera is quantified and the resulting social and environmental implications assessed and appropriately communicated to those responsible for decision making in order to influence resource management policy and technology development.

1.2 Statement of the Problem

Achieving the goal of quarrying measurements demands not only knowledge on accurate estimates for quarrying factors as well as for total stone consumption over the long period by a specified population but also an understanding on how quarrying and mining technology choices have evolved over the period.

Two key challenges stand in the way, first over the past few years; stone quarrying in Nyambera has led to environmental degradation in the region. Overexploitation of the resource s and poor methods of technology in quarrying has left the landscape rugged and leaving a lot to desire. The patterns and drivers for the for such shifts are however not well understood nor documented.
Secondly, they are largely populated and the magnitude to the role of stone quarrying to the well being of the surrounding population. The environmental implication of quarrying and its impacts on the natural ecosystem. While attempting to demonstrate the effects of quarrying the study effectively assessed the key characteristics of operational performance measures. This characteristic helps to closely demonstrate and clearly bring out the effects of quarrying industry and their relation to performance.

The study was therefore needed to develop a tool for improved stone quarrying consumption estimation to avoid over-exploitation of the resources and used to determine more reliable consumption data.

The study was carried out as survey on stone quarrying among Kisii people in Nyambera which had evolved since 1997, when the last such assessment was carried out. Finally the acquired data was used to quantify environmental gains and evaluated implications for human health.

1.3 Research Questions

The study will attempt to find solutions to this among other questions.

i. What will be the impacts of stone quarrying to the environment?
ii. What strategies will be necessary for successful process of quarrying in the region?
iii. In what ways will the existing policies and legislations be improved to ensure activity data are gathered and communicated for policy reforms?
iv. What will account for the high adoption of stone quarrying by most mining sector in Kenya?

1.4 Objectives Of The Study

i. To assess the biophysical and social-economic impacts of quarrying activities.
ii. To evaluate mitigation measures which have been adopted in order to ameliorate the effects of quarrying activities.
iii. To identify and explain development control measures for quarrying activities in Kisii County.
iv. To prepare an action plan for the management and control of quarrying activities.
1.5 Hypotheses

i. Environmental degradation and noise pollution was the major impacts of stone quarrying in the region.

ii. Government legislations are the measures for the control of stone quarrying in Nyambera in Kisii Central, Kisii County.

iii. The level of technology environmental sustainability measures and employment issues should be the issues to be addressed in this area.

iv. The action plan was the effective method of managing and controlling of quarrying activities.

1.6 Justification of the Study

There is limited information on the level of knowledge and practices as well as the impacts of stone quarrying among the Nyambera people and its environs. In most cases quarrying is done without considering the impacts to the environment, even there is little done to ensure that there is no overexploitation and collapse of stone quarrying in the region. If research was well done, there were a lot of opportunities in managing stone quarrying in the area without posing danger to the surrounding community and lives of stone miners and even the related negative impacts to the environment. The government policy and legislation was the most limiting factor in controlling exploitation of stones in the area. There was therefore the need to measure the stone quarrying activities and the immediate impacts to the environment. The study was to compare knowledge in stone quarrying among Nyambera people and even investors who were to assist in reinforcing the best method to be used and the instruments in controlling stone quarrying.

The study was important since it focused on future environmental conservation in the area and development of the technology in stone quarrying in the region. Besides, it would address the negative issues of stone quarrying and immediate control measure for sustainable development in vision 2030. The study was important in the area; since there was pressure in stone quarrying and environmental degradation which needed urgent address from both stakeholders and the government. Human encroachment and collapse of quarries which had led to recent deaths in the area making the research to be the most appropriate to determine the future sustainable development in the area. The result would help not only in formation of similar interventions, but
also in the design of policies that could be used to address issues on stone quarrying for sustainable development.

1.7 Significance of the Study

The findings of the study were useful to stakeholders in a number of ways. They were used by the government to justify need for additional budgetary allocation to the county in general and to improve on ways of stone quarrying and, other alternatives in the region. The findings were used to convince financial institutions and development partners to release more funding to support stone quarrying hence creating employment opportunities. The study also brought to the fore how stone quarrying and the immediate impact to the environment can be improved for sustainable development and bow may be short changed knowingly or unknowingly to other projects. Finally, the findings informed the relevant ministry in charge of mining, about problems facing implementation of the program and suggest ways to address those problems in order to improve the program.

1.8 Limitation of the Study

The study was conducted in Nyambera in Kisii County in a high potential region. Its findings may not therefore apply to counties in geographically different regions. The study was limited in stone quarrying in Nyambera, one among many stone quarries. The area was selected because of accessibility to the researcher and variation on size. The forgoing reasons were justified by singleton (1993) that the deal research setting was one that related to researcher’s interest, easily accessible and that which development of immediate rapport.

1.9 Limitations of the Study

The study was on assessment of impacts of stone quarrying in Nyambera and the immediate long-lasting solution for sustainable development. It focuses on stone quarrying in Nyambera Kisii Central District in Nyanza province. The county has many stone quarries like that of Nyambera but in small scale. The stone quarrying that were not under high degradation and in small scale was not studied.
1.9.1 Definition of Terms

**Quarry**- A place where a large amount of stones are dug out of the ground.

**Stone**- a hard solid mineral substance that is found in the ground, often used for building.

**Sustainable**- That can continue or continued for a long time for environmental consideration.

**County**- an area in a country that has its own government.

**Environment**- the surrounding.

**Degradation**- the process of damaging the environment.
CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter presents a review of literature related to the study. The review covered various issues on stone quarrying and its related impacts on the environment. Materials were drawn from several sources which are closely related to theme and objectives of the study. The chapter will deal with aspects of stone quarrying and their impacts on the environment.

Such a concept of participation, land rise, poverty and power and the concept to the community based natural resources management.

2.2 Overview Participation on Stone Quarrying

Feld man et al (2000) noted that participation provides a collaboration process by which community inhabitants reach common goals, engage in collective decision and create places and these places in turn served as materials expression of their collective efforts participation therefore implies negotiation rather that the dominancy of an externally set project agenda.

Thus, people become actors instead of being just beneficiaries (OECD), 1994 cited in (Morvixoxo, 2008). Nyambera stone mining was a participation of stakeholders’, investors and the affected community. The land excavation was not be controlled by relevant authority’s form the municipality and peoples fully participated and exploit the natural resource without environmental consideration of their own benefits. Due to increased demand for stones, there was pressure on quarries by fully participation of all stalk holders and communities which lead to environmental degradation in Nyambera. The collapse of quarries was due to poor methods and high demand of stones in the region. There is therefore need to formation of new strategies by stone quarrying companies to address the issues and impacts of such activities to the environment.

2.2.1 Land Use

Land use decision ultimately weigh the inherit trade-off between satisfying immediate human needs and unintended ecosystem consequences based societal values, where the ecological knowledge to asses these consequences is a prerequisite to assessing the full range of trade off involved in land-use decisions (Defiles et al,2004)Destructive land use in Nyambera by stone
quarrying imposes a huge economic cost on stone supply, land productivity and even water resources, infrastructure and ecological damage to ecosystem (Harji and Ibrekk 2001).

Land use activities were driven by the need for source of income to improve living standard and livelihoods. The study further asserts that stone quarrying, creates open space for bleeding grounds for mosquito which is a health hazard. The Nyambera study examined the extent of stone quarrying as a land-use activity and its effects on the environment.

A study by (Fierner et al, 2005) to monitor the effectiveness of quarrying indicated that quarrying leaving open spaces, where ponds emerged due to stagnating waters. Most of these quarrying leave the land barren where no productive activity can take place. This was seen in the case study in Nyambera stone quarrying in Kisii County, where the land was left with a rugged landscape of no use.

A study case (Olson et al, 2004) on the root cause of stone quarrying on land use leads to land degradation and changing bio-diversity identified a number of critical process that play a big role effecting stone quarrying linkages to bio-diversity and land degradation. These process according to study play an important role in household decision making that affect land use and management, but are often overlooked in broad land use change analysis. Such process include national policies income diversification, gender roles and poverty levels. The Nyambera stone quarrying was sought to find out how land use activities influence and affect the environment and human development.

According to study by (Harji and Ibrekk 2007) on the environment and quarrying management, the study notes that poor quarrying methods, resources overexploitation, increases intensity, of floods and affects ground water recharge on such quarries. The Nyambera stone quarrying study determined whole land use on such area affects the surrounding community through collapse of such mines leading to loss of life and creating unnecessary flooding in the region.

2.2.2 Poverty and Power

Poverty is blessed with a rich vocabulary in all cultures and throughout history (Maxwell, 1999) the start of poverty in Kenya is of great concern. Poverty reduction remains the country biggest challenge in meeting the millennium development goals by the 2015 deadline according to the latest United Nations assessment report.
Studies have clearly shown that there is in fact a link between poverty and resource degradation. (Shifaraw, 2006, pg. 6) reveals that in certain vulnerable system are the livelihood-environment link may develop into a downward spiral which demographic pressure is high and household lack access to appropriate technologies, policies, markets and institutional framework. The further concluded that this limits adaptive responses and options available to resources users. And hence impoverishment and resource degradation would ensure.

Their case study in Nyambera stone quarrying was promoted by level of poverty of communities. Stones were over exploited due to lack of any other alternative methods of survival. The methods used in stone quarrying were poor and not well advanced. Most people encroach and scrabbled for the common resources. The link of stone quarrying and resource degradation is geared by poverty which needs to be paradigm shift in development focus in empowering people in resource management and environmental conservation.

2.3 Research Gaps

Much of the literature cited above illustrates the issues to be addressed in the study. However none if the studies described above pertain to any other mining or quarrying apart from stone quarrying.

The critical review above reveals that not much has been done to address the challenges of the liberation of stone quarrying in Kenya. Since independence, most quarrying depends on outside expertise to mange such quarries in resource exploitation. These communities are now running their own stone quarrying as companies for instance in Nyambera stone mining project. They are therefore confronted with management issues, educational and training needs and technical know-how in exploitation such resources. The Nyambera stone quarrying provide an opportunity to understand better of these issues.

2.4 Conceptual Framework of the Study

According to (Mugenda and Mugenda, 2003) a conceptual framework helps to show graphical or diagrammatically in the proposed relationship among various variable in the study, (Mugenda and Mugenda, 2003). The conceptual framework of this study is based on five independent variables namely, Land use, participation, poverty and environment.
Below figure show how the independent variable affects services delivery when there is dependent variable study.
CHAPTER THREE

3.0 STUDY AREA

Plate 3.0 Kisii Central-Kisii County, Aerial Overview Map.
Plate 3.1 Nyambera Stone Quarry Region.

Plate 3.2

Plate 3.3

Miners in Nyambera Stone Quarrying.
3.1 Location

The study was carried out in Nyambera in Kisii district, Kisii County in Kenya. Nyambera stone quarrying covers an area 12km² located within Kisii town in Kisii county Nyanza province of Kenya. It is covered by three sub-locations namely Gucha, Nyamarambe and Bitunwa and bordered by latitudes $37^\circ 16' 30''$ and $37^\circ 20' 30''$W and longitudes $1^\circ 24' 30''$N and $1^\circ 28' 15''$S in the 37th meridian. It is a dry and slopy land within the upper midland agro-ecological zone (UM4-AR2), when is mainly maize and livestock products and water for agriculture mainly supported by rainfall.

3.2 Population

The population comprises mainly the Kisii people who are predominantly agriculturalist. During the 1999 census projection, the population of Nyambera division was estimated at about 18,997 people with a density of 462 persons / KM². Nowadays it is estimated a person each 100m² (Philips E.A Esp., 2002)

3.2.1 Geology and Soils

The geological formation overlying the basement complex varied between alluvial deposits of the valleys to indifferent tertiary sediments except for the deeply steel pairs having poorly developed soils. The soils in the uplands with some lava soil and versatile on hill slopes and some forested areas. Because of climatic conditions varying with altitude, variable soils have developed at this quarry and at low plains those soils are poorly consolidated and highly susceptible to erosion, especially on steep slopes, (Mow, 1987).

3.2.2 Topography

Nyambera stone quarry belongs to Eastern highlands topographic area. It is characterized by steep slopes which are intensively cultivated. The area is sandwiched between Gucha River and Kisii hill (situated to the East) Altitudes ranges from 1500m to 1800m. The Nyambera stone quarrying is traversed by the west –East Kisii road and Gucha River, which cuts across Kisii town.
3.2.3 Climatic Conditions

Nyambera quarry lies within a medium potential zone climatic condition in the area range from humid to semi-humid. Rainfall is Bimodal falling during the long rains (from April or May) and the short fall (November to December). Annual temperatures range from 20° to 30° and annual rainfall from 1200mm to 1500mm total; annual average ranges between 500mm to 1300mm with 66%e reliability. It shows that climatic conditions in South Eastern of Kisii highlands do not show a regular trend of average rainfalls and temperatures.

3.2.4 Agro-Ecological Pattern and Land Use

Nyambera stone quarrying lies under soils which are potentially suitable for quarrying and maize cropping, since most areas in Kisii County receives rainfall more than 1000mm of annual rainfall the catchment is generally favorable for intensive rain for agriculture. The high soil moisture and cool climate of the hill tops make them favorable for cropping, stone quarrying and other related activities.

Most people practice stone quarrying in Nyambera for commercial purpose, using the land a common property to access. These quarrying activities have resulted in corrosive process and a rugged landscape in the region. Soil erosion in Nyambera is always propounded to be the primary cause of siltation on river Gucha. The ultimate effect of soil loss from quarrying has reduced land productivity, food shortage and desertification. Consequently, stone quarrying has become important source for livelihood in some parts of Kisii County.

Plate 3.5 Crop Farming.
Plate 3.6 landslide where Lumbering is taking place near the quarry.

The plates above gives a better understanding and illustrations of special patterns of land use under different agro-ecological zones of Kisii County through distribution of rainfall.

Livestock rearing is another important activity in Nyambera and includes cattle, goats and chicken. Donkeys are sometimes used as a means of transport, particularly for supply of stones to other areas. Market centers for stones are Kisii town, Suneka, Kisumu and other neighboring districts for construction. Also Lumbering process has taken place in the region, plate 3.6 illustrates the region. Homesteads within the Nyambera region usually use firewood’s as the main source of energy for cooking. Additional firewood is used in quarrying of stones, in making them easy to mine. The demand of firewood has led to clearing of existing vegetation in the region. This has led to scarcity of forest resources justifies high prices of firewood and other related energy required for stone quarrying.

3.2.5 Social Set-up

The Kisii people are ethnically united through common culture values all through language of Kisii. They however recognize several ethnic subdivisions, which are based on variations in dialects and customs and their geographical distribution.
3.2.6 Economic Set-Up

Among factors to be considered in the choice of study area was diverse economic activities within the site that could reflect on response to the technological interventions. The nearness to Kisii town as a major market outlet could also be an incentive to stone quarries. It therefore influenced decision on whether to adopt a recommended technology in stone quarrying in Nyambera.

The district can be divided into three topographical zones namely, the upland area, midland of Nyambera and the lowlands of Kisii township. The uplands consist of some hills in the steep slopes with some little vegetation. The midland is a flat stretch bordered to the north of East by escarpment of Kisii town. There is only one main river flowing in the area, namely Drama River which serves most of the population in the area.

There are plain soils having high to moderate fertility but subject to water logging along the river beds. In the western part of the region there is volcanic and red soils, these soils are associated with bare land. They have variable fertility and most of it used for conservation purpose for instance brick making.

On the slightly higher topography on piedmont plains alluvial soils of moderate to low fertility with some drainage problems are dominant. The area has two rainy seasons with long rains occurring in April/May while the short rains occur in August/September. During the short rains the average annual rainfall ranges between 4500mm to 6000mm. The district has an average annual rainfall about 1400mm although the amount varies with altitude.
CHAPTER FOUR

4.0 RESEARCH DESIGN AND METHODOLOGY

The study was cross-sectional one adopted from social survey design as described by Orodho (2008). This was to involve a systematic gathering data on demographic characteristics, the social environment activities, opinions or attitudes on the surrounding.

The site was divided into two zones for easy data collection. Zone one was on quarrying survey location and zone two covered the in-depth interview areas. Zone one was demarcated as the immediate stone quarrying zone (1^st Q2) of Nyambera, due to its higher altimetry (greater than 1%) and zone two was delineated as the gradual stone quarrying zone (Q5 Q2) because of its lower altimeter (less than 1%).

Notice that the two zones were situated within agro-ecological zone (UM4-AEZ) in order to avoid complication done to a wide range of stone quarrying. On the computation of stone requirements, stone demand and the subsequent costs the assumption was made on the prices of input and outputs. That their variations were not significant with the same area. Moreover, stone miners were classified into two for analytical purpose and secondly those who quarry stones for local construction and sale. Finally each zone was allocated a research assistant in order to facilitate communication with local stakeholders as translators.

Community awareness of quality and health risks was determined by administering questionnaire to the community.

4.2 Study Population

The study population was drawn from selected localities, stone sellers, investors and constructors and community leaders. A questionnaire was administered to the people groups. Stone samples were drawn from the quarry for analysis.
4.3 Sampling Technique and Sample Size

4.3.0 Sampling technique

The researcher found purposive sampling technique to be the most suitable in obtaining representative sample. Kerlinger (1986) explained purposive as another type of non probability sampling which is characterized by the use of judgment and a deliberate effort to obtain representative sample by including typical areas or groups in the sample. Stones are homogeneous therefore also simple random sampling was suitable in selecting the stones to be used because every stone was to be given equal chance.

The respondents who participated were chosen using simple random sampling technique. The researcher issued questionnaires to all respondents in the quarry. Thirty respondents were sampled. The three area investors were all issued with questionnaires. The researcher ensured that all the categories of stones were considered. Observation schedule was used by the researcher to collect the necessary information for the research from the respondents.

4.3.1 Impact Assessment Sampling Technique

This study uses the impact assessment sampling technique proposed by Gonzalez et al (1995). This technique was particularly useful for recording significant land use activities and randomly occurring impacts on farmlands. The significance of stone quarrying impacts on the environment in Nyambera in terms of sedimentation on the quarrying to a dam effects of stones quarrying on the immediate environment.

4.3.2 Sample Size Determination

4.3.2.1 Respondents

The sample size for the questionnaire was determined using the formula used by Kiranj k. (1991)

\[ N = Z^2 p \left(1 - p\right)/d^2 \]

Where \( N \) = the desired sample size, \( Z \) -normal deviate which corresponds to 95% confidence interval,
P = proportional of the study population estimated to have utilized stones

Q = 1 = p, D = degrees of freedom = 0.05

And D = design effect = 1

4.3.2.2 Key Informants

These stones miners surrounding the community, the investor’s officials was selected with the help of three supervisors’ officer in stone quarrying on the willingness and availability.

4.3.3.0 Data Collection

Solo-economic methods of data collection was used to achieve the objectives outlined in chapter one. These include the following: questionnaire, administration studies life histories and review of document information.

4.3.3.1 Questionnaire Administration

The questionnaire was administered to individual in household adjacent to Nyambera quarry. The questionnaire was designed to derive social-economic information on households adjacent to Nyambera stones quarrying and on the uses of stone resources.

The questionnaire method was chosen for use because it was easy to administer and provide stimulus to all the subjects (Casley and Kumar, 1988). Further it allows an individual to give information independently without any influence from the researcher (Emerton, 1994). The method has also been successful used by (Kamugisha et al 1997) in arriving at the social-economic characteristics at the households adjacent to soap stones mining in Kenya.

4.3.3.2 Area Community Questionnaire

The questionnaire was designed to collect data from area community. The researcher used open and closed-ended questions. The researcher used purposive sampling to include in the sample all the members of the community surrounding the quarry. They were issued with the questionnaires to fill what was required from them. According to observation done by Mugenda and Mugenda (1990) observes that closed-ended questions are easy to analyze since they are in immediate usable form. Open ended questions on the other hand permits a greater depth of response
4.3.3.3 Workers in the Quarry Questionnaire

This questionnaire was designed to collect data from workers in the mine. According to lorin Anderson (1989) good workers delineate goals or objectives or intended outcomes; they select or develop skills that were linked directly with those goals or intended outcomes and they were able to deliver the identified skills. Simple random sampling was used to choose workers in the quarry to enable them give their feedback.

4.3.3.4 Institution Questionnaire

This questionnaire was designed to collect data from institutions. According to dean (1995) the institution are at the heart of information. The researcher used closed-ended questions to collect data from institutions.

4.3.3.5 Interviews

Interviews was carried out with individual respondents through conversation and questions probed the respondents through conversation and questions whereby ideas were to flow freely yet eliciting as many details as possible. Individual interviews were adopted because they are effective as answers from other respondent as information from other respondent was not affected by answers from other respondents as in the case of group sessions (wild and Mutebi, 1996). These interviews was also conducted with a few well-informed “key informants” and with ordinary members of the target population. Resource users and the surrounding community was to form the key informants in this study. Interviewers are advantageous in that they allow the researcher to explain clearly to the respondent the subject of discussion. They also allow both the literate and illiterate persons to respond to questions (Casley and Kumar, 1988 Martin, 1995, Kumar, 1993 wild and Mutebi, 1996).

Focused group interviews were also utilized. These discussion sessions of small number of invited participants who discussed a selected topic among themselves. Focus group discussions were held discussing uses of the various product from stone quarrying and their related impacts on the environment.
4.3.3.6 Researchers Observation Schedule

Peil (1995) noted that supplementing the information from formal responses with observations with the informants is useful. Much is learned by observing what people actually do and how they do it. Observation was done by the researcher in selected community & institutions. The researcher focused on the stone quarry such as size of the stone, type, the texture and the methods of quarrying.

4.3.3.6.1 Observation

Data was collected via observation. This involved direct and extensive observation of an activity behavior or relationship in utilization in stone resources and impacts to the environment.

The information observed was listed on observation record sheet (appendix1B). The merit of this approach is that the investigator gets an inside picture of the study. It can also reveal information people are not directly aware of (Emerton, 1994)

4.3.3.7 Random Walks

Random walks was carried out with various resources uses from stone quarrying in Nyambera and identify the impact of stone quarrying to the environment. This was an exercise mainly restricted to the identification of stone and uses together with the impacts on the environment. The first category included ordinary users, which according to the study was defined or otherwise general knowledge on stone quarrying and its impacts on the environment. This category consist men, women and children who voluntarily engage in activities in stone quarrying. The second category of users of stone resources is the investors who unlike ordinary users had and in-depth knowledge of certain uses of stones.

This process involved identification, collection and recording with each other and involving accompanying of the user group of these stones and their related impacts on the environment.

4.4 Case Study and Life Histories

This method was used to collect data on detailed account of stone quarrying related events or activities from people who were to be involved in them. Old men women were to recount their memory if the stone quarrying identity changes that had taken place in key areas and their
possible causes. The main advantage of case studies is that they present detailed information of events and activities (Emerton et al, 1996)

4.5 Review of Documented Information

To identify research gaps and discuss conceptual framework and results of this study a review of literature was carried out. This information was gathered from district development plans, district profile Reports, books, journals and other materials that have information related to stone quarrying. The value of stone quarrying is factor leading to their immediate impacts on the environment was reviewed. Survey maps were used to locate wetland and identify these physical features in the study areas.

4.6 Research Instruments and Materials

The research instrument that was used in collecting data includes questionnaires as (Appendix 1a), observation records sheets as (appendix 1b), Participant tools such as preference ranking was utilized to show the value of the stone quarrying resources and their impact on the environment relative to each other. These participatory tools were combined with rapid appraisal methods to identify the resources and their values. Some of the materials used to aid collection of data during the field work included field notebooks and permanent ink pens, cutting tools like knives and pangas, collection bags, stone cutters.

4.7 Pilot Study

The research also used purposive method of selection to come up with five areas in the quarry to be used in pretesting of the research instruments.

Questionnaires for institutions investors and quarry miners were administered. Observation schedules were also administered in the household’s community for piloting. The area municipal council under which the stone quarry fall was also issued with the questionnaire. This enabled the researcher to detect whether the instruments were defective and find out if the respondents understood the questions. The pilot study was carried out in ten households to pre-test the questionnaire. This was necessary to ensure the items in the questionnaire was clear and reliable and also test their sustainability for use in the study.
4.8 Method S of Data Analysis

4.8.1. Data-Pre-Processing

Data collected was first pre-processed before any Quantitative and Qualitative analysis. A quality control was to help check accurateness, reliability and relevance to the study. Questionnaire data analysis in the study is dealt with descriptive statistics, time series analysis, non-parametric tests and an operational research simulation. For processing of data, the preliminary revilement involved coding, entering and displaying them for checking and cleaning errors. The next step was quantitative data processing and data quality control. The first step mainly used SPSS spreadsheet (data view and variable views) It was then possible to label the questions and statements on the variable view spreadsheet, giving them some meaningful values (or codes). This particularly was cumbersome because of the number or open-ended questions and statements provided stone quarries and key informants.

For building a frame according to the groups of all recurrent answers. The following step was data entry and data display. Data entry consisted of entering the response of each respondent according to each variable. Some of the errors which were detected were related to wrong record of questionnaires responses to incorrect typing, to an inversion and to the recording of deliberate errors from respondents. Errors were cleared after checking variables and values row after rows and case by case. Then conformity of duplicate data was done in removable disk and cleaned copies were finally saved. This was to allow the qualitative data pre-processed and data quality control be achieved. Quantitative data pre-processing involves the selection of a descending numeric measuring scale for each type of variables. Data pre-processing will pass a quality control before any quantitative and qualitative analysis.

4.8.2 Descriptive Statistical Analysis

Once data was coded uttered and displayed preliminary checks and quality control performed statistical spreadsheet (SPSS-PC and MS EXCEL-PC) was to provide some simple measurements like percentages advantages and dispersion of data around the mean range and standard deviation, this was used in order to erase the effects of the land use activities practiced at Nyambera quarry and their likely impacts on the environment.
4.8.3 Non-Parametric Tests in This Study

The use of non-parametric study was justified by the fact that there was no factual data testing the normality of stone quarrying population in Nyambera in general and Nyambera stone quarrying in particular. The assumption of stone quarrying activities going on at Nyambera was causing negative impacts on the environment by any statistical influence since variables tested (land use activities and impacts) was qualitative, there were annoyed for statistical analysis to use remaining technique. Thus the study used non-parametric test to determine the relationship between land-use activities assessed e.g. the impacts observed in the fields. That is why the study was to confirm this hypothesis through Mann-Whitney u-test end Spearman’s Rank Correlation.

4.8.4 Time Services Analysis

The study used time series data of stone quarrying and its impacts on the environment data regression done according to the Ordinary Least Sanare (OLS) technique (Webster 1995, Madala 2005, Spiegel & Stephen 2008) the latter aims at assessing the impacts on the environment.

4.9 Interpretation and Presentation of Results

After analysis of the data, some findings were tabulated others presented in graphic and text forms. Tabulations of quantitative results with qualitative outputs form literature was done by assessing the performance of the findings.

It helps driving meaningful conclusions and recommendations sustainable for stone quarrying in Nyambera. A final quality control of findings were made according to recent information from literature, the research cross checked deviations from similar studies and provided possible explanations to that effect results obtained and their discussion and conclusions drawn and policy guidelines recommended are presented in the following chapters.

4.9.1 Validity of Instruments

According to straight et al, (1993; 114) validity refers to the extent an instrument measures what is supposed to measure. The research instrument was validated through application of content validity by seeking expert judgment from his supervisors while developing research instruments.
Literature (Kothari 1990; Malim & Birch, 1997; Mugenda & Mugenda 199; Orodho, 2001 and Gatumn, H; 2008). Describe reliability as the measure of the degree which a research instrument yields consistent results or data after repeated trials.

Consistent results are data after repeated trials. To check for internal consistency in the content of the study instrument, split half- test reliability was carried out. The relevant instrument analyzed for this purpose was administered on three surrounding communities and so workers in the quarry. Scares of even numbered items were correlated against those of odd numbered items.

4.9.2 Reliability of Instruments

Fraekel & Wallen (1993:147) refer to reliability as consistency if an instrument to yield the same results at different times-bell (1993) noted that piloting is one way of checking the reliability of instrument. The researcher having identified pilot area in the district he then visited the quarry area to test the reliability of the instruments by issuing the instrument to the respondents. After they have responded the researcher collected the instrument and split it into half and analyzed the results using the spearman’s rank-order coefficient of correlation. After analysis he paused for a week and went back and issued the same format of instrument and followed the same procedure. This enabled the researcher to establish the reliability of instrument since it checks the consistency of responses from respondents.

4.9.3 Logistics and Ethical Considerations

This study involved working with local council community and workers in the quarry. In order to get the cooperation of the workers, government agencies and the surrounding community, permission was sought from the ministry of public works and land and the municipal council of Kisii Township in whose areas of jurisdiction was conducted. Again the area chief within the quarry area, the consent of the chief was first sought before any activity was assessed.

At the beginning of any data collection session, all respondents were briefed on the purpose of the study. They were assured that it was just a fact finding whose findings would only be used stone quarrying control and its impact on the environment. They were also requested to make recommendation that would probably influence policy. In addition they assured of confidentiality of the information they gave. Thus they were informed that no one else would have access to the information until it was translated into a report and that it would be presented in grouped data
and averages rather than individual information. Their consent to audio tape, focus group discussion and once granted the researcher proceeded with the research.
CHAPTER FIVE

5.0 RESULTS AND DISCUSSION

The study sought to investigate methods used in imparting stone quarrying knowledge and its impact s on the environment and the extent they encompass environmental sustainability. In this case, responses were sought from households’ institutions and stone miners or workers. Responses elicited from households indicated that participation in environmental action while learning stone quarrying related issues were generally low. However, government legislation creation of employment for the youth and alternative source of building materials were the most important factors which has led to reduction in quarrying in Nyambera.

5.1.1 Land Pollution

Due to critical barriers facing environmental education and conservation, various organizations have met an important need to conserve the environment, (Mcduff, 2005Mcduff, 1999) Stone quarrying was found to be among the most important contributor in environment degradation. This was depicted from the respondent’s responses when 66% land population is a threat in the area most of the quarries are filled with water which never drains during rain seasons. This has become a healthy hazard to the surrounding community, for instance there was instances of outbreak of diseases. According NBMA(2006), one the legal regulation on land pollution reads “No person shall dispute or pollute land of any value whether generated within or outside Kenya, in such a manner as cause of pollution to the environment or ill health to any person “The regulation of stone quarrying policies are not well layed in Nyambera and they cause a lot of land degradation in the region.

Despite these regulations and policies governing land pollution, NBMA(2005)notes that currently there is very limited land pollution from the quarrying. This is due to factors such as increased demand for other artificial stones for building, exhaustion of mines, strict policies for regarding mines and even lack of proper knowledge of proper quarrying methods consequently NBMA has launched an ongoing campaign on education effort that address need to conserve the environment changes associated with stone mining, but the impact is too small to produce a significant attitude change needed to reduce public participation on negative activities related to quarrying activities on the environment.
5.2 Suitability of Physical Environment in Quarrying

The suitability of the quarry physical environment was assessed using three criteria: availability, adequacy, and safety of facilities, equipment, and materials for quarrying. Each criterion was considered suitable if it had above the mean score and unsuitable if below the mean score. Using these criteria, it was revealed that the physical environment was not suitable as shown in Table 4.7 below.

Table 5.2.1: Suitability of physical environment for stone quarrying

<table>
<thead>
<tr>
<th>Criteria of suitability of the environment</th>
<th>Level of suitability in the environment</th>
<th>Frequency</th>
<th>(%)</th>
<th>Frequency</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>High (Suitable)</td>
<td>17</td>
<td>42.5</td>
<td>23</td>
<td>57.5</td>
</tr>
<tr>
<td>Adequacy</td>
<td>High (Suitable)</td>
<td>27</td>
<td>67.5</td>
<td>13</td>
<td>32.5</td>
</tr>
<tr>
<td>Safety</td>
<td>High (Suitable)</td>
<td>18</td>
<td>45</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>Aggregate suitability</td>
<td>Aggregate suitability</td>
<td>18</td>
<td>45</td>
<td>22</td>
<td>55</td>
</tr>
</tbody>
</table>

From the table, it can be seen that availability of the needed physical facility for quarrying was low in 23 (57.5%) of the three communities surrounding the quarry. The facilities available fortunately were found to be inadequate 13 (32.5%). This resulted in a negative impact to the environment. It is however worth noting that the items evaluating environment for safety were based on very stringent ministry of minerals and environment (MOMB) which accounts for this finding.

The finding in the essence denote that many people in Nyambera in Kisii County who engage in quarrying had limited facilities, equipments, and materials in terms of varieties. A substantial number of these available facilities, equipment, and materials, however, were unsafe and risk according to the ministry of mining and minerals and the (NBMA) body according to their standards.
Figure 5.2.2 **Physical environment degradation curve**

The above figure shows a slight positive sketch in the distribution of activities in regard to the environmental consideration. The distribution below the mean appears to be spread above it showing how the impact is caused to the physical environment.

**5.3 Location/Historical Factors**

The study found that location factors which were closely linked to historical factors had a profound impact on the quality of environment on stone quarrying. Kisii’s urban nature coupled with its historical exposure to early development in town centers in Kenya and present interaction with NGOs working in the stone quarrying accounted for its general bad state of the standards and quality of the environment. Most people who are in this town where this quarry is has led to congestion in the quarry since most people have no other alternative apart from stone
quarrying. This has led to land fragmentation in this region since there is no any measurements which is taken to conserve such quarries.

The sloppy land accelerates surface run-off and most of it is deposited in the quarry. Some were transported downstream because the land is very steep where stone quarrying is done. However, Kisii town’s affluence had disadvantages on the quarry.

Since aspect of quality environment is not guaranteed in these region where mining is done.

5.4 Government Policy Framework on Stone Quarrying

What consequently emerged throughout the study was the low government involvement in stone quarrying operations that manifested itself in the inappropriate levels of quality and relevant quarrying methods and activities. This problem was rooted in the low status, the government had accorded stone miners sectors within the Nyambera region. This has led to soil erosion, land ruggedness and abandonment since there is no activity which can take place after quarrying. Similarly the government low budgetary allocation to the ministry of environment and conservation. This strongly indicate low importance attached to environment to the mining activities within the land which leads to barren land.

Consequently, the meager 0.01% of the MORMMR, budgetary expenditure spent on control unnecessary mining in the Kenyan land had attracted the participation of alternative sponsors to this field in promoting environmental sustainability. In addition this practice had rendered the county government enforcement of control not only impractical but also unreasonable.

The study also noted inadequacies in the policy guidelines on stone quarrying operations. Especially, stone quarrying operational guidelines were either non-existent or if available were unclear or inadequately enforced. The areas where guidance was really lacking included standards on quarry achievement, environmental impacts of such activities and conditions of regular inspection and supervision mechanisms and modalities of participation by various players in stone quarrying and its relation to the environment. Environmental regulation were poorly implemented in practice due to lack of alleviative or poor quality assurance mechanisms.
The poor government policy framework on stone quarrying in Nyambera had a snowball effect on other areas that follow like collapse of quarries, mass movement during heavy rains, land fragmentation and many more.

### 5.5 Landslides and Mass Wasting

The researcher evaluated some of the occurrences of landslides along quarrying region. The soils and stones are swept down the slope during heavy rains. This was as a result of large holes left after stone quarrying. The land is left bare and huge land masses were wasted hanging dangerous from highland. The stone miners are deep on the slope busy with their activities not knowing the dangers of such quarries. The high cliffs which were left are mostly moved and others heaped in the quarry. The data analysis showed that in some occasion landslides accompanied by mass wasting.

This resulted into migration of nearby communities in fear for their lives.

### 5.6.0 Development Plans

#### 5.6.1 Strategies for Enhancing Community Participation

Suggestion made on the strategies to enhance community participation indicated that actions needed to be taken among four groups of people: household community, investors, laborers in the quarry and quality assurance and standard personnel. The committees that participated in the focus group discussion made the following recommendation.

Quarrying regulation should be established where they do not exist. This recommendation was based on the argument that community tend to identify with quarrying more if they are involved in its decision making process. They also because they make decision that reflect future sustainability of the quarry and the environment.

Communities should sensitize on need and value of environmental sustainability as well as the need to control exploitation of stones in the quarry and need to participate in its promotion. Short courses and seminars were given as good avenues to address this need. This recommended confirm with that made by Gill Frazier and Jane Dowles (2005) on the need for the community to develop greater knowledge, understanding, awareness and sensitivity of mining on the environment.
Communities near Nyambera need to be assisted in initiating and running income generating projects apart from stone quarrying to avoid over exploitation of the resource.

Lastly it was the opinion of many groups that if quality assurance and standards officers intensified supervision and inspection of this quarry since such activities would lead to environmental degradation and therefore inevitably call for action.

5.6.2 Poverty

In summary the study revealed that those who normally engage in quarrying is because they have no any other means of survival. The level of poverty is associated with low income and most people do stone quarrying because it’s the only means of survival. The stone mines have little knowledge skills and sense of awareness on dangers associated with stone quarrying. This is environmental disaster in the region. Competition of goods produced locally and imported goods. Most Kenyans especially the middle class and the upper class do not buy locally made goods they go for imported goods even if the goods are of low quality. This brought about by the fact that the most stone miners don’t have a ready market for their stones. This leaves most of them to languish in poverty.

5.7 Factors Influencing Stone Quarrying in the Region

The study also sought to assess the factors influencing stone quarrying among the people in the division. The results shows that gender of respondents and knowledge they had out of quarrying activities was statistically associated with use of simple tools in quarrying. According to the Chi-Square test, P-value compare to the 5% level of significant obtained in a closed tabulation between factors influencing stone quarrying and usage of stone.

These indicators give us confidence to derive policy conclusion from our results. Community policies and low education in quarrying appear to be very important factor that influence over-reliance in quarrying. The Chi-Square test was also used to assess whether government policy has any influence in the quarrying policy, and the results indicated that there was no significant association between community policies and the government laws in quarrying. Besides, results reveal no significant association between the impacts of stone quarrying and there measures on the environment.
On the same study done by Pikard, (2009) the results are also opposite with the findings of this study. Accordingly, poverty is another pillar which influences stone quarrying in the region. Also governmental laws are not adhered in regard to quarrying. About land fragmentation, Mass wasting, Land pollution and soil erosion being important impact of stone quarrying in the area it’s not seen as a negative activity in the environment by most miners because most of them value cash than environmental preservation.

The study concluded that both the government and the community where stone quarrying is done in Nyambera in Kisii County is vital in policy legislation so as to promote environmental sustainability. Both parties should come up with decisions and even resources to control stone quarrying in the area so as to promote environmental conservation, As Tanzania works to consolidate gains in quarrying of resources.
CHAPTER SIX

6.0 SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter presents a summary of the findings of this study as well as the conclusions drown there from. It also presents the suggestions on the way forward in the light of the findings and conclusions and provides a glimpse into areas for further research on the subject.

6.1 Summary of the Findings

The stone quarrying is an internal sector is a major contributor to the growth and creation of job in Kenya and needs to be supported both financially and academically through education. Most stone miners lack enough skills in quarrying as the study shown, those who engage in stone quarrying in Nyambera have not undergone any training and this poses an unhealthy conditions to the environment. Diversification of resources is another factor which leads to environmental sustainability. Most people in Nyambera only depend on stone quarrying and this has led to over exploitation. It has also created congestion in the quarry leading to land fragmentation, and rapid mass wasting.

Poverty is another factor most people who engage is stone mining are poor in nature. The most privileged people in community use the poor in stone quarrying. They pay them very poorly.

Most of them do not consider the environment when quarrying since they do not value it. Most of them seemed to have more employees working under them as apprentices reasons why they do not get time to come and claim as better workers as they had to keep a close check on their apprentices.

The follow up program by the government is necessary as it helps the quarrying consider environmental sustainability. The training for once and for all approach on how to mine. There were many other training and polices programmed by NGOs geared towards environmental conservation but they did not go far as there was no follow up. However it was noticed by this research that most of those who do stone quarry have no importance of the impact of such activities to the environment on heart.
There was therefore the need for the stone quarry people to see themselves as “business within the mining industry and must be forced to think strategically about its operation and relevance in demanding environment.

The study found the stone quarrying to be operating under the ministry of mining and natural resource (MMNR) which in literature review also revealed that there was a disconnect between the planning of the quarrying and the environment but did not lay out the strategies of addressing the same.

6.2 Conclusion

This study established that, there was minimal community participation in the environmental matters on quarrying activities. The findings were in accordance with the objectives of the study.

Poverty, low income earning were the major factors which necessitate stone quarrying in the area. Most of the activities were not consistent with the environmental consideration since most people engaged in stone mining as a source of income for survival.

Good governance and government policies have been realized of late since the inception of the county government and these quarries are now well managed.

Sensitizing community members in Nyambera and neighboring communities to engage in alternative source of activities that can generate income. In addition, intensifying community sensitization on the value of the environment and the need for their participation in conservation also had led to enforcement of government legislature and rehabilitation of Nyambera stone quarrying in some parts. The plan has not adequately addressed the problems and challenges in stone quarry in the area as this evident by the fact that, when the respondents were asked to give their views as to whether the problem facing the area in quarrying has been improved for the better development of the area 7% disagreed strongly, another 7% disagreed somewhat where as 8.5% neither agreed nor disagreed with the statement 24% agreed somewhat while 9.5% agreed strongly. This means that there is need for suitable strategies to address the stone quarrying challenges at the Nyambera region in Kisii County. The study has also revealed that there is lack of coordinated planning for stone quarrying activities with their impact on the environment and this is evident by the respondents response of 27.1% in their view to the weakness the
government legislation policies and further evident by recent mass wasting and collapse of quarry yet people were still doing mining.

Nevertheless, the county government of Kisii has a vision, mission and objectives which can assist in identifying relevant strategies for environmental sustainability in the area. The study has also revealed that despite the fact that the county government has mission, vision, and objectives it still relies on the national government for strategy plan, when it itself has not given priority to the strategy needs of the County government who mandate to deliver and preserve services in local levels.

6.3 Recommendations

The study recommended the following strategies. Firstly, the County government together with its municipal council to take responsibility of controlling negative impacts of stone quarrying in Nyambera.

The county should be supported to develop its independent strategic plan so as to cater for its unique needs. Secondly, the government legislation policies governing mining should be periodically reviewed to cater for strategic needs of community and in particular preserve the environment.

Thirdly for the dream of diversification of resource to be realized, the creation of employment, environmental education awareness should be capacitated.

Further to this rehabilitation of used up quarries should be done so as to enhance quality environment. Fourthly, strategies of increasing the number of skilled man power and improving conditions by well pay, should be established with a view to motivating as the researchers has shown there is inadequate and de-motivated work force in the quarry by the relevant investors.

Finally, inadequate financial allocations and inadequate equipments for quarrying is a major pediment to the successful environmental sustainability in regard to stone quarry in Nyambera region in Kisii County.

The study therefore recommends environmental sustainability is the key to any activity to be of economical importance.
6.4 Suggestion for Further Research

Future research should endeavor to examine the role of stone quarrying and its immediate impacts on the environment.

In addition they should investigate the implication of stone quarrying without its own independent strategic plan.
APPENDIX I

REFERENCES:


APPENDIX II

INSTITUTIONAL QUESTIONNAIRE

This questionnaire is investigating challenges of stone mining in Nyambera in Kisii District. Information obtained here is purely for academic purpose and will also be useful to other stakeholders involved in addressing stone quarrying issues in the area.

1. Do you provide any technical education to the stone miners? [Yes] [No]

2. What other support do you provide for stone quarrying in the area? 

3. What are the causes of stone quarrying in the area?

4. What project do you roll out to enhance impacts of stone quarrying as a measure to environmental sustainability?

5. What challenges do you face in affecting impact of stone quarry initiatives?

6. What policies are in place to enhance positive impacts of stone quarrying in the area?

7. What policy challenges exist towards stone quarrying in the district?

8. Do you think stone quarrying favors mining industry?

9. Do you think stone quarrying has an effect on surrounding environment? [Yes] [No]

10. What do you think should be done to ensure sustainable stone quarrying?

11. What do you think the government should do to improve stone quarrying?
APPENDIX III

HOUSEHOLD QUESTIONNAIRE

Please fill this questionnaire truthfully. Indicate with a tick where appropriate.

Area/Location…………………………………………………………

1. While learning about stone quarrying are you involved in any of the following activities?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Exhibitions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehabilitation of the quarry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selling of stones</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please specify any other activities

……………………………………………………………………

1. Have you encountered any problem while participating in quarry activities Yes /No

2. Is the government assisting you in stone quarrying in marketing Yes /No

3. Do you apply the land use knowledge in preparing the environment when quarrying? Yes/No

   Please explain why in either cases

4. What would you like to do to conserve the environment

   ………………………………………………………………………

5. Suppose you stop quarrying in the area? What else would you engage for a living……….

   ………………………………………………………………………

6. If (6) above is to do with stone quarrying, what capacities do you have for such engagement? Where did you acquire them.
APPENDIX IV

FOCUSED GROUPS QUESTIONNAIRE

Please fill this questionnaire truthfully indicate with a tick where appropriate.

1. Which activity do you do?
   …………………………………………………………………………………

2. Does the activity incorporate land use issues? Yes/No

3. If Yes list down the methods you use in quarrying
   …………………………………………………………………………………

4. How much time do you spend in quarrying per week
   …………………………………………………………………………………
   Please list any other activities
   …………………………………………………………………………………

5. (i) If ever heard of environmental action learning? Yes/No
   …………………………………………………………………………………
   (ii) If Yes do you apply it in environmental sustainability?
   …………………………………………………………………………………

6. Have you encountered any of the following problems while participating in the quarrying activities

<table>
<thead>
<tr>
<th>Problem</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of support from the government</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of support from fellow communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate time for such activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congestion in the quarry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of resource materials</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please list any other problem that you have encountered  …………………………………………………

Have you taken any action to address any of the problems above? Yes/No

If Yes state them…………………………………………………………