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Are the Environmental Pollution Effects Promising to an end?: Practices of Quarrying Activities in Tanzania, Case of Moivaro Ward, Arusha City

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Abstract: Communities of Tanzania are in dilemma whether the problem of environmental pollution in mining activities will come to an end or not. Different schools of thoughts are still emerging discussing the problem of pollution, thus it is a topical, contentious and debatable issue. Therefore, this paper intends to assess the perception on the practices of quarrying activities which cause environmental pollution to the community in Moivaro Ward in Arusha City. The study adopted cross-sectional research design. Methods of data collection comprised household survey which involved 64 respondents, interview involved 5 Key informants, 2FGD comprised (8) males and (8) females and documentary review. The study used both quantitative and qualitative analysis, whereas questionnaire and checklist were applied as tools for data collection. Stratified random sampling was used to get the sample size of 64 households. Quantitative data were analyzed using IBM-SPSS (20.0) software to generate frequencies and percentage and Chi-square ($\chi 2$) test was also applied to test the proportions of community's perception. While Qualitative data were subjected to content or thematic analysis. The study indicates that quarrying activities not only cause encroachment to resident houses but also cause soil erosion, pollution which affect human health because people are infected with TB, malaria, cancer and other diseases which cause death of people. Besides, bad effects people reported that quarrying activities help to get job opportunities which generate income. Moreover, majorities are aware with legal procedures of quarrying activities despites they work illegally to study area. Furthermore, results show that there was statistical significance differences on the result of perception of quarrying activities that it increase environmental pollution and social evils at Chi-square (χ^2) =32.731, p=0.045. Basing on the findings it is recommended to the government of Tanzania specifically to the Ministries concerning with Health, Land and Housing, Mining and Environment and other key players for example, Non-Governmental Organizations should be serious on guiding legal and institutional frameworks addressing quarrying activities and adopting Integrated Planning Approach on selecting the appropriate areas where people can engage in quarrying activities with friendly technology.

Keywords: *Community perception, Environmental pollution, quarrying activities*

1.0 Introduction

Environmental pollution is among of the factors pressing stress on human planet in this competitive world of industrialization (Lwegaila *et al.*,2019; Ibrahim *et al.*,2019).This is being attributed by many factors like population increase and increased demand of the environmental resources necessary for human livelihoods (Mwamlangala *et al*., 2016; 2018). Ultimately, environmental pollution affects most people in social and economic development (Kasimbazi, 2019). Experiences show that in India environmental pollution on land due to quarrying activities affected 15-60% loss of agricultural productivity, destruction of ecological system and temperature is raised by 1-1.5ºC (Pal and Mandal, 2019). Similar effects which threatening livelihoods of 75.8% of people is existing in Malaysia, Sri Lanka, Australia, Denmark and other

countries around Latin America and Europe. The effects include loss of access to land, pollution, deforestation, diseases, water scarcity, and new uncertain risks (Camisani, 2018; Ibrahim *et al*., 2019).

Like other continents in the world, African continent is facing similar challenge of environmental pollution due to quarrying activities. In spite of different scholars and policy makers and planners have tried to address the problem of practicing quarrying activities in many areas of the developing countries still people engage in these activities so as to earn their living. For example, about 10-25% and 50-60% of indigenous in west south and north east of Uganda respectively are small miners who practice quarrying activities (Kasimbazi, 2019) and these people face similar problems of human health, cancer, body injury like what is happening in Botswana, Namibia, Zambia where indigenous in mining areas are always involved in land disputes with their governments due to quarrying activities which cause environmental pollution (Musenga and Aigbavboa, 2018). But, why indigenous still continue engaging in quarrying activities while there is strong laws?. It was found by Kasimbazi (2019) who claimed that, regulatory framework has been developed; there is a limited level of enforcement which results in mining authorities and companies not adhering to the legal requirements thus force indigenous to be free with quarrying activities in mines which cause pollution in the regions.

Tanzania is among of the developing country in African continent which economically grow fast, it might be due to the new development policy of industrialization (Mwamlangala *et al*, 2018).Therefore, industries cannot develop without natural resources like mining, but it faces challenge due to poor methods of harvesting mining materials through quarrying activities which results to environmental pollution. However, due to the development of the world also demand of basic needs of human being is also increasing and people continue to fight against poverty by practicing quarrying activities on mining areas. This argument opens a room for debate among scholars, politician and practitioners. Other scholars argue that quarries resources with less consideration of its sustainability tend to threaten the survival of human being (Tukur, 2015) on other hand they argue that, people has rights to extract their resources at the maxim so as to address challenges facing them like poverty, diseases and hunger (Saleh and Tukur 2015). WhileNene (2011) points that, quarrying activities encourage income generating activities such as food vending, loading and unloading the extracted materials. Thus, remain one among of the source of livelihood to some individuals.

Across Tanzania regions, literature indicate that in Mbeya Region there is soil erosion (45%), loss of vegetation cover (32.5%), air pollution (11.6%) where 55% there is no any initiative to address the challenge which is caused by quarrying activities in Songwe limestone zone (Ringo *et al*., 2016). Similar story in Merelani in Arusha Region shows that 6.6% of miners suffer from Tuberculosis (TB), 82% of the suffocation accidents were caused due to quarrying activities to are where government stopped to extract minerals (Mayala *et al*., 2016). Most of the literature reviewed are contrary with Tanzania legal frameworks because illegal quarrying activities do not support sustainability of economic development of the nation, among of the legal and institutional frameworks is Tanzania National Environmental Policy of 1997 which stipulates that to ensure sustainable and equitable use of resources without degrading the environment or risking or safety, Environmental Management Act No.20 of 2004 states that no person shall emit any pollutants which cause pollution in contravention of standards prescribed or that may be

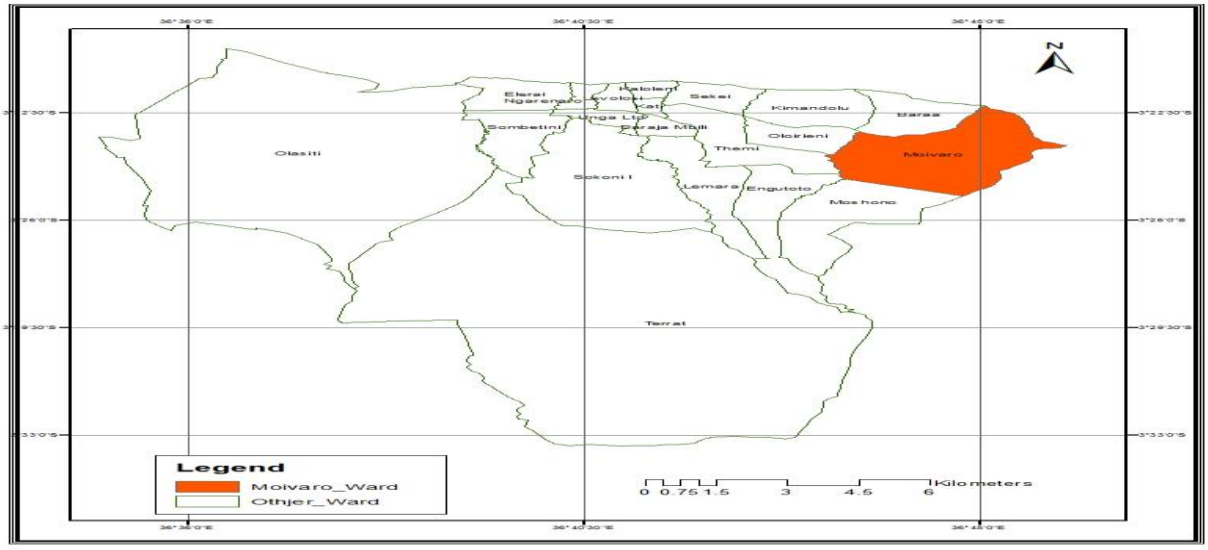
prescribed under this Act. But also, Mining Policy of 2009 indicates crosscutting issues in mining sector which are mining activities that cause environmental land degradation, pollution and social disruption to local communities around mines site that must be addressed so as to ensure security of people and the policy is against with illegal extraction of mining.

Despites the fact that the countries in the world specifically Tanzania is supposed to have good legal and institutional frameworks which guide the practice of quarrying activities on the environment, but instead there are emerging of day to day debates of different school of thoughts which postulate the quarrying activities as an alarming issue of causing environmental pollution which affects the human livelihood. From this point of view the study remain in dilemma whether quarrying activities has positive effects on Movairo ward in Arusha region or not. Then, the study is very urgency to be studied now and not latter because will give more information on the effects of quarrying activities on environment in study area.

2.0 Methodology

2.1 Study area and criteria of selection

The study was carried out at Moivaro ward. It is an administrative ward located in Arusha City. The area is located in northern Tanzania in Arusha Region nearby Mount Meru on the eastern edge of the eastern branch of the Great Rift Valley. The main reason for selecting Moivaro ward as the study area was due to the existence of quarrying sites that are found in Ngurumausi, Shangarao and Sekei streets. In this ward, there are diverse effects of environmental pollution due to quarrying activities taking place at an alarming rate as compared to the past experience. This can be due to the increasing in population and demand of high rate of building and construction materials. However, the study employed cross section research design to cope with limited time for data collection. The sampling was random sampling from households living around quarrying area and a sample size of 64 respondents together with five (5) key informants selected purposively. Primary data were gathered by using both quantitative and qualitative methods. Questionnaires were administered to respondents and checklist was used to guide discussion with key informants. Furthermore, Focus Group Discussions (FGDs) with (8) males and (8) females were conducted so as to avoid biases and interview was done so as to get in-depth information about the respondents. Besides, secondary data were obtained from different sources like internet, magazines, journals, books and maps. Again, observation method was applied to depict the physical status of the surrounding environment, where photos were taken as supporting document of the real situation. Moreover, Data analysis used quantitative data were analyzed using International Business Machines Statistical Product (IBM-SPSS.20.0 version) programme with the use of Chi-square test to produce descriptive statistics in terms of frequencies and percentages. Qualitative data were subjected to content analysis to present peoples' perception with regard to environmental degradation as a result of quarrying activities.



Map 1: Moivaro ward in Arusha City

Source: Arusha City, 2017

3.0 Results and Discussion

3.1 Socio-demographic characteristics of the respondents

The respondent's characteristics are presented based on sex, marital status, education and occupation as indicated in Table 1. The table indicates that respondents were 62.5% and 37.5% males and females respectively.

Table 1: Present characteristics of respondents (n=64)

Variables	Frequency	Percentage
Sex of Respondents		
Male	40	62.5
Female	24	37.5
Total	64	100
Marital Status of Respondents		
Married	39	60.9
Divorced	6	9.4
Widowed	7	10.9
Single	12	18.8
Total	64	100
Education Level of Respondents		
Primary	42	65.6
Secondary	11	17.2
Diploma/degree	3	4.7
None	8	12.5
Total	64	100
Occupation of Respondent		
Employee (private)	4	6.3
Employee (public)	7	10.9
Quarrying activities	15	23.4
Business	36	56.3
None	2	3.1

Results imply that males were mostly engaged with quarrying activities compared to females. About 60.9% of respondents were married, 9.4% divorced, 10.9% widowed while 18.8% single. The education status of the respondents was as follows; 65.6% attained primary education, 17.2% secondary education, 4.7% Diploma/Degree level while the rest 12.5% had non-formal education. The level of education implied that respondents were aware with procedures of practicing quarrying activities. According to the occupation of the respondents, the findings show that most of the people engage in business almost 56.3%, 23.4% engage in quarrying activities; 10.9% were employed in public sector, 6.3% were employees in private sector and the rest 3.1% depend on casual labour.

3.2 Community responses on effects of quarrying activities

Understanding the responses on the effects of quarrying activities was a mandatory to this study because it helps to know if the respondents are aware with the effects of quarrying activity on environment.. Results in Table 2 indicate that about 55% of the respondents reported that quarrying activitiy causes enchroachment to homesteads. This is followed by the problem of loss of grazing land with 50% of the respondents identifying it as the effect to their day-to-day activity because the area is now subjected to quarries rather than grazing land. While few 32% complained that their land for housing construction has been reduced as indicated in Table 3 and Plate 1.The implication of the results meant that however people deeply know the effects of quarrying activities they still engage in quarrying activity due to search for job opportunities and income generation .This can be supported by interview with a man with 58 years old who reported that "*....my former house was cracked in all parts because of the continuous quarrying activity in this rock because we use heavy mashines in quarrying and my neighbour faces the same problem in 2012…"*

Table 2: Presents the effects of quarrying activities

Effects of quarrying activities	Frequency	Percentage (%)
Encroachment to homesteads	35	55
Destruction of water sources	24	38
Loss of grazing land	32	50
Loss of farming land	26	41
Loss of land for settlement development	20	32



Plate 1: Enchroachment of quarrying activity to homesteads at Moivaro ward

In assessing the effects related to quarries, the findings indicate that land for production and area for settlement is encroached. For the mean time the livelihood of people depended on farming are negatively affected (Adeola and Nenuwa Olushola, 2016; Aduku and Awaah, Undated). Yet again, some buildings near quarry extraction were found with cracks because of vibrations caming from rock blasting (Adeola and Nenuwa Olushola, 2016, Nartey *et al.*, 2012; Ibrahim *et al.*, 2019). Drawing on the literature Azad and Ashish (2006) and Lwegaila *et al.* (2019) point out that quarrying activity has effect to other land uses and the people living close to the extraction of construction and building materials. Results from FGDs participants show that most people knew the effect of practicing quarrying activity in the ward but they fail to diversify other economic activities which are friendly to environmental policy of 1997 and other legal instruments which address proper use of natural resources. Therefore, the general observation of the study is that people know the effects of quarrying activity on their environment.

3.3 The environmental effects caused by quarry activities

Apart from encroachment of homestead, faming and grazing land, the study revealed (Figure 1) that 61% of the respondents reported that quarrying activities cause removal of the top soil cover while 50% of respondents reported that people were affected by diseases that emerged after excavation such as respiratory and complained on the problem of eruption of diseases like malaria due to stagnation of water in the pits filled during rainy seasons (Plate 2). The findings imply that quarrying activities has effect on human health which cause death to people.

Negative effects caused by quarrying activities

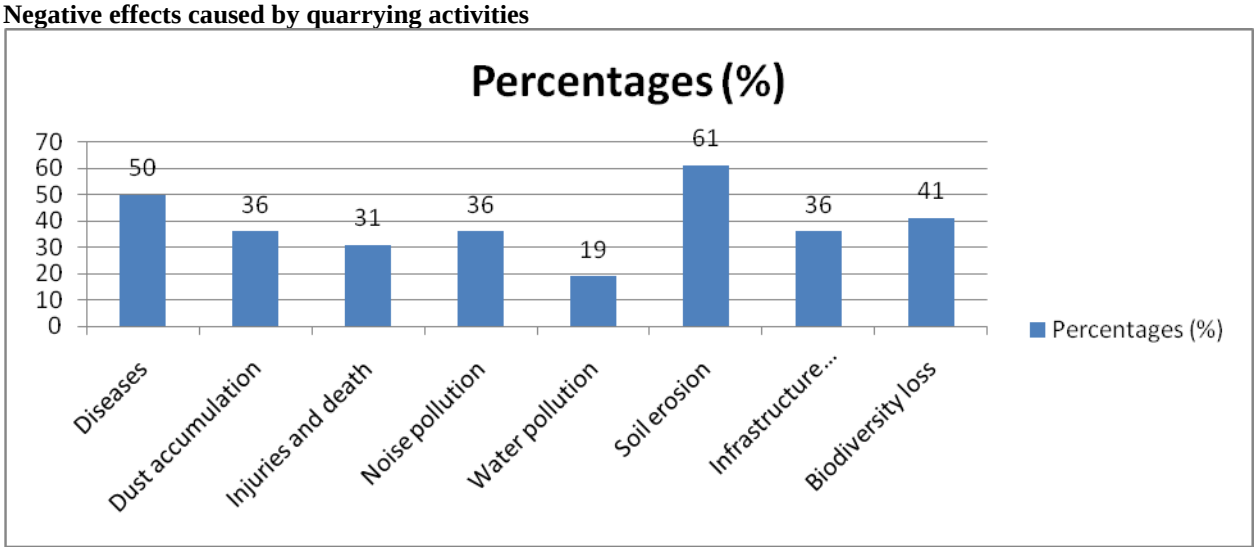


Figure 1: Negative effects caused by quarrying activities

Others reported on respiratory infections like cough and eye infections due to dust accumulation. This is in line with a study by Malele (2009) who explained the problems eruption of diseases associated with quarrying activities such as respiratory diseases like TB, pneumonia and bronchitis. The study results was matches with quotation from interview with one woman 45 years old who lamented that I worked this activity of quarrying rocks for 26 years *"…actually I will not forgot when TB was in my body without cured and up to date my health*

you can see is not standing proper and because I fail to get another job so am still doing the same work until God in heaven will take me away of this world…"

Yet, soil erosion was another environmental problem caused by extraction of quarry materials, as the process starts by removing the top soil which in the later stage the top cover may be washed away by rain water. Study results correspond with Nartey *et al*. (2012), Lameed and Ayodele (2010) and Musenga and Aigbavboa (2018) have noted the consequences of quarrying on the environment as it involves blast of rocks with explosives as a means to extract the needed materials. In the same vein, Eshiwani (2007), William (2001) and Kasimbazi (2019) further argued that, quarrying activities as the approach for extraction it results into noise, pollution, air pollution, and water pollution, damage of biodiversity and habitat destruction. Therefore, the study noted that most respondents agreed that quarrying activities had many negative effects on their life which can also affects economic activities in study area.



Plate 2: Stagnation of water in the pits filled during rainy seasons in Moivaro ward due to quarrying activities

3.4 Positive effects related to quarrying activities

The findings of this study have indicated that, in spite of negative outcome of quarries,there are also a number of positive impacts of quarrying. During field survey, respondents indicated the positive benefits to the people living adjucent and the neighbouring community.The result (Figure 2) indicates that 60% of the respondents identified that income generation was one of the advantage they enjoyed as it conntributed to increase in household income, especially those working in the quarries and landowners. Some of the respondents said that the availabilty of the quarrying sites have lead to the availabilty of the building and construction materials. As discussed earlier, quarries provide essential building and construction materials necessary for housing development, bridges, and construction of roads (Kasimbazi, 2019; Eshiwan, 2014; Nartey *et al.,* 2012; Aduke and Awaah, undated). Also youth from Moivaro ward are also employed in the quarrying sites and this has improved their livelihoods with 44% respondents agreed on the existence of employement opportunities. The study results matches with argument by Nene (2011) and Aduku and Awaah (Undated) that quarries provide employment opportunities and leads to the improvement of peoples' livelihood. On the other hand the existance of the quarrying site has influenced infrastructure developments such as roads, bridges and houses with 45% and 38% respondents identified the existence of interaction between the

people living in the area and those coming to acquire quarrying materials thus incresing social network.

Furthermore, arguments by Nene (2011) and Ibrahim *et al.* (2019) corroborates with FGD participants in studied area, it was reported that about 75% of households in Moivaro ward get their income through quarrying activities comparing to other economic activities like trade and agriculture. It was parallel from indepth interview with Environmental officer and District Land Officer (DLO) in Arusha Region who both reported that people in this region use mined areas for quarrying rocks so as to obtain building and gold materials for their livelihoods. Furthermore, it was quoted by one of the respondent with 66 years old in Moivaro ward who claimed that*"….since I born in this ward I found my parents are quarrying rocks for building and looking gold and they used to sell and get money….and when I become also independent with 23 years old also I started the same activity which helps me to pay even school fee for my children…"* Generally, it was observed by the study that most of the respondents reported that quarrying activities help to generate income rather than other benefits in the study area.

Positive effects of quarrying activities

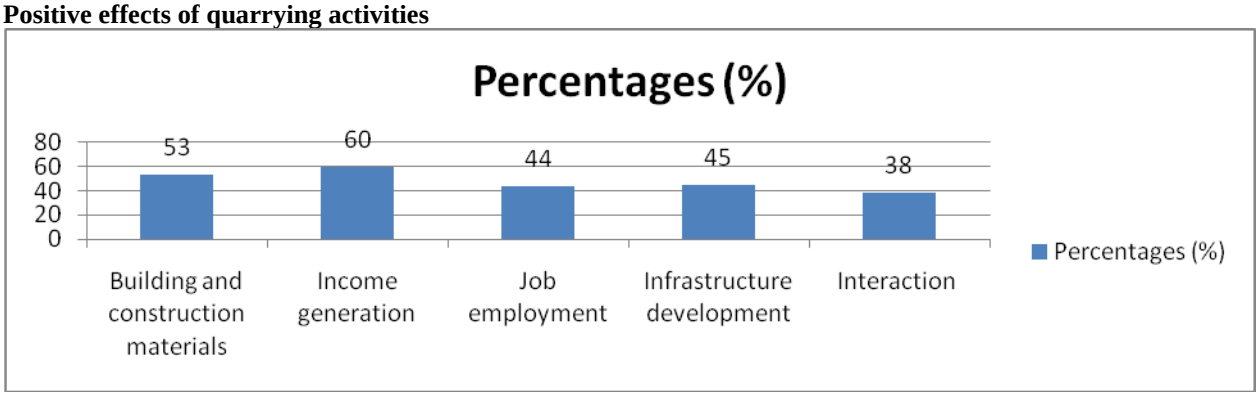


Figure 2: Positive effects of quarrying activities

3.5 Awareness on the procedure responsible for quarrying activities

Furthermore, the study was interested in understanding if the respondents were aware with procedures and rules which address quarrying activities so as to inform the government to an end. The study results as shown in Table 3 indicate that about 45% of respondents were uncertain on the awareness on procedures responsible for quarrying activities while 44% of the respondents were aware of the existing policies and by-laws that guide the process of quarrying activities in the area. During the interview, it was revealed by one of the respondents that, by-laws responsible for quarrying in the area were set to encourage the use of proper methods for extractions that may not cause injuries and death. Results from the study signify that majority of respondents were aware on the existence of the policy and by-laws guiding quarrying activities.

However, respondents are not sure of the effectiveness of the policies and by-laws governing quarrying activities. Thus, one of the respondents 37 years old were quoted by claiming that "*…actors responsible are just at the office because they do not face the problem was facing like air pollution on one hand. On the other hand, officers at City do not execute their duty to control quarrying activities in this area….*"

In the same vein, the argument by Saleh and Tukur (2015) and Mwamlangala *et al*. (2018) who propounded that, "the images people hold of their environment are critical in their actions and reactions to the development, studies in the area of peoples, environmental perception is instrumental to policy formulation and implementation, especially by determining the main targets that are fundamental strategies for sustainable development". Meaning that people wish to see laid down policies are implemented with accordance to the respective issue at stake. On the contrary, the policy remains meaningless if not in place to guard development.

Table 3: Awareness on the procedure responsible for quarrying activities

Respond	Frequency	Percent (%)
Aware on procedures required for quarrying activities	28	44
Uncertain	29	45
Not aware	7	11

According to the Urban Environmental Officer, "there are no procedures that have been developed to guide the mining of quarries in the area as still the area is not planned." Again, he pointed that the area lacks Environmental Impact Assessment (EIA), environmental audit and evaluation. Thus, there is less intervention on the negative effect of quarrying activities in the area. The argument by Urban Environmental Officer reflects views in Agenda 21 of 1997 that, despite having laws and regulations in the mining sector in the country, the enforcement at the Artisan and small scale (informal) mining has remained ineffective. It was contrary, Waweru and Makundi (2015) and Lwegaila *et al.* (2019) who reported that planned quarry land increases economic gain to the society such as creation of animal habitats, reduction of hazardous nature of quarried land, increase of biodiversity and development of local community. Generally, study results investigated that people in the study area were aware with procedures guiding the use of natural resources.

3.6 Community perception on quarrying activities towards environmental and social life within the Ward

Environmental degradation and decreasing of social ethics in mining areas is becoming an alarming issue in many areas of the country. Therefore the study asked respondents on perception of quarrying activities by using Likert scale towards environmental degradation. Most number of respondents (Table 4) reported that quarrying activities have negative effects in the ward because these activities cause environmental degradation, source of land disputes and social evils.

Table 4: Community perception on quarrying activities

Attributes	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
Does not cause environment degradation	12.4	8.3	6	12	3
It cause environment degradation	56.9	45	1	14	12
It increase nutrients in the soil	10.0	7	3	6	7
Creates job opportunity	44.6	53.1	2	8	11
It is a source land disputes	39.8	47.3	0	3	5
It is source of social evils like prostitution ,robbery	40.3	51.1	1	2	9

Key: Figures within the Table are in percentage (%)
***Indicate significant levels at 1% where p<0.01, Chi-square (χ^2) =32.731, p=0.045

But, other respondents reported that quarrying activities create job opportunity to residents. Implication of the results indicates that quarrying activities within the ward caused environmental degradation which affects people's livelihoods.

Furthermore, the study made statistical analysis by using Chi-square test in order to investigate the statistical significance difference of the responses. It was observed Table 4 that there was statistical significance differences at Chi-square (χ^2) =32.731, p=0.045.Results of statistical analysis imply that quarrying activities mostly has negative effects on livelihoods of the people within the Ward. The results corroborates with Mwamlangala *et al*. (2016), Camisani (2018) and Kasimbazi (2019) who both propounded that the increase of population in areas with potentialities of resources like in mining activities, there must occur many illegal practices for example social evils and robbery which mostly affects the livelihood of many families. In the same vein, report from In-depth interview with Urban Environmental Officer said that quarrying activities has many negative to this mining areas like Moivaro and Merelani were people destroy the scenery of the landscape and destruct the general environment but when quarrying activities are legalized people must benefit their resource for their livelihoods. General observation of the study it was found that quarrying activities has perceived negatively despites they benefit from it.

4.0 Conclusion and Recommendations

It is concluded that quarrying activities at Moivaro are perceived to have great negative impact on the environment as compared to positive ones. Damage of houses, water, air and noise pollution expose people to health risks and lack of safety. Nevertheless, encroachment of land has been also a threat to the adjacent communities. Besides, these negative effects quarry provides employment opportunities either direct or indirect; direct to the people who engage in excavation, loading and unloading extracted materials while in direct include food vending. Basing on the findings it is recommended to the Government of Tanzania in particular to Ministries of Health, Land and Housing, Mining and Environment and other key players like from Non-Governmental Organizations (NGOs) should adhere to the guiding legal and institutional frameworks addressing quarrying activities and adopting Integrated Planning Approach on selecting the appropriate areas where people can engage in quarrying activities with friendly technology. Also, there should be alternative means of construction and building materials and encourage the community to manage the environment.

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