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Original Article

Assessment of Socio-Economic Impacts of Stone Quarrying Activities in Narok Town Ward, Narok North Sub-County

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Quarrying is an excavation process involving abstracting materials, which are neither fuel nor minerals in nature from rocks. The ever-increasing development and construction in major urban centres worldwide have necessitated the need for quarries to provide materials for construction. This has led to detrimental environmental and social economic impacts which are usually ignored at the expense of economic pursuit by developers. The study focused on assessing the socioeconomic impacts of stone quarrying in Narok Town Ward, Narok North Sub-County, Kenya. The target population were quarry workers, the residents and government agency officials dealing with environmental management. The study employed a descriptive research design where both quantitative and qualitative techniques were used. Stratified sampling and random sampling techniques were used during the study. Questionnaires, interviews, observations and photography were used to collect data during the survey. Descriptive statistics, percentages, frequencies and correlation were used to analyze data in Microsoft software MS Excel and SPSS. Findings have been presented descriptively, quantitatively and qualitatively. Quarrying activities in Narok Town ward have played an important role in the economic development and infrastructural development, however it has brought about negative social issues such as a change in social fabrics, conflicts, displacement, and health-related issues. The correlation coefficient ($r=0.705$, $P<0.001$) show a positive correlation between the severity of dust and respiratory illnesses among the respondents. The respondents strongly agreed that quarrying activities have led to the creation of employment in the area. The study recommends that Stakeholders should put efforts into the mitigation of negative outcomes of quarrying activities that lead to the disruption of livelihoods. Community

education and sensitization on environmental and socioeconomic impacts and safety measures should be done to minimize the negative impacts of quarrying activities in the Narok Town ward.

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INTRODUCTION

Quarrying is an anthropogenic activity involving the process of removing sand, Gravel, rocks, or any non-mineral materials from the ground in order to use the materials for construction or other uses. It is also described as a stone excavation process involving abstracting materials which are neither fuel nor minerals in nature from rocks (UKpong, 2012). The ever-increasing development and construction in major urban centres worldwide have necessitated the need for quarries to provide materials for construction (Bewiadzi *et al.*, 2018). Increased quarrying activities worldwide are perhaps due to population growth, advancement in technology, urbanization, and infrastructural development (Opondo *et al.*, 2022). Bhattacharjee *et al.* (2018) asserted that the unplanned extraction and crushing of stones have detrimental effects on the environment and livelihoods.

Quarrying activities impact the life of the communities living around the quarry zones and those working in the quarry positively or negatively (Nartey *et al.*, 2012). A number of scholars for instance (Olusegun *et al.*, 2009; Nartey *et al.*, 2012

and Wanjiku *et al.*, 2014), have reported negative impacts on socioeconomic status with an increase in health complications. The impacts are often ignored at the expense of economic development. These impacts are usually linked to laxity in the implementation of sustainable resource management policies and strategies. Infrastructural expansion and urban development in Kenya have led to increased quarrying activities to offset the high demand for construction materials (Waweru *et al.*, 2018). This has led to a rise in issues of environmental degradation and negative social impacts among the neighbouring communities.

Waweru *et al.* (2018) noted various social issues such as displacement, conflict, the influx of foreigners and changes in societal social fabrics and behaviours. Exposure to dust and noise caused by quarrying activities has resulted in health complications among the quarry workers and communities living near the quarries (Nwibo *et al.*, 2012; Kim *et al.*, 2015). Despite the negative social impacts caused by quarrying activities, it has also, to some point, contributed to economic gain. Anunda (2014) attributed the increased quarrying activities to the rising real estate business and road

expansion in most urban centres in Kenya. The activity creates employment for many people that would otherwise be rendered jobless (Bhattacharjee, 2018). Additionally, local economic development has been observed due to the rise in population providing a market for local products.

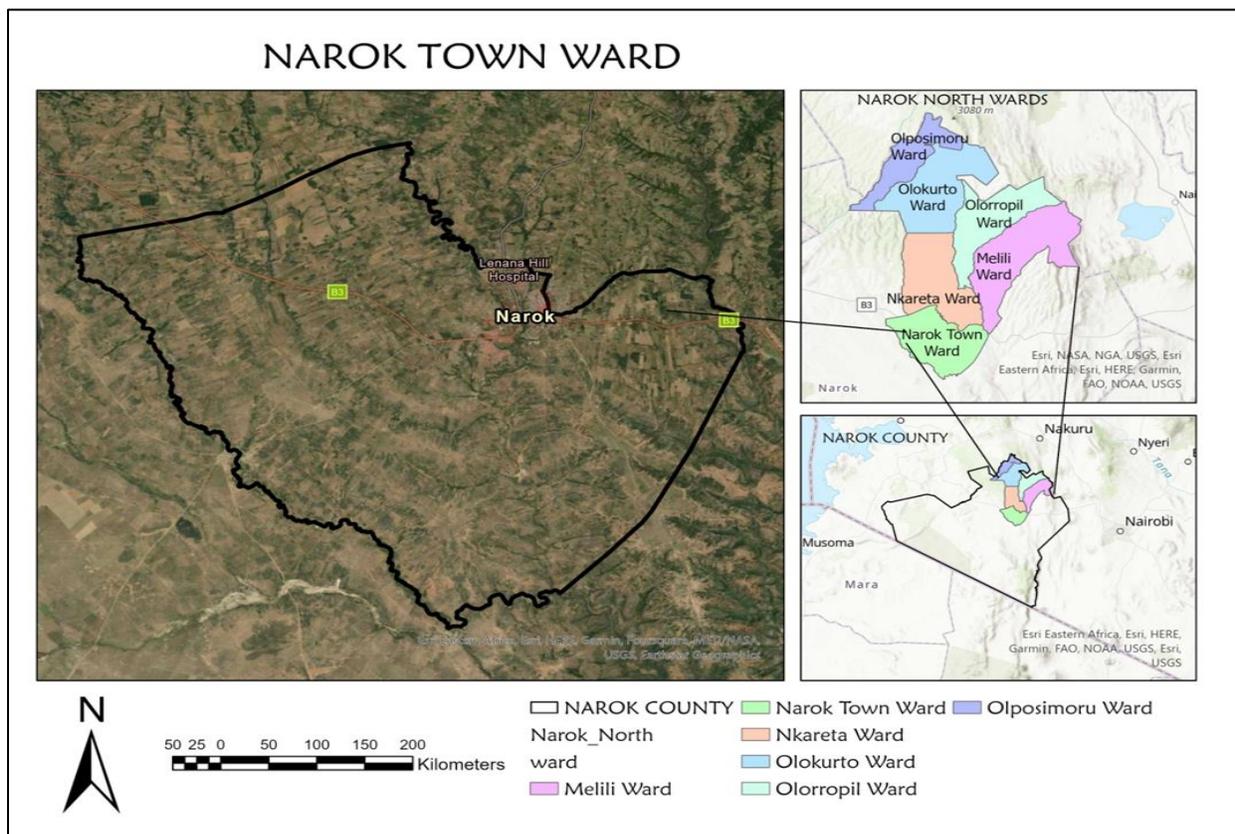
Abundance and easy access to building stones has made some areas in the Narok town Ward ideal sources of quarrying products for many developers in the rapidly growing Narok town and ever-expanding estates on its outskirts. The repercussions of increased quarrying activities in the area include environmental degradation and disruption of livelihoods, and thus, the aim of this study was to assess the socioeconomic impacts of quarrying activities in the area.

MATERIALS AND METHODS

Study Area

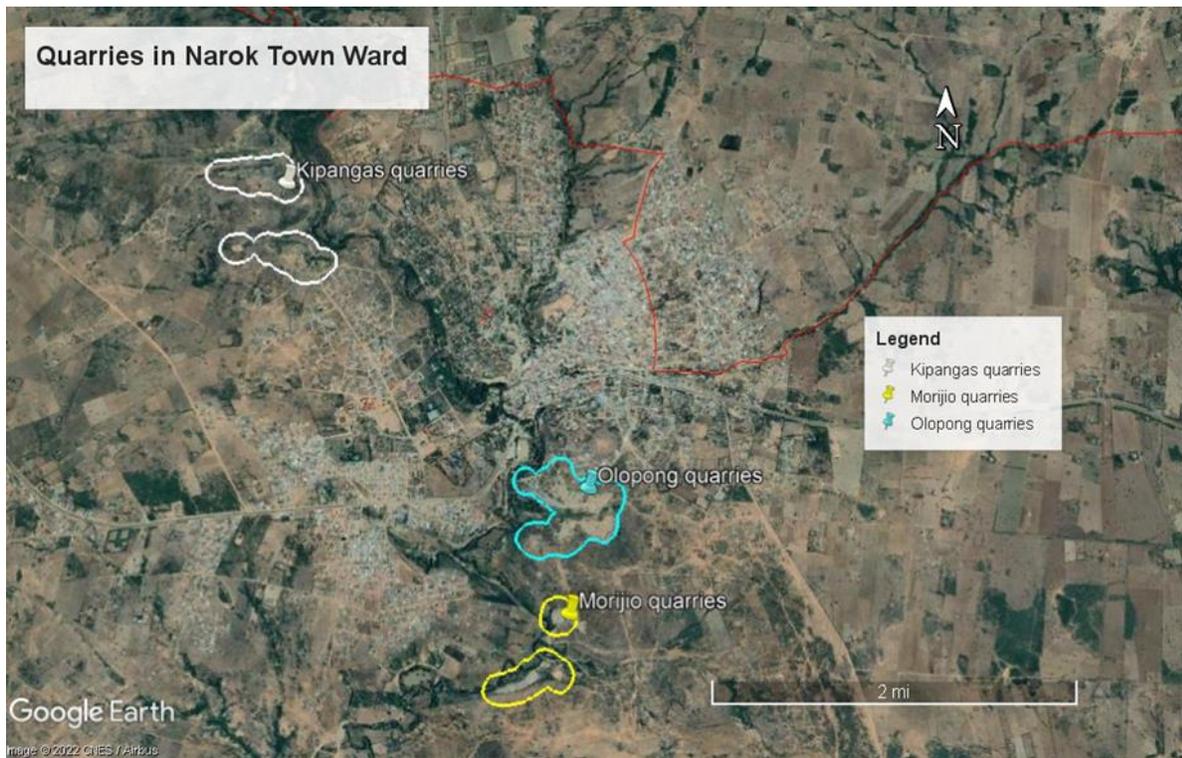
The study was conducted in the Narok town ward which is one of the wards in Narok North Sub-County that covers the Narok Town Municipality. The ward lies between latitudes $0^{\circ} 50'$ and $1^{\circ} 50'$ South and longitude $35^{\circ} 28'$ and $36^{\circ} 25'$ East in Narok County. The ward hosts County's headquarters. It is divided into two locations, namely the Oleleshwa location and the Narok township location. The ward also has the highest urban population among other wards in the county of about 68000 (Kenya Population and Housing Census [KPHC], 2019).

Figure 1: Map of Narok Town Ward



Source: Google Earth

Figure 2: Map showing different quarry sites in the Study Area



Source: Google Earth

Urban development and infrastructural development have led to increased quarrying activities in the study area leading to increase social and environmental impacts

The study employed a descriptive research design incorporating mixed methods of data collection for both quantitative and qualitative data. A descriptive research design is suitable for describing the existing situation, narrating facts, and investigating phenomena (Opondo *et al.*, 2022). It enables the researcher to understand the past state and the current state of the phenomena under investigation (Opondo *et al.*, 2022). The study targeted people working in the stone mining quarries and the residents living near the quarries. Additionally, there were special groups such as local government officials and agency representatives on matters relating to the environment.

The total population of Narok Town Ward is about 67683, with a population density of 95 persons per sq. with 17420 households. (KPHC, 2019). The

sample size for the study was calculated using the formula by Yamane (2016).

$$n = \frac{N}{1 + N(e)^2}$$

Where; n = sample size required; N =Total population; e = allowable error (%);

With a confidence level of 90% and allowed error is 10%, the study sample size was calculated as follows

$$n = \frac{67683}{1 + 67683(0.1)^2} = 100$$

Therefore, a total of 100 residents living near the quarry site were sampled during the study.

Reconnaissance was conducted to find the current number of quarry workers in the study area. A total of nine hundred and ninety-five (995) workers were found to be working in different quarry sites in the study area. Quarry owners noted that the numbers keep fluctuating as some workers join and others leave for better jobs. According to Mugenda and

Mugenda (2003), when the population is less than ten thousand (10,000), a sample size of between 10%- 30 % of the population can be used for generalization therefore, for this study, 15% of the quarry workers were sampled to participate in the study.

$$n = \frac{15}{100} \times 995 = 149.25$$

Thus, hundred and fifty (150) quarry workers were sampled to participate in the study.

Structured questionnaires with both closed and open-ended questions were used to collect data during the study. A different set of questionnaires were issued randomly to both quarry workers and household heads living near the quarry sites in the study area. Four Quarry managers, three environmental officers in the NEMA office and two village elders were purposely interviewed during the study. Observations and photography were also used during data collection.

Table 1: Summary of data matrix for the objective

Objective	Data variable	Data sources	Data collection methods	Data analysis	Data presentation
To evaluate the socioeconomic impacts of stone mining in Narok town ward, Narok North Sub-County	Social and health issues, economic impacts	Field survey	Questionnaires, interviews Observation	Descriptive statistics (SPSS, MS Excel)	Reports Charts Tables Frequencies and percentages

Source: Author 2022

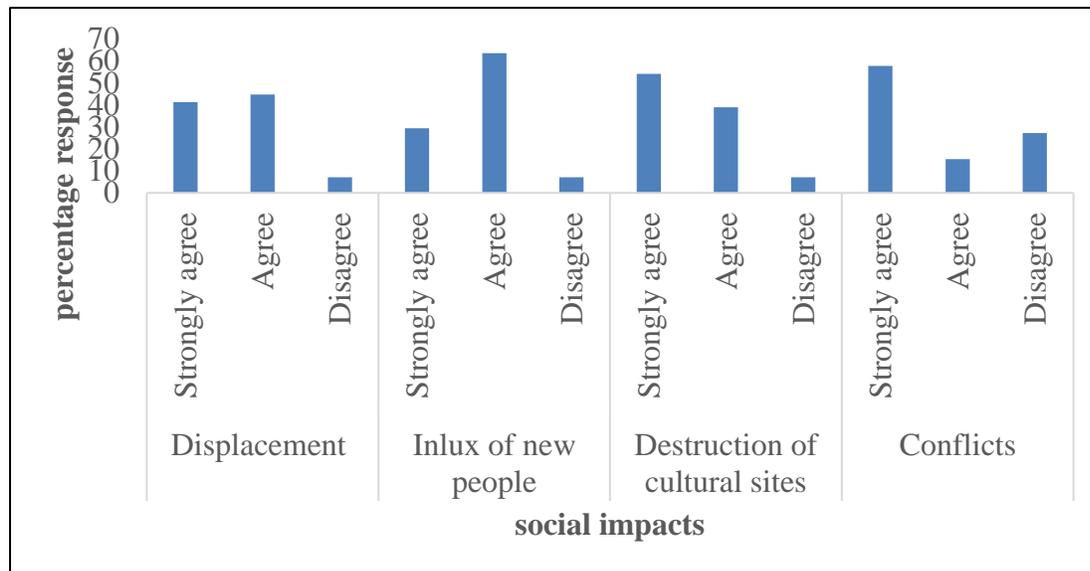
RESULTS AND DISCUSSIONS

study aimed to examine whether there exist social impacts due to stone quarries in the study area

Social Impacts Related to Quarrying Activities

Quarrying activities are accompanied by social issues arising from the disruption of livelihood. The

Figure 3: Social issues arising due to quarrying activities



Source: Author 2022

Figure 3 shows the social issues that arose in the study area due to the introduction of stone quarrying. To examine the social impact in the area, respondents were asked to give their opinions on how they agreed with the perceived social effect related to quarrying activities. Findings indicate the aspects of displacement were among social issues in the study area caused by quarrying activities in the area; 44.7% of the household heads agreed, while 41.2% strongly agreed that indeed quarrying had caused the displacement of some residents in the area, only 7.1 % disagreed.

Some residents who were owners of commercial rental houses in the area noted that there are many vacant houses since customers relocate after a short while after facing challenges related to quarrying activities. They further explained that they had been forced to lower the price of their commercial rental houses in order to attract tenants. Population influx in the area was also an issue that stood out in the area, with 63.5% of the respondents agreeing and 29.4% strongly agreeing that there are actually more people coming into the area to work in the quarry. One of the key informants during the interview asserted that people came from other areas, especially from informal settlement areas of Majengo, to look for jobs in the quarry. The issues

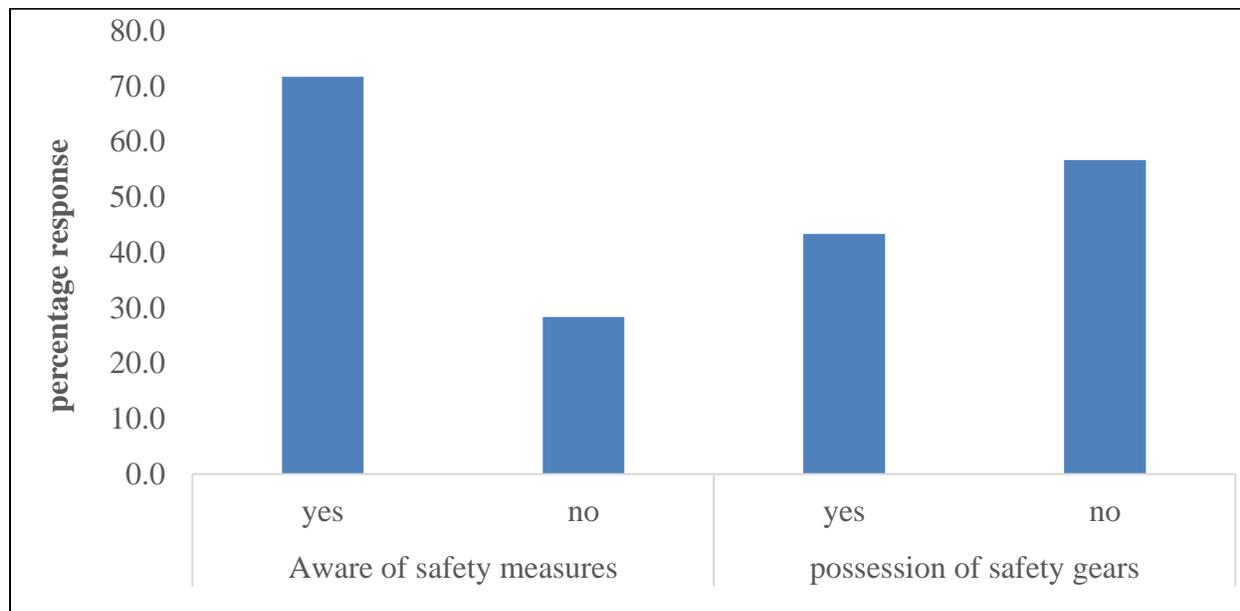
of conflicts also were indicated as 57% of the respondent strongly agreed that indeed quarrying activities have led to conflicts in the area.

Further probing indicated that conflicts arise because quarry owners and managers fail to mitigate dust generated, especially during transportation, furthermore residence, and business people along the main access road to the Kipangas quarry site were reported to have demonstrated several times due to dust and blame the county government for not watering the road to reduce dust

Health Impacts Caused by Exposure to Dust and Excessive Noise

Safety measures and gears among the quarry workers are important aspects in preventing health issues related to stone quarrying activities. The study first sought to find out whether quarry workers were aware of safety measures, possess and use safety gear. From the study, it was noted that the majority of the quarry workers (71.67%) were aware of available safety precautions. The findings further demonstrated that despite being aware of safety precautions majority of the quarry workers were not in possession of protective gear (Figure 4)

Figure 4: Awareness of safety measures and possession of safety gear.



Source: Author 2022

Respondents were not using protective gear such as gloves, safety goggles and masks. They further explained that gears were expensive and based on their income, they could not purchase them and thus were at high risk of physical injuries and health

issues related to quarry dust. Similarly, those who were using protective gear further explained that they faced minimal injuries and that the masks they put on prevented them from inhaling dust.

Plate 1: Quarry workers having PPEs (a) and (b) without PPEs

a



b

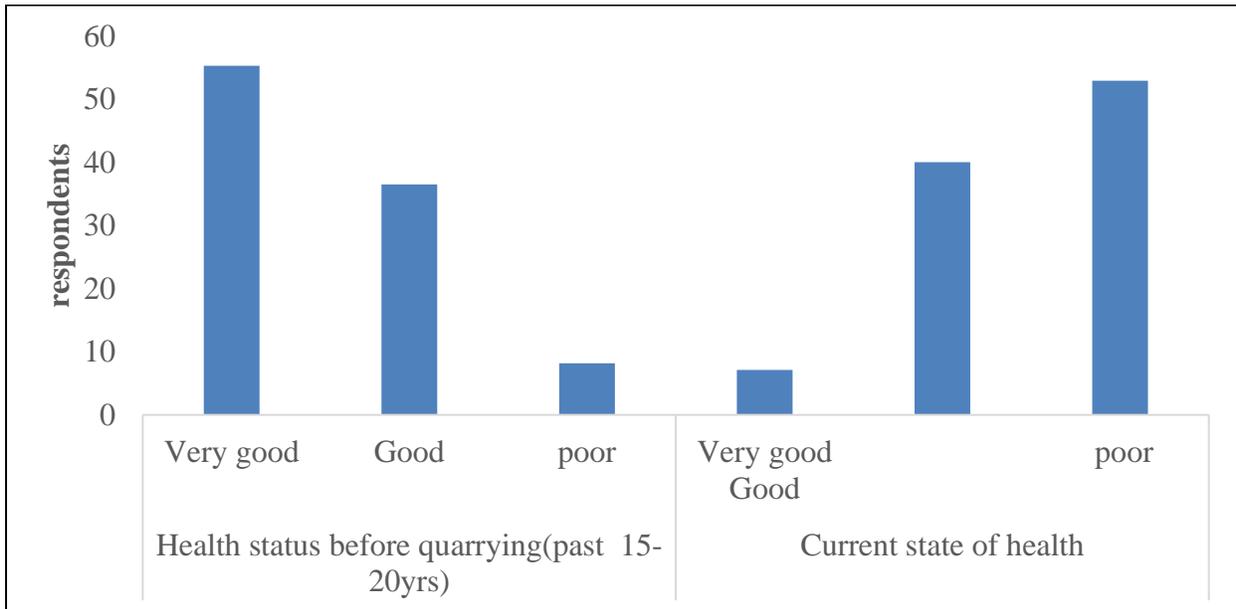


Source: researcher 2022

The study further examined various health problems related to quarry activities ranging from physical injuries to respiratory illnesses. Dust generated by quarrying activities both during transportation, excavation and the breaking of stones exposed the respondent to dust-related ailments. Respondents were asked to describe their health status before exposure to quarry dust and their current health status after exposure to dust. The findings showed that respondents' health had changed after exposure

to quarry dust. *Figure 5* below shows the majority of the quarry workers (55.3%) indicated that their health status before working in the quarry was very good. On contrasting with current health status, the majority (52.9%) recorded poor health conditions. Quarry Workers further explained that their health status had changed a while after working in the quarry, indicating that they had regularly suffered respiratory ailments, which they had not suffered before engaging in quarry jobs

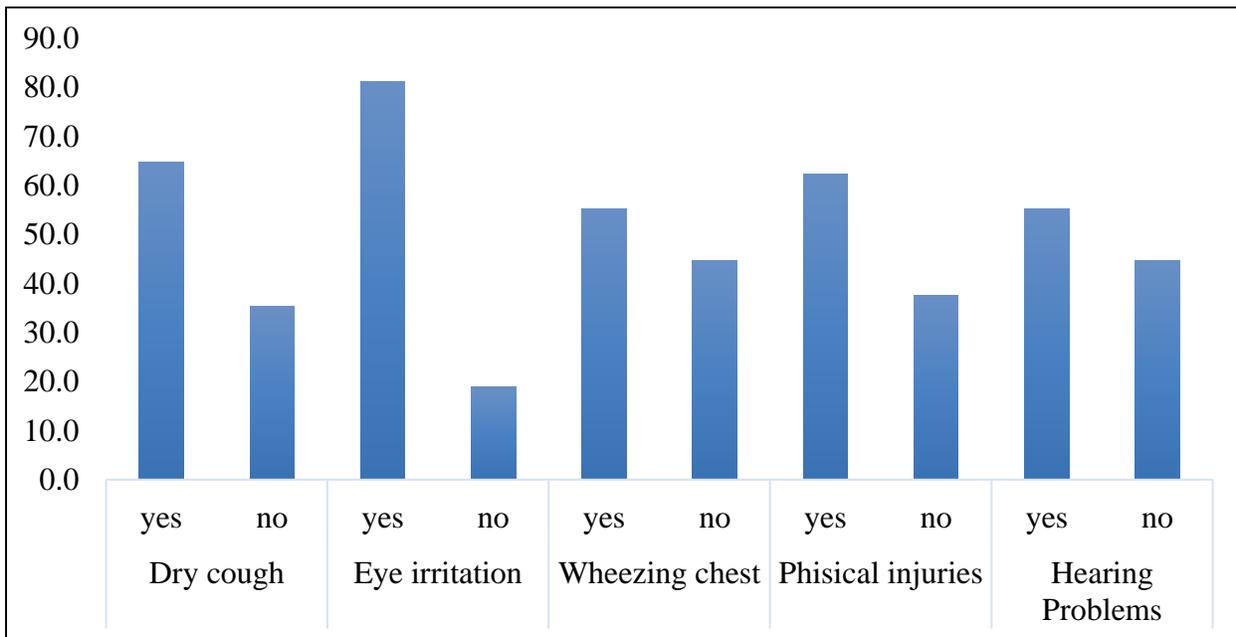
Figure 5: Health status before quarrying activities and their current health status



Source: Author 2022

The respondents were further probed to establish whether they had suffered from quarrying-related ailments, shown in *Figure 6* below

Figure 6: Displays ailment indicated by respondents



Source: Author 2022

H₀: There is no significant relationship between dust and respiratory ailments reported in the study area

The study sought to find out whether exposure to dust has led to respiratory ailments in the area based on the issues raised by respondents. A correlation was run to determine the relationship

Table 2: Correlation between dust severity and respiratory illnesses

			Severity of dust	Respiratory ailments
Spearman's rho	Severity of dust	Correlation Coefficient	1.000	.705**
		Sig. (2-tailed)	.	.000
		N	120	120
	Respiratory ailments	Correlation Coefficient	.705**	1.000
		Sig. (2-tailed)	.000	.
		N	120	120

***. Correlation is significant at the 0.01 level (2-tailed).*

Source: Author 2022

Correlation coefficient ($r = 0.705$, $P < 0.001$) shows a positive correlation between the severity of dust and respiratory illnesses among the respondents. From this finding, the null hypothesis is rejected, and the alternative hypothesis is upheld. However, the severity of dust alone cannot be attributed to respiratory ailment; there could be other factors, perhaps age, immunity, and health status before exposure.

Economic Benefits of Stone Quarrying

Despite the negative impacts associated with quarrying activities, quarrying activities also bring about economic improvement in the area. The study sought to find out whether perceived economic benefits of quarrying activities exist in the study area and respondents were asked to give their opinions on perceived economic benefits, as shown in *Table 3* below

Table 3: Economic benefits attributed to quarrying activities in the study area

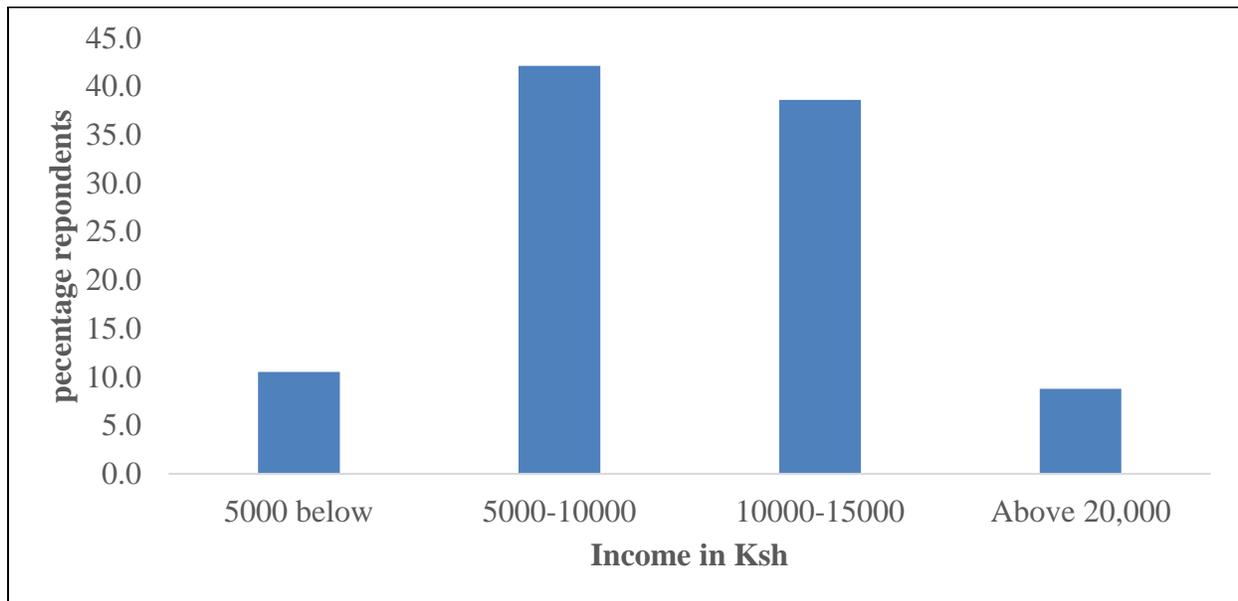
Statement	Agree	Strongly agree	Disagree
Quarry has created employment opportunities	55.3%	27.1%	17.6%
Quarrying supports the local economy	49.4%	37.6%	12.9%
Quarrying has led to the development of roads	52.9%	29.4%	17.6%
Source of construction materials in the area	61%	32%	7%

Source: researcher 2022

From *Table 3* above, the majority of the respondent showed a positive response in agreement with existing economic benefits in the study area. 27.1% of the respondents strongly agreed, while 55.3% agreed that quarrying activities have led to the creation of employment in the area, especially for the youths. This is confirmed by the fact that the demographic characteristics of respondents indicated that the majority of the quarry workers were of age between 21 years and 35 years. Income statistics also indicate that quarry workers earn between 5000 ksh to about 20,000, with the majority earning between 5000 to 10,000 Ksh. as shown in *Figure 7* below. This clearly indicates that many

people who would otherwise be jobless now earn income from the quarry.

Figure 7: Monthly Income levels for quarry workers



Quarrying activities in the study area supported the local economy by providing a market for local supplies, this was agreed by 49.4%, and 37.6% of the respondents strongly agreed (*Table 3*). This was observed in the field whereby hotels and shops within the area were most supported by quarry workers who are their regular customers, hawkers were also among those who benefited from the presence of the quarry as they sold their merchandise to the quarry workers.

Additionally, it was noted that the county government also collect taxes from quarry owners and from the business people who buy quarry products from the area thus further contributing to the country's economic development. Other benefits noted include the development of access roads agreed upon by a majority of the respondents (52.9%) which improves accessibility in the area. Similarly, 61% agreed that quarrying in the study area was the source of construction dimensional stones in the entire region, attracting many developers in the area. The findings correspond to that of Wangela (2019) who reported that stone quarrying in the Ndarugo area in Kiambu had led to economic growth in the area citing job creation, road development and improvement of local businesses in the area, among other developments. The finding also concurs with that of Orimba (2020) who noted that other than creating employment,

stone quarrying brings about sustainable economic development through increased income and taxes earned by the county government.

CONCLUSION AND RECOMMENDATION

In conclusion, quarrying activities in Narok Town ward have played an important role in economic development and infrastructural development, however it has brought about negative social issues such as a change in social fabrics, conflicts, displacement, and health-related issues. Disruption of livelihood by quarrying activities outweighs the economic gains from the quarrying activities

The study calls on all the stakeholders to put efforts into the mitigation of negative outcomes of quarrying activities that lead to the disruption of livelihoods. Additionally, Community education and sensitization on environmental and socioeconomic impacts and safety measures should be done in order to educate community members on ways to minimize the negative impacts of quarrying activities.

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