ASSESSMENT OF THE IMPACTS OF SAND HARVESTING ON LAFIA URBAN AREA OF NASARAWA STATE, NIGERIA

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ABSTRACT

Sand harvesting has been one of the serious problems around the globe in recent years. It impacted in one way or another on the environment, social and economic aspects of man in harvesting areas. This also often results in land degradation and devastation, loss of aesthetic beauty of the land, loss of agricultural lands, destruction of infrastructure, though with also positive impacts. The situation stated above is not an exception in Lafia urban area. The main purpose of the study was to assess the impacts of sand harvesting on Lafia urban area of Nasarawa state, Nigeria. The study used descriptive survey design as research approach and 100 samples questionnaires were administered using stratified and purposive sampling method. Data collected were analysed using both descriptive statistics and Chi-square analysis procedure and the results were tested in all cases at x=0.05 using the aid of SPSS package. The findings revealed that there were environmental and socio-economic impacts of sand harvesting on Lafia urban area. The results from the analyses indicated that the negative impacts of sand harvesting as land devastation, road destruction and loss of vegetation ranking 1st, 2nd and 3rd order and the positive impact as growth of building activities, source of livelihood and road construction ranking 1st, 2nd and 3rd order. The result finding also from the mean score of 3.26 and 4.31 for negative and positive were greater than the benchmark mean score of 2.50 which indicated that sand harvesting has very strong impacts on Lafia urban area. The Chi-Square (χ2) analysis revealed that the positive impact of sand harvesting is more than the negative impacts. The study recommend that there should be efficient surface mining that allow up to a maximum of 2-5m depth and harvesting of 2m depth only reduce more than 80% damage to communities. There is also, the need to regulate sand harvesting activities so as to avoid further damage to the environment. Appropriate reclamation measures need to be undertaken with involvement of the stakeholders and restoration plan for decommissioned mining sites, alternate mining sites to reduce challenges associated with continuous uncontrolled sand extraction. The study conclude that without considering the precise gift provided by nature, harvesting of sand indiscriminately from the land, rivers and beaches for man's benefits will destroy the whole environment if measures were not put in place.

Keywords: Sand harvesting, sand mining, environmental impact, socio-economic impact, land reclamation.

1.0 INTRODUCTION

The impact of resource exploitation on the environment and human wellbeing has become a major sustainable development issues over the last decade. Sand harvesting is one of the resources being exploited in the environment. According to Nema (2004) sand harvesting can be describe as the practice of extracting sand mainly through open pits. Sand harvesting is the removal of sand from their natural configurations. Sand harvesting is a world-wide activity in both developed and developing countries (Draggen and Kondolf, 2008). Sand harvesting is an activity referring to the process of harvesting sand from an open pit or areas where they can be found in larger quantities.

Globally, many people are increasingly being influenced into sand harvesting on a daily bases (Robert, 2014). This trend of mass movement of people into sand harvesting has become a major concern for people living in the harvesting fringe communities (Savior, 2012). Harvesting of sand occurs on both small and large scale in major parts of the country. This is becoming common and is having noticeable impacts on the soil structure, vegetation and local wildlife of many communities. Makweba and Ndonde (1996) opined that operations of sand harvesting, whether small or large scale are inherently disruptive to the environment. Uunona (2005) discovered that the process of sand harvesting had accelerated environmental degradation to an alarming rate in many areas. Ashraf *et al*. (2011) in a research carried out in Malaysia found out that environmental problems occur when the rate of extraction of sand , gravel and other materials exceeds the rate at which natural processes generate these materials. Surprisingly, although more sand and gravel are mined than any other material, but reliable data on their extraction is uncertain on developing countries (Krausmann *et al*., 2009). Sand harvesting is widespread, highly unregulated, uncontrolled and is being carried out at an alarming rate. The gravity of the situation poses a threat to the environment in most cities and towns. Observation shows that sand harvesting is done in different locations in Lafia urban area. This sand harvesting is done indiscriminately leaving behind large abandoned mines and causing massive damage to landscape if less attention is given. Sand harvesting creates environmental and socio-economic impacts in most towns and cities such as land degradation, loss of vegetation covers, soil erosion, destruction infrastructures and increased dust particles resulting from the transportation among many others.

Sand harvesting seems to continue unabated in a highly unregulated manner. This creates several environmental and socio-economic impacts at the expense of the environment in Lafia urban area. The assessment of these impacts after harvesting on the community has been neglected. The law in Nasarawa State is apparently inadequate as far as regulation of sand harvesting is concerned. Many previous literature have discussed intensive sand harvesting with disregards to the environmental significance is accompanied by series of socio-economic and environmental problems. (Hemalathar

et'al, 2005; Rao, 2006; Brynes and Hiland, 1995). The studies examine the impact of sand harvesting in their localities based on experienced and observation. Araya *et al*. (2000) found that although sand harvesting cannot be completely stopped, the government and other stakeholders should develop new laws and policies which should aim at promoting sustainable harvesting by striking a balance between environmental conservation and business proceeds. There is, however, no evident of empirical data to show the environmental and socio-economic impacts of sand harvesting on Lafia urban environment.

It is against this backdrop that this study therefore seeks to assess the environmental and socio-economic impacts of sand harvesting on Lafia urban area and come up with recommendation for best management practices for sustainable sand harvesting.

2.0 REVIEW OF LITERATURE

2.1.1 Environmental impacts of sand harvesting

Available studies show that unsustainable extraction of sand and gravel seriously affects the environment. Environmental impacts of sand harvesting often results in soil erosion, loss of vegetation, loss of biodiversity land degradation, noise pollution across communities and other impacts include loss of farmland, depreciation of land value, loss of aesthetic beauty of the land, dust pollution, creates noise and vibration and destruction of roads and other structures due to movement of heavy vehicles cause damage to roads and bridges and sometimes cause traffic hazards (Podila, 2017). Study by Musah (2009) in northern Ghana on the economic and ecological impacts of gravel mining revealed that the impacts of sand harvesting included pits, serving as breeding grounds for mosquitoes and spread of other waterborne diseases, erosion and loss of vegetation, loss of economically important trees as well as routes of conflicts. The ecological impacts were erosion, landscape destruction, biodiversity loss, loss of grazing land, sand as dust pollution as major negative environmental impacts of harvesting while positive impacts of harvesting are enhancing infrastructural development such as roads.

In Nigeria, Lawal (2011) reported that sand harvesting results in the destruction of aquatic and riparian habitat through large changes in the channel morphology. Another example is the environmental degradation in Cross River State. According to Okereke & Eze (2020), Sand harvesting has caused extensive environmental problems in Cross River State. The sand harvesting activity has destroyed farmlands, aquatic habitats, and forests. That the government has set up a task force to enforce the ban on sand harvesting, but it has been difficult to curtail the illegal activity.

2.1.2 Socio-economic impacts of sand harvesting

Apart from environmental impacts, sand harvesting has socio-economic impacts to the society. In the

case of Togo, the sand harvesting industry and transport has had an important role in the local

economy of Togo for many years (Togo National Report, 2007). On a national basis quarrying and sand mining has been the second after agriculture as a source of rural employment such as firm manager, labourers and truck drivers. The report added that the benefits include income and local revenue generation which is used in to meet the basic needs of the family including food, school fees for children and even entertainment. Mutisya (2006) in his research on sand harvesting and its environmental and socio-economic effects in semi arid areas of Kenya found out that socio-economically sand harvesting is a source of income through the provision of incomes and employment opportunities. It is also associated with negative social problems such as deaths resulting from conflicts between sand harvesters and the local community, prostitution and abuse of drugs and alcohol which threaten the security of the local residents. This study seeks to find out if the same situation is found in Muooni River.

In Nigeria, NEMA (2004) reported that sand harvesting has contributed significantly to the economic development in areas where it is done through the creation of employment opportunities, creation of local supply of raw materials for the construction industry, generation of export revenue and alleviation of poverty. However, sand harvesting has also led to social and health problems including prostitution and high school dropout rate rise in alcoholic and substance abuse, sexual misbehavior and drug addiction. Nkwocha & Opara, (2018) examined the activities of sand harvesting on sources of livelihood and discovered that the activity has damaged fishing grounds, making it difficult for fishermen to make a living.

2.1.2 Ameliorating the impact of sand harvesting

Sand harvesting, sand harvesting or sand excavation can be ameliorated trough several suggestions that were put up by scholars. Though, every part of the environment has its unique methods and ways of reducing the impact of sand harvesting on such environment. Kondolf (1997) suggested that concrete rubble should be recycled to avoid using aggregates, at least for low-quality uses. This would in turn reduce demand for sand for certain construction works. Khamput (2006) showed that quarry dust could be used to replace sand in general concrete structures. It is even believed to give better output. The replacement of sand by up to 40% of incinerator ash exhibits higher compressive strength than regular cement mortars (Al-Rawas *et al*., 2005). There are also alternatives for building houses, including wood, straw and recycled material (UNEP, 2014).

Other scholars suggested the use of tax on extraction of sands and that the situation will continue unless sand extraction is correctly priced and taxed so that other options become economically viable (UNEP, 2014). Other school of thought belief that policies would help reduce the problems, policy actions should include the introduction of scientific harvesting operations, followed by ecological

restoration. Greater consideration of substitute and sustainable use of the resource could drastically reduce impact on the environment (Chauhan, 2010).

3.0 STUDY AREA:

Lafia town is located in Lafia Local Government Area in North Central part of Nigeria. Globally, Lafia Local Government area is located between latitude 8˚20'N - 8˚38'N and between longitudes 6˚34'E - 7˚30'E. It share boundaries with Nasarawa Eggon and Wamba Local Government Area (L.G.A) in the North, Obi Local Government Area (L.G.A) in the South East, Doma Local Government Area (L.G.A) in the South-West, Kokona Local Government Area (L.G.A) in the West and Plateau state in the East respectively. It has population of 330,712 according to National Population Commission Lafia (2006) (figure 1).

Lafia town as the study area is the headquarters of Nasarawa State. Lafia town is found at the south-western part of the State within latitudes 8°25' N and 8°35'N and longitudes 8°28'E and 8°34'E. Lafia town has population 87,352 inhabitants from NPC, 1991 census. This was further projected to 2016 by Lafia Development Plan (2012) plan as 259,786. This study projected the population to 2019 using 3% growth rate per annum as 286,868. The Local Government Area has a population of about 330,712 inhabitants in 2006 census (Grater Lafia Master plan 1998; NPC, 1991 & 2006; Lafia Development Plan, 2012) (figure 2).

Figure 1: Map of Nasarawa State Showing Lafia local Government
Source: Nasarawa State Ministry of Land Survey and Physical Planning, 2019.
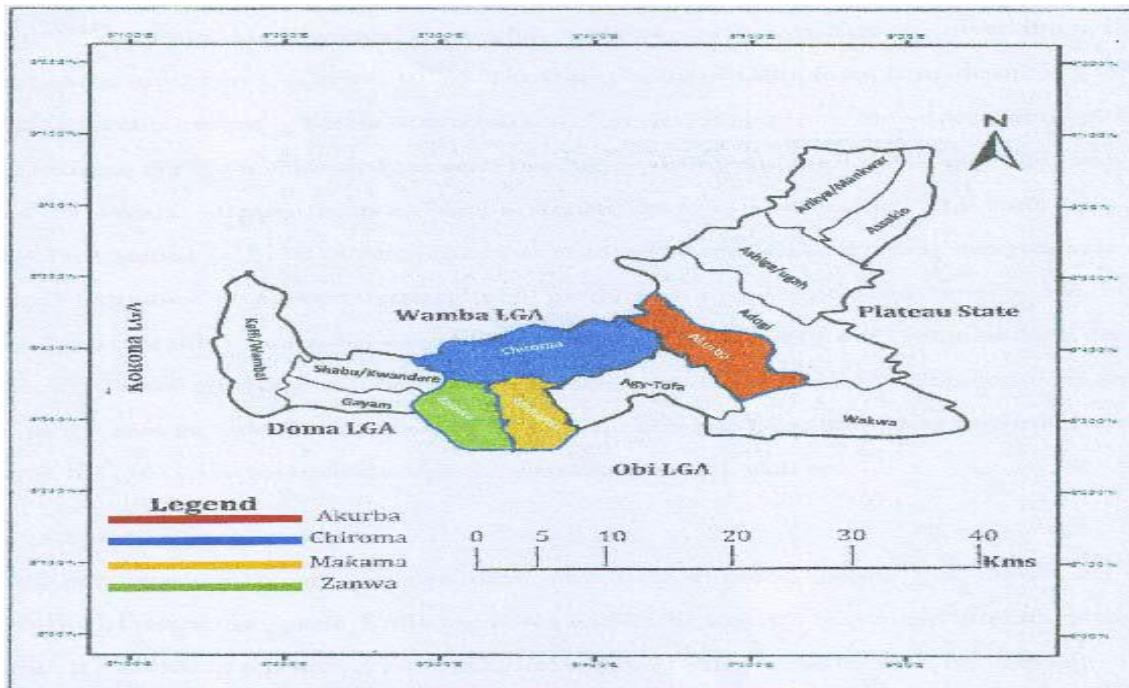
3.2.1 Map of Lafia town

Figure 2: Map of Lafia showing wards
Source: NAGIS, (2019)

4.0 RESEARCH METHODOLOGY

This study used "Research Design" as main framework when conducting the research (Jalil, 2013: Mishra & Alok, 2017). Descriptive research design was adopted where a case study was conducted on the impact of sand harvesting in Lafia urban area. Descriptive research design was used because it is relatively quick and cheaper and the results can be inferred to a large population. This study used quantitative approach. Quantitative approach involved random selection of research participants from the study population in an unbiased manner, the administration of standardized questionnaire they receive, and statistical methods used to test predetermined hypotheses regarding the relationship between specific variables (Denzin & Lincoln, 2005; Creswell, 2012).

The population of the study shall not cover the entire Lafia urban population but shall comprise of the local communities closer to the sand harvesting sites and where the impact may be felt much. The population shall including the local communities, sand harvester dealers, transporters/loaders and experts which constitute 103,638. The sampling methods used during the study were the stratified sampling and the purposive, also called the judgmental sampling method. For the purpose of stratified sampling technique was used to issue questionnaires to the local community members and people involved in sand harvesting activities. The sample size was derived from the population of study and Yamane (1967) formula was used to arrive at a sample size of 100 for the study.

The researchers engaged the services of eight trained research assistants for the administration and

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collection of the instruments. Descriptive and inferential statistics were employed for the study. There search questions were analysed with various descriptive -frequency count, percentages mean statistics, while the inferential statistic employed for the test of hypotheses was the Chi-square (χ^2) statistics and others include correlation analysis and mean ranking analysis at the tests of hypotheses were conducted at 0.05 level of significance.

5.0 DATA RESULTS
This section indicated the characteristics of sand harvesters and the activities they were involved as presented below:

Table 1: The characteristics of respondents of sand harvesting

S/N	Response	Frequency	Percent
1	**Occupational status of those engage in sand harvesting activities**		
	Land owners	11	11.0
	Sand loaders	18	19.0
	Drivers	4	4.0
	Sand miners	52	53.0
	Any others	13	13.0
	Total =	98	100.0
2	**Duration of being in sand harvesting activities**		
	Less than 1 year	11	11.0
	2-3years	42	43.0
	4-5years	28	29.0
	5years and above	17	17.0
	Total	98	100.0
3	**Reasons for engaging in sand harvesting activities**		
	Lack of job	55	56.0
	Is family business	13	13.0
	To get temporary Income	30	31.0
	Total	98	100.0
4	**Number of trip sand is harvested per day**		
	11-15	49	50.0
	16-20	43	44.0
	>21	4	4.0
	4.00	2	2.0
	Total	98	100.0
5	**Monthly income generated in sand harvesting**		
	Less than N10,000	11	11.0
	10,000-14,000	42	43.0
	15,000-19,000	30	31.0
	20,000-24,000	13	13.0
	25,000 and above	2	2.0
	Total =	98	100

Source: Field Survey, 2024

Result from table 1 revealed that most of the respondents engaged in sand harvesting activities were sand miners representing 43% where as 19% constituting the sand loaders, 11% of the respondents were land owners whereas fewer respondents were drivers 4% while 13% representing others.

The study also revealed that majority of the respondents spends only between 2-3years in sand harvesting activities constituting 43%. This support the fact that some of them are engage in the business to make temporary money to pursue other thing in life or augment their other source of income, while 29% of the harvester spend between 4-5 years in the business and only 17% of the respondent actually spend more than 5 years in the business of sand harvesting in the study area.

It was also revealed that the major thing that led them to sand harvesting activity was lack of jobs, which account for 56% of the respondents, followed by those who believed it was a temporary source of income representing 31% of the sand harvesters. Only 13% were actually connected to the activity as family heritage. The finding shows that those who engaged in the activity due to lack of jobs constituting the majority of the respondents while others who may engage in sand harvesting activities as their alternative source of income. The implication of this result shows that the unemployed people constituting the significant portion of the people who may found this as their source of living.

In addition, the study revealed that the sand harvester can make as many as 16-20 trips in a day which represent 44%. But what were mostly obtainable were the 11-15 trips per day which represent 50% of the responses.

The table also revealed that 44.9% of the harvester which represent the majority had a monthly income from between 5,001-10,000. Also, with regard to how much they make, 31% of the respondent made from between 10,001-20,000 monthly and 13% made more than 20,000 monthly. However, 11% had a monthly income which was less than N10, 000, whereas fewer respondents (2%) earned more than N25, 000.

Table 2: The environmental and socio-economic impact of sand harvesting

Impact (Construct)	Variable	Responses		Percent of Cases
		N	Percent	
Environmental Impact	Land Degradation(pits/Ditches/Gully)	76	11.0	84.4
	Soil Erosion	84	12.1	93.3
	Loss of vegetation	74	10.7	82.2
	Loss of farmland	73	10.5	81.1
	Breeding place for snakes and other dangerous reptile	65	9.4	72.2
	Pollution cause by dust	69	9.9	76.7
	Land alteration	65	9.4	72.2
	River Bed degradation	69	9.9	76.7
	Destruction of aquatic life	63	9.1	70.0
	Loss of aesthetics	56	8.1	62.2
	Road construction	76	23.6	76.0
	Destruction of Infrastructure facilities	64	19.9	64.0
	Cracks on building wall (truck Movement)	76	23.6	76.0
	Housing construction	56	17.4	56.0
	Road construction	50	15.5	50.0
	Total	694	100.0	771.1
Socio-eco Impact	Source of livelihood	91	20.6	91.0
	Source of employment	96	21.7	96.0
	Reduce crime rate due to unemployment	77	17.4	77.0
	Source of income/Revenue	73	16.5	73.0
	Depreciation of land value	53	12.0	53.0
	Land conflicts	52	11.8	52.0
	Total	442	100.0	442.0

Source: Field Survey, 2024

In table 2 above, its shows the rating of the likely environmental impact of sand harvesting within the study areas. In the rating above soil erosion is rated as the highest environmental impact within the study area which represents 93.4% of the responses by the respondents. Followed by degradation of land 84.4% and the least of the impact according to their opinion is loss of aesthetics which represent 62.2% of the environmental impact. Details of the environmental impact of sand harvesting are contained in the table 4.46 above.

In addition, the respondent rated the likely physical impact of sand harvesting as follows. Road construction and cracks on building walls as results of truck movement was rated the first in physical impact of sand harvesting within the study area with 76.0% while destruction of infrastructural facilities was rated second as part of the physical impact of sand harvesting in the study areas. Road construction was rated the least in the physical impact of sand harvesting within the study area.

According to the respondent, the socio-economic impact of sand harvesting can be rated thus. 96.0% rated sources of employment as the highest, sources of livelihood as the second with 91.0% and sources of revenue as the third in that order. While land conflicts was rated the least in the socio-economic impact of sand harvesting within the study area.

5.1 Mean Ranking of the impact of sand harvesting in Lafia town

Literature reviewed started that a factor or determinant with 4.5-5.0 mean range shows that the factor is very strong, 3.50-4.49 is strong, 2.50-3.49 is fair 1.51-2.49 is weak and 1.00-1.50 is very weak factor (Morenikeji & Shuibu, 2005). Therefore, physical and economic factors are the major determinants that affect or influence utilisation of public open spaces in Lafia town while climatic and socio-cultural are complimentary factors (table 3).

Table 3: Mean Scores (M) and Standard Deviation (SD) of the determinants of public open spaces in Lafia town

Impact	Mean	Ranking
Negative impact		
Soil erosion	4.29	1
Road destruction	3.90	2
Destruction of aquatic life	3.87	3
Pollution cost by dust	3.84	4
Land alteration	3.50	5
River Bed Degradation	3.83	6
Cracks on Buildings walls (Truck Movement)	3.82	7
Land conflicts	3.78	8

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Loss of aesthetics landscape beauty	3.76	9
Destruction of infrastructural facilities	3.74	10
Loss of farm land	3.70	11
Loss of vegetative cover	3.67	12
Breeding place for snakes and other dangerous reptiles	3.68	13
Depreciation of land Value	3.63	14
Land degradation (pits/ditches/gully)	3.63	15
Increase social vices	3.31	16
Increase insecurity	3.07	17
Positive impact		
Growth of Building activities	4.53	1
It provide source of livelihood	4.43	2
Road construction	4.43	3
Filling Roads	4.36	4
It provide employment	4.35	5
It will generate revenue for government	4.34	6
Reduce crime rate due to unemployment	4.31	7
Prevent flood by emptying the stream bed	4.18	8
Pits/Ditches provide source of water for animals	3.88	9
Total =		

Source: Author's analysis, 2023

Results on the table also revealed the mean scores of all items for respondents of the following statements on negative impact of sand harvesting: "Soil erosion", "Road destruction", "Destruction of aquatic life", "Pollution cost by dust", "Land alteration", "River Bed Degradation", "Cracks on Buildings walls (Truck Movement)", "Land conflicts", "Loss of aesthetics landscape beauty", "Destruction of infrastructural facilities", "Loss of farm land", "Loss of vegetative cover", "Breeding place for snakes and other dangerous reptiles", "Depreciation of land Value", "Land degradation (pits/ditches/gully)", "Increase social vices" and "Increase insecurity" were higher than the bench mark score of 2.50.

On the other hand, the mean scores on all items for respondents of the following statements on positive impact of sand harvesting: "Growth of Building activities", "It provide source of livelihood", "Filling Roads", "Road construction", "It provide employment", "It will generate revenue for government", "Reduce crime rate due to unemployment", "Prevent flood by emptying the stream

bed" and "Pits/Ditches provide source of water for animals" were higher than the bench mark score of 2.50.

Lastly, the overall mean score of 3.26 and 4.31 for negative and positive impact respectively is greater than the benchmark mean score of 2.50. Hence, this shows that sand harvesting has very strong impact on both the environment and socio-economic of the inhabitants of Lafia town. This found in similar studies by Mbaiwa (2008) and Mbaka & Rono (2022).

Ranking of the analysis responses of the negative impact of sand harvesting in Table 4 indicates that land devastation ranked 1st as the main of sand harvesting on Lafia urban area. The respondents also ranked road destruction as 2nd while loss of vegetation, Pollution cost by dust and land alteration as the 3rd, 4th and 5th impact respectively and others follow. The study also revealed the positive impact of sand harvesting which ranked growth of building activities as 1st main he main of sand harvesting on Lafia urban area. The respondents also ranked provide source of livelihood, and road construction which ranked 2nd and 3rd order of the major impact of sand harvesting on Lafia urban area.

Hypothesis 1: Sand harvesting has no statistical significantly environmental and socio- economic impacts on Lafia urban area.

Table 4: Chi-square (χ2) Analysis on the environmental and socio-economic impact of sand harvesting

No of items	Response/Score					
	1	**2**	**3**	**4**	**5**	Total
Increase social vices	3(3%)	24(24%)	26(26%)	30(31%)	15(15%)	98(100%)
Increase insecurity	8 (8%)	25(25%)	34(35%)	14(14%)	17(17%)	98(100%)
Depreciation of land Value	15(15%)	2(2%)	15(15%)	48(49%)	20(20%)	98(100%)
Land conflicts	3(3%)	4(4%)	16(16%)	54(55%)	19(19%)	98(100%)
Land degradation (pits/ditches/gully)	4(4%)	6(6%)	9(9%)	58(59%)	18(18%)	98(100%)
Soil erosion	2(2%)	3(3%)	15(15%)	43(44%)	39(40%)	98(100%)
Loss of vegetative cover	4(4%)	5(5%)	10(10%)	54(55%)	27(27%)	98(100%)
Loss of farm land	9(9%)	8(8%)	14(14%)	49(50%)	20(20%)	98(100%)
Breeding place for snakes and other dangerous reptiles	7(7%)	10(10%)	10(10%)	49(50%)	22(22%)	98(100%)
Pollution cost by dust	3(3%)	6(6%)	9(9%)	57(58%)	23(23%)	98(100%)
Land alteration	2(2%)	4(4%)	18(18%)	52(53%)	15(15%)	98(100%)
River Bed Degradation	3(3%)	1(1%)	19(19%)	51(52%)	22(22%)	98(100%)
Destruction of aquatic life	6(6%)	12(12%)	2(2%)	32(33%)	43(44%)	98(100%)
Loss of aesthetics landscape beauty	10(10%)	7(7%)	8(8%)	55(56%)	20(20%)	98(100%)
Road destruction	2(2%)	6(6%)	13(13%)	51(52%)	23(23%)	98(100%)
Destruction of infrastructural facilities	6(6%)	15(15%)	14(14%)	36(37%)	29(29%)	98(100%)
Cracks on Buildings walls (Truck Movement)	7(7%)	3(3%)	16(16%)	57(58%)	17(17%)	98(100%)
It provide source of livelihood	2(2%)	2(2%)	8(8%)	46(47%)	44(45%)	98(100%)
It provide employment	2(2%)	3(3%)	4(4%)	49(50%)	42(43%)	98(100%)
Reduce crime rate due to unemployment	2(2%)	2(2%)	6(6%)	52(53%)	38(39%)	98(100%)
It will generate revenue for government	2(2%)	2(2%)	7(7%)	47(48%)	42(43%)	98(100%)
Pits/Ditches provide source of	1(1%)	6(6%)	5(5%)	63(64%)	25(25%)	98(100%)

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water for animals

	SD	D	U	A	SA	Total
Prevent flood by emptying the stream bed	3(3%)	5(5%)	15(15%)	48(49%)	29(29%)	98(100%)
Filling Roads	3(3%)	2(2%)	7(7%)	51(52%)	39(40%)	98(100%)
Road construction	2(2%)	2(2%)	4(4%)	54(55%)	40(41%)	98(100%)
Growth of Building activities	2(2%)	3(3%)	3(3%)	43(44%)	51(52%)	98(100%)

Pearson Chi-Square (χ2) = 11.647   **p-value = 0.057**

Likelihood Ratio = 10.907   **p-value = 0.053**

d.f =28, N = 444

SD= Strongly Disagree, D= Disagree, U= Undecided, A= Agree, SA= Strongly Agree

Source: Author's Analysis, 2024

Result in Table 4 revealed that the Pearson Chi-Square (χ2) of 11.647 and likelihood ratio of 10.907 are both statistically significant ($p<0.05$). Hence, the null hypothesis was accepted. This indicated that there are environmental and socio-economic impacts of sand harvesting in Lafia urban area. This result is in line with the findings of Osei (2016); Tesi *et al*. (2018); Zamanifard *et al*. (2019); Okereke & Eze (2020) and Ohaeri *et al*. (2021) that there are environmental and socio-economic impacts of sand harvesting in urban areas. In a similar vein, Mutisya (2013); Mngeni *et al.* (2016); Mohammed (2017) in their findings noted that there are environmental and socio-economic impacts of sand harvesting but not at high scale.

Hypothesis 2: The positive impacts of sand harvesting do no statistically differ more than negative impacts in Lafia urban area.

In this hypothesis, Chi-Square was used in testing the null hypothesis (H_0) which states that: The positive impacts of sand harvesting do no statistically differ more than negative impacts in Lafia urban area.

Table 5: Chi-square (χ2) Analysis on the different between negative impacts and the positive impacts in Lafia urban area

N	Degree of freedom	X² calculated	X² table critical	Alpha level	Result	Decision
98	24	56.203	32.711	0.05	Significant	Rejected

Source: Author work, 2021.

Table 5 reveals that the calculated Chi-Square (χ2) value was 56.203 and the table Chi-Square (χ2) value of 32.711 are both statistically significant (p<0.05) at 24 degree of freedom. Since the calculated Chi-Square (χ2) value of 56.203 was greater than the critical Chi-Square (χ2) value of 32.711, the null hypothesis was rejected and accepts the alternative hypothesis (H$_{1)}$) which states that the positive impacts of sand harvesting do no statistically differ more than negative impacts in Lafia urban area.

This indicated that there is significant difference between positive impacts and the negative impacts in Lafia urban area. This invariably explains that there are more positive impacts of sand harvesting than the negative impacts in Lafia urban area.

Generally, sand harvesting has impacts on the environment. This study revealed that there are more positive impacts of sand harvesting than the negative impacts in Lafia urban area. This contradicts the studies of Osei (2013) and Erastus (2017) that the practice of sand harvesting in the county, kenya had so many negative impacts to the environment that any positive impacts would be outweighed. These include soil erosion and landslides caused by irresponsible scooping methods degraded the environment and flew in the face of sustainable development, spread of diseases, and loss of vegetation cover, insecurity, lack of water, loss of arable land, school dropout, noise pollution and drug abuse.

6.0 DISCUSSION OF FINDINGS

The gender of the respondents is mainly men and this can probably be attributed to the fact that sand mining activities are typically undertaken by men (Bosco & Sumani, 2019). The age of most respondents was below 35 years. This implies that sand mining activities are typically undertaken by the youthful adults and similar findings have been reported by other studies (e.g., Bosco & Sumani, 2019; Dawson, 2021).

Engagement in sand mining activities can probably be attributed to the need for quick money to cater for the needs of the relatively large families. The finding to attested to the study of Arwa (2013) assessed the existing governance structures in sand mining in Masinga, Kenya, and found that sand harvesting is primarily carried out by men and that women are mainly involved in businesses such as

selling of food to the miners. The study also found that the promise of quick money is attracting more male adults to the sand pits. Most of the respondents (90.4%) indicated that sand harvesting had led to social issues whereas fewer respondents (9.6%) did not associate sand harvesting with social issues. Sand harvesting was mainly associated with social issues such as drug and substance abuse, school dropout, and criminal activities. Sand harvesting has a lot of negative consequences on the landscape and most (87.8%) of the respondents indicated that sand harvesting had affected the value of land in the area. On the other hand, fewer respondents (12.2%) indicated that sand harvesting did not have an impact on the value of land in the area.

Most of the respondents (56.6%) indicated that sand harvesting had led to improved livelihoods whereas 43.4% indicated that sand harvesting had not led to improvement of livelihoods.

Other social problems associated with sand harvesting include insecurity and deaths caused by conflicts (Gathogo, 2020; Musyoka & Nalugala, 2022). Despite the negative social effects, sand harvesting is an important economic activity which provides jobs for the local communities and contributes to national development. Sand harvesting may also lead to the establishment of new businesses in an area and lead to improved livelihoods.

However, it may have negative effects such as reduced value of land due to environmental factors associated with sand harvesting. Sand harvesting has various impacts on the environment and one of the impacts is land degradation. Most of the respondents (30%) indicated that sand harvesting had led to land degradation. Other impacts that were mentioned by the respondents include soil erosion (18.75%), channel widening (12.5%), water pollution (7.5%), loss of landscape aesthetics value (6.25%), deep gullies (6.25%), and deforestation (6.25%). Fewer respondents indicated that sand mining caused air pollution (3.75%), loss of biodiversity (2.50%), and drying of wells (1.25%).

This study is in line with Idris-Nda *et al*. (2018) which reported that sand harvesting lead to land degradation, erosion, and pollution of soil and water. Sand harvesting can also affect agricultural production in an area by causing water scarcity, through reduction in surface, and ground water levels (Rentier & Commeraat, 2022). Conversion of farm lands into sand harvesting sites, trampling by heavy vehicles, soil erosion, and pollution can also have adverse effects on agricultural production.

7.0 CONCLUSION AND RECOMMENDATIONS

The study has critically looked at sand harvesting, identifies the locations of sand harvesting in Lafia, the study area, investigated the impact of sand harvesting on the study area and also assessed the environmental and socio-economic impact of sand harvesting on Lafia town. Therefore, the following recommendations are proffered.

1. Planting of trees that could hold the sold together such that the activities of especially illegal sand mining could be curtail.

2. Sand filling land areas were sand harvesting is no longer in practice to avoid breeding places for snake and dangerous reptiles.

3. To put punitive measures to all defaulters of best practice of sand harvesting in the study areas. The persons responsible for the irreversible damage caused to the environment must be made to pay for retrieving the loss of natural resources.

4. There should be a strong and clear policy in place to ensure that the harvesting is done in a sustainable manner. This will mean the small scale sand harvesters will have their sand mining activities done by registered and licensed miners and the owners of the lands used for harvesting will have to get permits allowing their lands to be mined for sand.

5. There should be in place proper restoration plan for decommissioned mining sites, alternate mining sites to reduce pressures and challenges associated with continuous uncontrolled sand extraction in the study area.

6. Rehabilitation after mining is highly recommended and should be one of the conditions for issuing sand mining certificates.

Other mitigating measures can be applied to prevent or minimize potential damage to the environment.

i. Selection of the best sand mining areas: A well-known mitigating measure applied at various locations around the world is selecting sand mining areas, which will cause the least environmental damage.

ii. Efficient surface mining: This is a very important mitigating measure for surface mining, sand mining is allowed up to a maximum of 5m depth. By harvesting sand in long stretches with a depth of 2m or pits, the damage to communities can be reduced by more than 80%.

iii. Restoration and reclamation: The various levels of government should ensure formulation, monitoring and enforcement of land reclamation bylaws. Sensitization and awareness creation should be integrated in land reclamation bylaws to ensure that people are aware of what is involved in sand mining and what mitigation measures are required. Involvement of chiefs, land owners and other key persons in communities is very important in the reclamation process.

iv. Illegal sand mining: Illegal mining activities were a great concern as the damage to the environment was extensive. There should be regulations on illegal sand mining in the state. Sand harvesters only mine the sand and leave the environment devastated. The state

government should issue sand mining permits in private lands and register operators that will

pay revenue for restoration.

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