



**LIVELIHOOD IMPLICATION OF ARTISANAL MINING ON HERDERS IN JEMA'A AND SANGA LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA**

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**ABSTRACT:** *This study assessed the livelihood implication of artisanal mining on herders in Jema'a and Sanga local government areas of Kaduna state, Nigeria, with a view to providing information for sustainable living. Data for this study was collected through questionnaire survey, in-depth interview and direct field observation. The result showed that herders are involved in artisanal mining due to economic hardship/poverty, quick/high income generation from mining, supplementing income generated from other sources, lack of livestock, availability of minerals, high level of insecurity and Covid-19 lockdown. The result also indicated that artisanal mining increases asset acquisition, empowerment and provision of job to herders, leads to new income generating opportunities, and increase in income due to high demand for animal products, but diminishes available land for grazing, forces herders to relocate to new areas, causes competition for natural resources, lures their younger ones away from herding, prostitution, armed robbery and kidnapping, loss of livestock, pollution of domestic water sources and loss of young herders. It is therefore important that adequate training be given to herders on modern methods of livestock keeping to discourage them from involving in mining of minerals. In order to reduce their vulnerability to mining of minerals, it is also recommended that government and private sectors should work towards reducing poverty and unemployment to all kinds of persons across the country.*

**KEYWORDS:** Livelihood, Artisanal mining, Livestock, Herders, Basic needs.



## INTRODUCTION

Mining of minerals serves as both a means of survival for impoverished households and as an engine for small business growth and agricultural expansion, complementing national micro, small and medium size enterprise projects (Wilson et al., 2015). But extraction of minerals such as gold, tantalum, sapphire, tin and columbite has serious impact on the environment and socio-economic lives of the people and communities involved directly or indirectly in the mining activity (Amakwah & Anim-Sackey, 2004; Hilson, 2002). Some of the environmental problems associated with mining of minerals are soil erosion, loss of soil fertility and decline in biodiversity and pollution, among others (Xuejiao et al., 2019).

There are different livelihood activities that households in the rural areas engage in to meet their daily needs (Chambers & Conway, 1992). These activities include cultivation, herding, hunting, gathering, and reciprocal or wage labor, trading and hawking, artisanal work such as weaving and carving, processing, providing services in transport to fetching and carrying (Danquah et al., 2017). Artisanal mining represents a significant livelihood and source of income for rural communities and poverty-driven populations in the world (Ulrike et al., 2012). For example, Oliveri (2019) noted that some 20 to 30 million people are employed by artisanal mining across the world. Also, between 10 to 50 percent of women constitute artisanal mining in different countries (World Bank, 2016). They take artisanal mining as a livelihood opportunity that enables them to generate income for their families.

Artisanal mining adds value as part of rural livelihood diversification strategies for people (Arthur et al., 2016). In sub-Saharan Africa, artisanal mining provides direct employment and cash income to tens of millions of people, and has created innumerable economic opportunities for many millions more in the downstream industries it has spawned (World Bank, 2013; Arthur et al., 2016). In Nigeria, this activity provides livelihood opportunities for people (Bansah et al., 2018). But its operation is associated with many negative externalities, such as environmental degradation, crime and health hazards (Ango et al., 2019). One tragic example is the 2010 lead poisoning outbreak in Nigeria's northwestern Zamfara State, which affected thousands and led to the death of nearly 400 children (Ango et al., 2019). That is why Danquah et al. (2017) pointed out that livelihood resources are exposed to the detrimental impact of mining and its activities, hence making it difficult for livelihood outcomes to be achieved by rural households.

Herding is the main livelihood occupation of herders across the world. But artisanal mining has had a serious effect on this occupation. There are high numbers of herders that have been employed and are still seeking employment in artisanal mining in developing countries of the world to support their families. This livelihood activity (artisanal mining) affects their traditional livelihood occupation of rearing livestock (World Bank, 2009). For example, World Bank (2009) noted that mining affects herders livelihood in different ways, such as the relocation of herders to new areas, increase in income for herders as the demand for animal products increases and new markets open, relocation of herders to new areas, decrease in income and threat of chronic impoverishment for herders unable to adapt to new grazing areas or access to new income-generating opportunities and competition for natural resources (water, grazing land) which may lead to conflict.

Kaduna state is blessed with different kinds of minerals distributed across the 23 local government areas (Kareem & Owao, 2000; Adekoya, 2003; Yunana & Banta, 2014;



Gadzama, 2015). These minerals include tin, tantalite, sapphire, gold and nickel which attract mineral extraction. This sector employs individuals across different ethnic nationalities including herders in the state and the country at large. This activity has had a serious effect on the livelihood of herders by providing income and employment opportunities to them and affecting the environmental resources such as degradation of water bodies, vegetation and land across the study area. There are a number of studies which have been carried out in Jema'a local government of Kaduna state on mining of minerals. These studies include environmental, health and socioeconomic implications of mining (Kareem & Owao, 2000; Malo, 2010; Ajibuah, 2012; Waziri, 2014), application and utilization of clay minerals (Adelabu, 2012), artisanal quarries (Salawu & Sadiq, 2020), and other study includes effect of participation in artisanal and small-scale mining on output, income and standard of living of farmers in Kaduna state. However, these studies failed to look at the livelihood implication of mining activity on herders in the study area. As such, this study looks at the livelihood implication of artisanal mining on herders in Jema'a local government area of Kaduna state, Nigeria, with a view to providing information for sustainable utilization of natural resources.

## **MATERIALS AND METHODS**

### **Study Area**

Jema'a and Sanga local governments are found in Southern Kaduna between latitudes (9° 15' 00" to 9° 22' 58"N and longitudes 8° 16' 5" to 8° 26' 60" east of the Greenwich Meridian (Figure 1). The local governments shared boundaries with Zangon-Kataf and Jaba local governments to the north, Nasarawa State to the West and South and Kaura local government and Plateau state to the East. The population is culturally diverse with differences in religion, ethnicity, traditions and social norms. They are predominantly Christians of a variety of ethnic groups, such as the Nindem, Ninkyop, Gwong, Kanufi, Numana, Ninzo and Nandu. The dominant economic activities are farming, mining and commerce, livestock keeping and hunting.

### **Type and Sources of Data**

The primary data for this study was sourced through the questionnaire survey, in-depth interview and direct field observation. The target population for the study includes participating and non-participating herders who live in the mining communities of Jema'a and Sanga local government areas. It also involves their leaders (Ardos) across the mining communities of the study area. The questionnaire consisted of close and open ended questions. The documentary source was obtained from journals, unpublished dissertations and theses.

### **Sampling Technique**

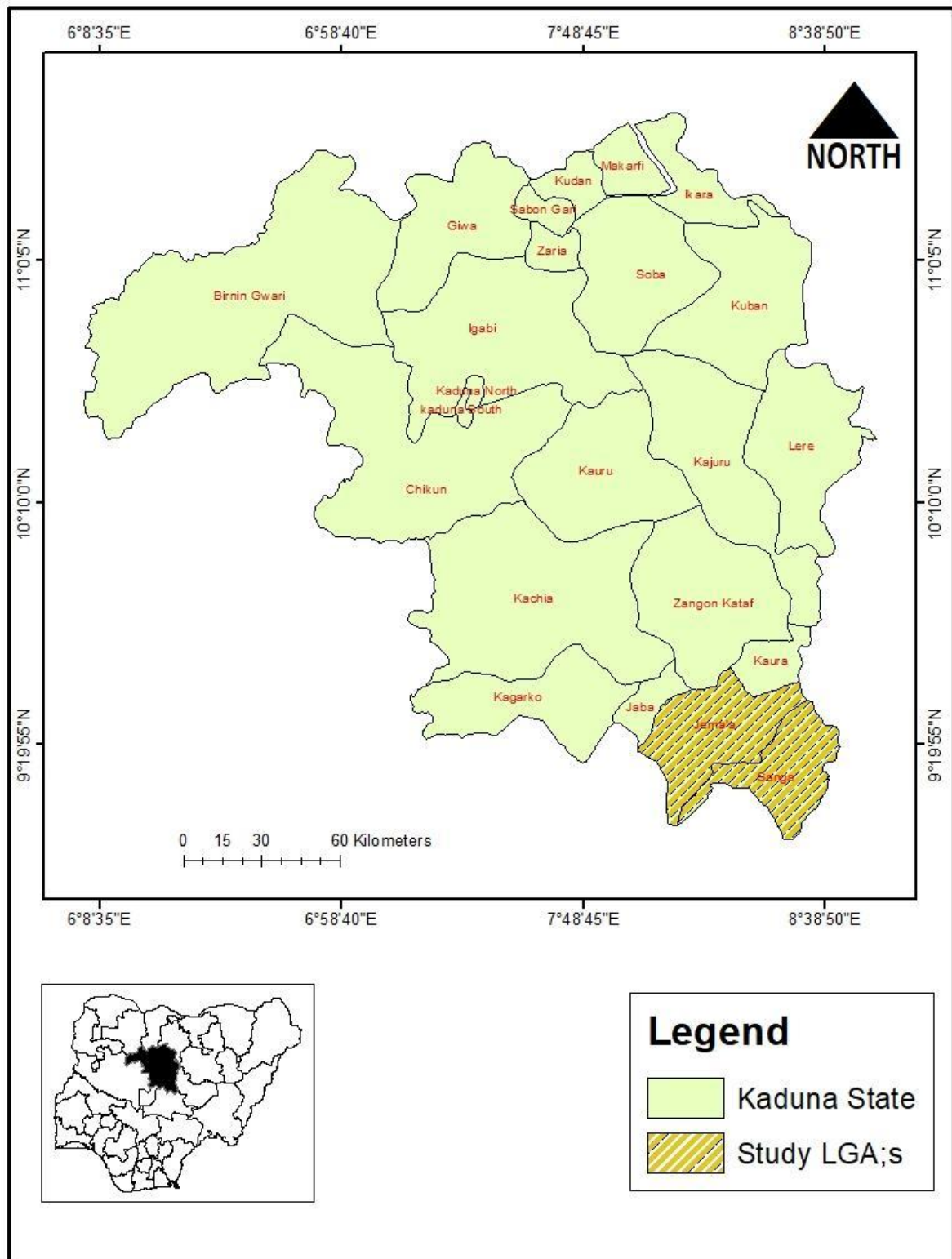
A field survey was carried out in the study area to obtain the primary data for the study. The study area has two local governments that include Sanga and Jema'a. Only mining communities in these local governments were identified and selected for the study. They include Zankan-Nindem, Godogodo, Gidan Waya, Antang and Nisama in Jema'a local government, and Tayu, Agamati, Tari, Ankara and Angwan-Nungu in Sanga local government. Self administered questionnaire was carried out across the study area using a



convenient/accidental sampling procedure. Convenient/accident sampling was used to administer the questionnaire among herders because most of them are not stable. As such, the researcher used the most available ones among them to conduct the study. In-depth interview was done with Ardos who are their leaders. Direct field observation was also carried out in the mining sites to have first hand information on the implication of artisanal mining on livelihood of herders across the study communities. The in-depth interview and direct field observation were carried out in order to complement the result obtained from the questionnaire survey.

## **DATA ANALYSIS**

The data obtained from the field survey were in two categories: qualitative and quantitative data. The quantitative data collected through the questionnaire were analyzed using descriptive statistics such as, tables, mean and percentage; while the qualitative data obtained through in-depth interview was subjected into transcription and represented in narrative format to further strengthen the quantitative data.



**Figure 1: Kaduna state showing the study area**

*Source: Cartography Lab. Department of Geography BUK (2022)*



## RESULTS AND DISCUSSION

This section presents and discusses the results obtained from the field survey through direct questionnaire interview administration and in-depth interview on artisanal mining in Jema'a and Sanga local government areas.

### Demographic Characteristics of the Respondents

The study shows that 33.3% of the study population were people who combined farming and mining work as their occupation, 54.2% farmers, 9.2% traders, and 3.3% civil servants. Though some of them claimed not to be farmers, they also engaged in keeping livestock like poultry and cultivation of cash crops around their homes like potatoes to generate income for the family. About 73% were males while 27% females. 63% are married; 37%, single; and 9% fall below 20 years; 10% fall between 20-29 years; 36% fall between 30 to 39 years; 18% fall between the age of 40 to 49 years and 18% also fall between 50-59 years, while 9% fall between the age of 60 years and above. In terms of education, 36% have had primary education; 21%, secondary education; and 10%, tertiary education while 33% have had Quranic education.

### Factors Responsible for Artisanal Mining among Herders in Jema'a and Sanga LGA's

There are different factors responsible for involvement of herders in artisanal mining in Jema'a and Sanga local government areas of Kaduna state. They include economic hardship/poverty, quick/high income generation from mining, loss of livestock, availability of minerals and high level of insecurity (Table 1).

**Table1: Factors Responsible for Artisanal Mining among Herders in Jema'a and Sanga LGA's**

S/N	Item	SA	A	UD	D	SD	Mean	Remark
6	Economic hardship/poverty	60	34	0	17	9	3.74	Agreed
7	Low income earning in agriculture	20	34	0	35	31	2.80	Disagreed
8	Quick/high income generation from mining	44	70	0	3	2	4.23	Agreed
9	Supplementing income generated from other sources	40	76	0	0	4	4.23	Agreed
10	Lack of livestock	80	33	0	2	5	4.50	Agreed
11	Availability of minerals	76	43	0	1	0	4.62	Agreed
12	High level of insecurity	45	57	0	7	11	3.99	Agreed
13	Lack of job satisfaction	56	48	0	10	6	4.15	Agreed
14	Covid-19 lockdown	61	47	0	8	4	4.27	Agreed
	Grand Mean						4.06	Agreed

Table 1 shows the mean score of factors responsible for artisanal mining among herders in Jema'a and Sanga local government areas of Kaduna state, Nigeria. From the table, it was indicated that the mean scores for item 6-14 are 3.74, 2.80, 4.23, 4.23, 4.50, 4.62, 3.99, 4.15 and 4.27 respectively, which are above 3.00, the benchmark for acceptance. Only low income earning in agriculture that had a mean score of 2.80 was below the benchmark for acceptance. This means that there are different factors that are responsible for artisanal mining among



herders in Jema'a and Sanga local government areas of Kaduna state, Nigeria. The grand mean of all items in Table 1 is 4.06, indicating agreement.

The result shows that economic hardship/poverty is a motivating factor that compels herders to engage in artisanal mining in the study area (Table 1). Many people face serious hardship in Nigeria due to government policies such as closure of borders to prevent importations of goods into the country and other factors like insecurity. This has increased the prices of many commodities in the markets across the country affecting many families. Herders are not exceptional on the problem of hardship facing households in Nigeria. They move with their livestock from one place to another without much attention on crop production to feed their families and also sell parts to generate income. This makes them sell their livestock everyday to solve their family needs of food supply, clothes and payment of medical bills. The continuous sales of livestock to solve family needs have prompted some of them to become involved in artisanal mining in order to save their livestock. Level of poverty increases everyday among different people in Nigeria. Involvement of some of the herders in artisanal mining has helped them to solve some of their family needs such as purchasing of food, clothes and settlement of hospital bills. This was well illustrated by one of their leader:

*In fact, there is serious hardship in Nigeria. A lot of our people are suffering because of the way this government does things. Look at the cost of food items in the market. They are very high. We also sell our livestock at higher prices but when we go to market to buy food items, the money cannot buy enough food for us to feed the family and our people cannot continue to sell their livestock every day in order to feed the family. This has made them involved in mining of minerals.*

Result of this study supports Arthur et al. (2016) which noted that the economic hardship/poverty situation of people in rural communities in the mining regions compels people to get involved in artisanal mining.

The result also shows that low income earning in agriculture is not a motivating factor for herders to involve in artisanal mining in Jema'a and Sanga local governments as the mean score of the respondents was 2.80, meaning they disagreed. They disagreed that income earned in agriculture in recent years is not low due to high prices of agricultural produce across the country. Prices of agricultural produce are higher in Nigeria due to closure of borders by the Federal Government of Nigeria which prevents the importation of food items and other commodities into the country. Though, there is corresponding increase in the prices of farm input such as fertilizer, herbicides and insecticides, yet farmers still benefit a lot from agriculture due to high prices of the produce. Some of the herders don't depend solely on rearing livestock and agriculture for their living, but adopted artisanal mining as one of their livelihood strategies to earn a living. This is because areas where they keep their livestock during the dry season are converted for crop production during the rainy season which leads to increased yield in crop production due to the presence of animal dropping. Result of this work disagreed with Arthur et al. (2016) which noted that low income earnings in agriculture is responsible for artisanal mining in the rural communities of Ghana and Ellis (1999), who reported that farming on its own is increasingly unable to provide a sufficient means of survival in rural areas.



The result of the study indicates that quick/high income generation in artisanal mining has motivated herders to use their efforts and engage in artisanal mining (Table 1). People engaged in mining of minerals due to quick or high income generated from such activity. Today, there are a lot of herders who have had the opportunity to get huge amounts of money due to their engagement in mining of minerals in Jema'a and Sanga local government areas of Kaduna state. Some of them were attracted by the high earnings or quick cash people generate from mining of the minerals to engage in such activity. Though the risk of involvement in such activity is very high, they still consider it to be a livelihood activity that may support them and their families, especially the poor families among them. Apart from involvement in mining, they are also involved in other activities that allow them to get quick cash such as purchasing and selling of the minerals which has given the opportunity to accumulate a lot of wealth instead of selling their livestock everyday to earn a living. This is well illustrated by a leader at Gidan Waya:

*Quick cash or high income generated from mining of minerals has attracted our children a lot in mining of minerals. Though, this activity is very risky, yet they are still involved to earn a living, especially the poor families who don't have livestock. Some of them also engaged in buying and selling of the minerals which also gives them the opportunity to generate more money for their families.*

Miners can earn higher incomes in artisanal mining than through other traditional activities (Villegas et al., 2012). They use artisanal mining as a medium to generate income to solve their family needs of food and clothes.

The result reveals that herders get involved in artisanal mining to supplement income generated from other sources as the mean score of the respondents was 4.23 (Table 1). People have different sources of income they depend on, such as farming, fishing, hunting and marketing. Artisanal mining serves as a means of income generation to support other livelihood sources for herders in Jema'a and Sanga local governments. There is a high number of herders who are involved in crop production in the study area. As such, they use their earnings in artisanal mining to supply farm inputs such as fertilizer, herbicides and insecticides to support their crop production. Some of them also use their earnings in artisanal mining to support their livestock by buying more animals to increase their number or supply potash and medicine for the livestock. This has reduced the rate at which they sell their livestock to settle their needs. This supports previous studies (Arthur et al., 2016; IGF, 2018) which revealed that many families in Ghana turn to artisanal mining to supplement their farm earnings and invest in farming and farm inputs. Artisanal mining is a livelihood strategy that has supported a lot of herders to do their businesses in Jema'a and Sanga local government areas of Kaduna state, Nigeria.

The study also indicates that lack of livestock amongst herders is responsible for their involvement in artisanal mining in Jema'a and Sanga local government areas of Kaduna state (Table 1). Herding which is their main source of livelihood across the country is suffering due to mismanagement of these resources. This work is in line with Zankan et al. (2020) who reported that keeping of livestock serves as the main source of livelihood for herders in the world. Many families in the study area mismanaged their livestock by selling them to earn





income without minding the fact that these animals were depleting and as a result losing them in totality. Some of them lost their livestock to different kinds of diseases which also affected their children who grew up without inheriting any animal from their parents. Some of those who lost their livestock or did not inherit any animal from their parents end-up gaining employment in artisanal mining. They engaged in mining of minerals to meet their basic needs of food, clothes and medical bills.

Availability of minerals in a place attracts mining as more people, especially miners, go there to mine the minerals. The study reveals that availability of mineral deposit in the study area has motivated herders to get involved in artisanal mining (Table 1). The study area is characterised by different kinds of minerals such as tin, tantalite, sapphire and mica. This has attracted a lot of people in Nigeria including herders who trooped into this region to mine the minerals and also sell other products. Mining of minerals has become a livelihood strategy that has supported many families among the herders and other ethnic nationalities in the rural communities of Jema'a and Sanga local governments like Godo-Godo, Gidan Waya, Nisama and Zankan-Nindem. There are a lot of minerals of high economic value that still remain untapped like nickel and gold in Nindem forest around Dangoma, Bakin Kogi and Kogo-Nindem. These minerals have attracted multinational companies but have not been fully harnessed. These minerals are mined at artisanal basis by households in the study area which also gives herders the opportunity to involve in such activity to achieve their livelihood target of food, shelter and settling medical bills.

The result also shows that high levels of insecurity together with loss of livestock has compelled herders to get involved in artisanal mining in Jema'a and Sanga local government areas of Kaduna state (Table 1). Herding is the main occupation for herders across the world. There are a lot of herders in Nigeria who have lost their livestock due to different factors like conflicts or banditry, diseases and natural disasters (floods, drought, thunderstorm and lightning). Herding, the main source of livelihood for herders, is suffering in Jema'a and Sanga local government areas of Kaduna state and Nigeria today due to insecurity. For example, there are a number of herders who have lost their livestock due to insecurity that affected the country like herders-farmers crises, banditry and other forms of problems. During most of these conflicts, livestock are killed as a result of crops damaged by herders or when communities are attacked by herders. This has forced some of them to engage in artisanal mining to solve their family needs. Hundreds of livestock have been killed in reprisal attacks in the study area as well as other parts of the country by farmers or lost to bandits who snatched them away from their owners. For example, about 49 cattle were killed at Gada Biyu of Jema'a local government in the year 2016 by farmers in a reprisal attack caused by Fulani herdsmen who attacked Ninteh Community. Banditry is also another form of problem that affects the country. Bandits have snatched a lot of livestock away from herders in the study area and then moved them to other parts of the country for sale or converted them to be their personal properties. For example, in the Zankan-Nindem and Dangoma communities of Jema'a local government, bandits took advantage of the 2016 crisis to snatch livestock away from their owners. This caused serious problems to these families, increasing poverty amongst them as such, forcing them to get involved in mining of minerals and other livelihood activities like driving, farming and trading to earn a living.



In Nigeria, the level of job satisfaction among the populace is very low which makes people change from one job everyday to another. The result of the study reveals that lack of job satisfaction among herders is responsible for their involvement in artisanal mining in Jema'a and Sanga local governments (Table 1). Herders are attracted by the quick cash they get from artisanal mining since herding has to undergo a long process due to the fact that herder has to rear an animal for many years before selling it to get money/income. Involvement of herders in artisanal mining helps them to reduce the selling of livestock to get cash for their family needs. Some of them have realized that moving cattle from one place to another alone cannot give them what they want. As such, they engaged in other livelihood activities such as mining of minerals, farming and trading in different commodities to achieve their livelihood targets. They picked employment in artisanal mining because it is an activity that generates a lot of income to miners. There are high numbers of herders in Godo-Godo and Gidan Waya that have made mining to be their main source of livelihood. They abandoned their traditional herding occupation due to different reasons and picked employment in artisanal mining. Most of them are moving from one mining area to another. They even travel to other states of the federation and other countries like Cameroon to mine minerals. This agrees with the previous studies of Arthur et al. (2016) and Bansah et al. (2018) which revealed that artisanal mining provides direct employment opportunities to people as engineers, chisel men, processors, and head porters and indirect employment to people as water sellers, food vendors, taxi drivers, gold dealers/goldsmiths, carpenters, steel benders, and masons to earn income.

The result also shows that Covid-19 pandemic also forced herders to get involved in artisanal mining in Jema'a and Sanga local governments (Table 1). The Covid-19 lockdown and movement restriction imposed by the government of Nigeria caused serious hardship across the country among the citizens. This forced many people in the cities to return to their villages. Most of them quit their jobs in the cities because of this pandemic which forced them to look for the most available livelihood alternative within their area to meet their basic needs of food and payment of medical bills. Herders also faced the same problem because they are part of the Nigeria population that the pandemic affected. The pandemic affected markets for their livestock. They could not take their livestock to the markets due to absence of buyers which affected the supply of food and other things needed for the family. It also affected the treatment and supply of medicine and potash to the livestock and this caused serious problems for the livestock. Because of this, some herders decided to involve themselves in artisanal mining to raise money for the family since there were few buyers of the minerals within the mining communities. Though, prices of minerals also fell during the pandemic due to absence of buyers, but they were getting some little money from the mining activity. Today, many of them have considered such occupation to be a supporting activity for their family. This is because it generates a lot of income for them, which helps them to substitute the selling of livestock to meet their basic needs.



## Effects of Artisanal Mining on Herders Livelihood in Jema'a and Sanga Local Government Areas

This section presents and discusses the effect of artisanal mining on livelihood of herders in Jema'a and Sanga local government areas of Kaduna state, Nigeria. Artisanal mining has a positive effect on herders' livelihood such as increased asset acquisition, empowerment, and provision of jobs to herders. But it also poses negative effects, such as diminishing available land for grazing, forces herders to relocate to new areas, lures young herders away from herding and loss of livestock (Table 2).

**Table 2: Effects of Artisanal Mining on Herders in Jema'a and Sanga LGA's**

S/N	Item	SA	A	UD	D	SD	Mean	Remark
15	Increase asset acquisition to the herders	52	61	0	2	5	4.27	Agreed
16	Increase empowerment to the herders	60	50	0	3	7	4.28	Agreed
17	Provision of job for the herders	76	34	0	6	4	4.43	Agreed
18	Leads to new income generating opportunities	62	53	0	3	2	4.42	Agreed
19	Increase in income due to high demand for animal products	41	73	0	3	3	4.22	Agreed
20	Diminishes available land for grazing	59	54	0	1	6	4.33	Agreed
21	Forces herders to relocate to new areas	57	55	0	6	2	4.33	Agreed
22	Causes competition for natural resources among herders	44	70	0	2	4	4.22	Agreed
23	Lures young herders away from herding occupation	41	66	0	5	8	4.06	Agreed
24	Causes prostitution to the herders	55	46	0	7	12	4.04	Agreed
25	Lures herders into armed robbery and Kidnapping	51	41	0	10	18	3.82	Agreed
26	loss of livestock	65	55	0	0	0	4.54	Agreed
27	Pollution of domestic water sources	44	76	0	0	0	4.36	Agreed
28	loss of young herders	80	30	0	2	1	4.67	Agreed
	Grand Mean						4.29	Agreed

Table 2 shows the mean score of the effects of artisanal mining on the livelihood of herders in Jema'a and Sanga local governments of Kaduna State, Nigeria. From the table, it was indicated that the mean score for item 14-28 are 4.27, 4.28, 4.43, 4.42, 4.22, 4.33, 4.33, 4.22, 4.06, 4.04, 3.82, 4.54, 4.36 and 4.67 respectively, which were above 3.00 the benchmark for acceptance. This means that artisanal mining has an effect on the livelihood of herders across the study area. But it also diminishes available land for grazing, forces herders to relocate to new areas, lures young herders away from herding and loss of livestock. The grand mean of all items in Table 2 is 4.29, indicating agreement. Therefore, artisanal mining has had an effect on herders' livelihood in Jema'a and Sanga local government areas of Kaduna state, Nigeria.

The result shows that artisanal mining increases acquisition of assets among herders in Jema'a and Sanga local government areas of Kaduna State (Table 2). Mining of minerals in the world gives people the opportunity to generate income and as a result acquire different



kinds of assets for their own uses. In Jema'a and Sanga local government areas of Kaduna state, mining of minerals such as tin, tantalite and sapphire has given herders the opportunity to acquire different assets. They acquired assets such as motorcycles, vehicles, generators to power light in their houses and also built houses with their earnings from mining of minerals. Instead of selling their livestock to acquire these assets, they engage in mining of minerals which gives them the opportunity to generate a lot of income for their own uses. Some of them have used the opportunity of mining to increase the number of their livestock. This occurred as a result of their earnings in mining of minerals which are used sometimes for the acquisition of more livestock for the family. Direct field observation for this study shows that a lot of herdsmen are involved in mining of minerals across the two local government areas. And this activity benefits them in different ways such as generating income to buy assets, food and settling other family problems. This work is in line with Arthur et al. (2016) which noted that artisanal mining contributes to livelihood enhancement through income generation and asset acquisition.

The result also shows that mining of minerals increases empowerment of the herders in Jema'a and Sanga local government areas as the mean score is 4.28, indicating agreement (Table 2). Mining of minerals in a place provides an opportunity for people to do different kinds of businesses and as a result, generate a lot of income for their own uses. However, in Jema'a and Sanga local government areas of Kaduna state, mining has empowered a lot of herders to do different kinds of businesses. Some of them engaged in mining of minerals and later became buyers of the minerals and today, they trade in different commodities across the study area. There is a high number of herders that have shops and other businesses in the mining communities of Godo-Godo, Gidan Waya and Agamati where people buy their foodstuffs and other items for their own uses. This occurred as a result of the number of people that moved into these communities for mining which have led to an increase in business opportunities. Mining has also helped many of them to buy more livestock for their families. Instead of relying on these animals to solve their family needs, mining has substituted for that. And this has reduced the rate at which herders sell their livestock in a year across the study area. That is why Arthur et al. (2016) stated further that artisanal mining contributes to the livelihood enhancement through empowerment of people to establish other economic activities.

The result also indicated that artisanal mining provides job opportunities for herders in the mining communities of Jema'a and Sanga local government areas (Table 2). It provides both direct and indirect employment to the herders. It provides direct employment to them in the form of miners, head porters and chisellers, and indirect employment in the form of food and water vendors, transporters and buyers. In the mining communities of Jema'a and Sanga local governments such as Gidan Waya, Godo-Godo and Zankan-Nindem, there are a number of herders who are involved in mining of minerals, supplying food and other items for sale to the mining sites. Others also used the opportunity of the mining to sell other products at home. They also engage in transportation of people to the mining sites and return them home after their daily work with the help of motorcycles and buses. Artisanal mining is a livelihood supporting activity that has employed and supported many households across the mining communities of Jema'a and Sanga local governments. This activity has changed the economic status and standard of living of household as it involves the influx of people into the mining communities which increase prices of accommodation, food and other items needed for their mining work as such, the locals benefit indirectly from the activity through



petty trading (World Bank, 2009; Arondekar & Murthy, 2017). Herders used the presence of the minerals to extract it for their own benefits. Result of this study supports previous study (Nguyen et al., 2018) which revealed that communities with active miners demonstrate improved job development, decreased poverty rates, enhanced infrastructure and social development. But the herder's leaders (Ardo) argued that mining of minerals cannot be the livelihood option for their children. This is because the mining activity has killed a lot of their children due to the collapse of the underground roof. Employment in artisanal mining is very risky, as such those who lost their livestock or those who don't should allow their children to serve their relations to be compensated later instead of involving in mining of minerals. This was well illustrated by their leader at Godogodo:

*Mining of minerals cannot be an option for our children. This is because we have lost a lot of our children as a result of the collapse of mining pits. This activity is very risky and because of this, those who have lost their livestock or do not have should allow their children to serve others in order to receive compensation at the end of their assignment.*

The result also shows that artisanal mining has led to new income generating opportunities for the herders in Jema'a and Sanga local governments (Table 2). Mining gives people the opportunity to transact different kinds of businesses in the mining communities where minerals are extracted. Because of this, mining has given herders a lot of opportunity to transact different businesses in the mining areas. For example, they transact businesses in animal products like milk and fats and other commodities to earn a living (plates 1A & 1B). This activity has led to new income generating opportunities, such as quick cash obtained from the mining of the minerals, selling of animal products like milk and fat, selling of food, water and clothes by the herders. This has given them the opportunity to generate a huge amount of money to meet their basic needs for their families. Artisanal mining generates significant local purchasing power and leads to more demand for locally produced goods and services, such as food, tools, equipment, housing, and infrastructures (Hentschel et al., 2002; Hentschel et al., 2003). There are a lot of them that have been opportuned to generate huge amounts of money from selling of minerals they got from mining and as a result, enables them to buy more livestock for the family. Some of them have used the opportunity of the mining to buy and sell clothes, mining tools and others are the ones that are employed to wash the minerals in the rivers/streams and be compensated at the end of their work. This has enabled them to generate income for the family. That is why the World Bank (2009) reported that the impact of mining development on herder's livelihood includes access to new income-generating opportunities.



(1A)



(1B)

Plate 1A: Researcher interacting with a herder and, Plate 1B, women selling animal products and other food items at Hayin Gada mining site, Gidan Waya.

The result of the study indicates that artisanal mining has led to an increase in income for the herders due to high demand for animal products like milk, fat and meat (Table 2). Increased population in a place also boosts market opportunity for people. This is because it gives people the opportunity to trade in different commodities such as food and water vending, clothes and animal products. Artisanal mining has given herders the opportunity to increase their income as a result of the high influx of people into the mining communities of Jema'a and Sanga local governments like Godo-Godo, Gidan Waya and Agamati as they increase prices of animal products like milk and fat. This study supports the World Bank (2009) which noted that one of the effects of mining on herders is the increase in income as the demand for animal products increases and new markets open. Prices of animals also increase due to high demand for meat in the mining areas by miners and households who get money every day from mining of minerals and other forms of activities in the study area. This is what one of their leaders has to say about this issue:

*Mining of minerals in our communities has given our people the opportunity to get a lot of money from people. As you can see, our people are selling animal products like milk and oil at higher prices. This is as a result of the high demand for these products in the area as too many people troop to this area to mine the minerals.*

That is why the World Bank (2009) and UNDP (n.d.) revealed that artisanal mining provides income generation opportunities and supports the livelihood of many households in different localities where minerals are produced. The selling of animal products like milk and fat has enabled them to reduce the rate at which they sell their livestock to settle their family needs such as provision of food and clothes.



Concerning the effect of mining on grazing land, the result of the study reveals that artisanal mining reduces available land for grazing of livestock among herders (Table 2). Mining of minerals is associated with opening of mining pits and ponds in the mining sites. This affects not only grazing but also agricultural lands. This activity has drastically reduced available land left for grazing in Jema'a and Sanga local government areas of Kaduna state. Mining, whether artisanal, small scale or large scale, affects rural economies because it reduces the availability of grazing land as those areas are increasingly taken up for exploration and exploitation activities (World Bank, 2009). Livestock no longer moves freely in the mining areas of Jema'a and Sanga local governments due to the presence of mining pits which serve as a death trap for livestock or the herder who mistakenly fall in these pits. This work is also in line with World Bank (2009) which reported that as more mineral deposits are tapped for exploration and exploitation and associated infrastructure is developed, the land available for grazing diminishes affecting the livelihood of the herders. Availability of land in non-mining areas enables herders to graze with their livestock freely without any fear of an accident that may occur. But the problem of mining pits and ponds have forced many of them to relocate to new areas that are devoid of mining pits.

The result of the study also shows that mining of minerals has forced herders to relocate to new areas in Jema'a and Sanga local governments (Table 2). Presence of mining in a place leads to destruction of vegetation resources, reduction in available land for grazing and pollution of water sources. Mining also has an undesirable effect on livestock due to mining pits which sometimes forces them to relocate to new areas where there is available vegetation to feed the livestock. They relocate to new areas which may be free of mining pits and have enough vegetation (grasses, shrubs and trees) to feed their livestock. This problem is applicable to mining communities in Jema'a and Sanga local governments where mining of minerals takes place. For example, grazing of livestock doesn't take place at Dankurciya, an area between Godo-Godo and Gidan Waya communities where mining of minerals occurs. This is due to the presence of mining pits and low vegetation caused by mining that has prevented grazing of livestock and forced many herders to relocate to safer areas like Kogo Nindem, Dangwa and Jagindi Tasha. World Bank (2009) reported the impact of mining development on herders' livelihoods to include the relocation of herders to new and safer areas for their livestock and a decrease in income and threat of chronic impoverishment for herders unable to adapt to new grazing areas.

The result of the study also shows that mining has forced herders to compete for the available natural resources among themselves and with the host communities in Jema'a and Sanga local government areas of Kaduna state (Table 2). Mining of minerals reduces available land for grazing and vegetation, and pollutes and contaminates water bodies. This forces herders to relocate to new areas and as a result, causing competition for the available natural resources (land, water and vegetation resources). This also leads to conflict within them and also with the host communities. For example, reduction in land available for grazing of livestock in the mining areas and the corresponding loss in vegetation has caused herders to move to safer areas with their livestock, resulting in destruction of economic trees like mangoes, oranges, locust bean and mahogany. This has led to conflict among them or with the host communities. Example of this is the crisis between herders and farmers in Kagoro communities which occurred as a result of cutting down of mango trees by the herders which led to the killing of a Kagoro woman. This crisis led to destruction of livestock, homes, lives and properties worth millions of naira. This occurred as a result of herders who relocated



from mining communities like Gidan Waya and Godo-Godo to Kagoro area which was free of mining pits but resulted in such conflict. Herders also fight with one another due to limited natural resources in the study area. They fight one another where they gather in struggle to control territory to rear their livestock especially when some of the livestock are infected with diseases resulting in killings of one another. This work supports the World Bank (2009) report that mining forces herders to relocate to new areas and as a result causing competition for natural resources (water, grazing land) available that always lead to conflict.

The study revealed that artisanal mining lures young herders away from traditional herding occupation in Jema'a and Sanga local government areas of Kaduna state (Table 2). High income earning in mining motivates young herders to engage in mining of minerals in the study area, resulting in loss of traditional herding occupation by these young people. They have the opportunity to get quick cash in mining rather than relying on their parents for provision which affects their traditional livelihood of rearing animals. World Bank (2009) reported that the expansion of the rural economy may lure the younger generation away from herding and into work in the mines or related business resulting in the loss of culture surrounding traditional herding. Most of them disrespect their parents as they mingled with other people with different cultural backgrounds in order to mine minerals. This problem has necessitated their parents to employ the services/labor of people from another place to control the livestock in the bush. For example, most of them employ the services of young people from Ganawuri communities of Plateau state and their herders who do not have cattle or have very little livestock to be compensated based on the stipulated number of years agreed with the servant's families. This is causing them to lose their livestock in giving to other people as compensation for the services they rendered to their masters.

The result of the study also indicated that artisanal mining has lured herders into prostitution in the study area (Table 2). In the mining communities of Jema'a and Sanga local governments, herd women sell animal products like milk and fats and other food items to people that engage in mining of minerals at the mining sites and other towns. They are sometimes lured into prostitution as they are carried away by the income generated from the mining of minerals. They mingle with different kinds of human beings, men and women from different cultural backgrounds which get them exposed to different social behaviors that are not acceptable to society. Sometimes, men give them money outside their business of selling the animal products or food items to get compensation later. It is these free monies that take away their attentions and as a result they give their bodies for sexual intercourse with people around. They engage in sex trading in order to buy fashionable things like clothes, jewelleryes and body cream of different varieties. A lot of this problem occurs in the mining communities like Godo-Godo, Gidan Waya, Nisama and Agamati of Jema'a and Sanga local governments. Women are more negatively impacted by their engagement in artisanal mining in their communities (African Mineral Development Centre (AMDC), 2015; GRF, 2016). For example, concentration of a predominantly male population many of whom are away from their families, and a concentration of unemployed female labour speculators create an environment in which commercial sex work and transactional sex thrives (World Bank, 2009; GRF, 2016; World Bank, 2016).

Mining areas are also associated with other social behaviors like armed robbery and kidnapping. The study reveals that artisanal mining has led herders into armed robbery and kidnapping of people in the study area. Different people go into mining with different reasons. Some go to those areas for mining, selling of food items, clothes, while others go to





observe what people have. There are a number of herders in the mining areas who go to observe those who have gotten the minerals and hit huge amounts of money so that they inform their members to snatch the minerals or money away from them. Sometimes they are kidnappers who kidnap the victims and demand for ransom before freeing the victims. Example of this is the case that happened at Gidan Waya where young herders took a trader of the mineral away and when ransom was paid, the victim returned home and noted that those who took him away were herders. This behavior has become rampant among the herders across the country where people are kidnapped everyday on the way, home, farm and offices for ransom to be paid. Some victims end-up dying in the kidnappers' den after receiving ransom. This agrees with Ango et al. (2019) who reported that partly due to its informality, artisanal mining is associated with many negative externalities such as crime and health hazards.

The result also shows that artisanal mining has led to loss of livestock by herders in Jema'a and Sanga local government areas (Table 2). Mining of minerals is associated with the opening of mining pits and ponds. Most of the mining pits and ponds left after mining serve as death traps for livestock especially when they fall inside. There are a number of herders who have lost their livestock (cattle and sheep) in the study area due to mining pits left after mining of minerals. Presence of mining pits in an area does not allow free movement of livestock and people from one place to another. This does not only affect the livestock but including people who control them while in the field for grazing. They fall in these pits and die or get injuries which also cause them to treat such animals or sell them at a cheaper rate. Most of the domestic water sources in the mining areas of Jema'a and Sanga local governments are polluted which also affects the health of livestock and herders. This is what one of their leaders has to say:

*Presence of mining pits in this area is affecting us too much. In fact we are losing our livestock everyday in these pits especially when we employ a new person (servant) who does not know the area very well to work for us. Our rivers are polluted with too much dirty (pollution) caused by the mining activity which makes water unavailable for our livestock because if they drink it, they can be ill.*

This supports previous studies which identified the effect of mining to opening of mining pits which serve as death traps to livestock and breeding ground for mosquitoes making the area prone to malaria (Mallo, 2010; Onwuka et al., 2013; Dibal et al., 2016).

The result indicates that artisanal mining has led to pollution of domestic water sources in Jema'a and Sanga local government (Table 2). Pollution of domestic water sources has an effect on livestock rearing. This is because it makes water unavailable for consumption to both livestock and man. There are just a few places in Nigeria where the government makes water available for the rearing of livestock. Shortage of water is one of the causes of conflict between herders and farmers, especially in the middle belt of the country as herders fight in order to gain access to water sources for their livestock. Mining of minerals is one of the human activities that have affected most of the water sources (rivers and streams) which are used for livestock consumption in Jema'a and Sanga local government areas of Kaduna state. Many livestock have died due to the consumption of polluted water caused by miners or



fishermen who use chemicals to catch fishes during the dry season in the study area. Some of the herders spent a lot of money treating their sick livestock which drank the polluted or contaminated water from streams and rivers in the study area. Polluted water also has an effect on the life of the herders. This is because most of them stay in the bushy areas that are absent of open wells for water consumption which also forces them to consume the polluted water along with their livestock. They rely on polluted water in the streams/rivers for their domestic activities which has serious health effects on their life. This supports the World Health Organization (2016) report that artisanal mining communities often have little or no access to safe drinking water, adequate sanitation or health care. Most of the domestic water sources like Gidan Waya River have been polluted with feces, urine and chemicals from mining of minerals. And there is a high level of siltation which reduces the depth of these rivers and as a result causes scarcity of water for both animals and human consumption. This work also supports previous studies which reported that artisanal mining has wide range of social and environmental problems, such as break down of social structure, degradation of health, air, water and noise pollution, reduction of natural resources, decline in agricultural production, deforestation, and changes in the traditional form of livelihood and displacement of people (Mishra, n.d.; Goswami, 2015; Miserendino et al., 2018) .

Artisanal mining is associated with different risks such as injuries, death and diseases. The study indicates that artisanal mining has led to loss of young herders in Jema'a and Sanga local government areas of Kaduna State. A lot of young herders go into mining of minerals and some of them die or get injured in an underground roof when subsidence occurs. Sometimes they are trapped inside the mining pits which can lead to their death or injuries. Example of this is the incident that happened at Hayin Gada Gidan Waya where a young herder was trapped underground when subsidence occurred which led to his death. Apart from death, they also get injuries through the mining tools they handle during the mining operation such as digger, hammer and shovel or inside the mining pits when roofs collapse underground causing their families to spend a lot of money on treatment of their injured relations. Artisanal mining is a livelihood strategy that has supported many families across the world. But its mode of operation makes people more vulnerable to such activity. This is because when a miner is injured, a lot of money is wasted in treatment of the victim and as a result, the family may end-up in poverty as they sell their assets including livestock to treat their injured victim which may do more harm than good to their families.

### **Strategies Taken by Herders to Cope with the Effect of Mining in Jema'a and Sanga LGAs**

There are a number of strategies taken by herders to cope with the effect of mining in Jema'a and Sanga local governments. These strategies include refilling of mining pits left by miners after mineral extraction to reduce the risk of losing their livestock in those pits and ponds. Here miners go as a union (Miyetti Allah) to refill these pits or they employ the services of other people to do such jobs on their behalf in order to have more areas for livestock grazing. Secondly, livestock are prevented from drinking polluted water from streams and rivers where miners wash their minerals to prevent them from contracting diseases that may lead to death of the animals. Thirdly, they give special treatment immediately to livestock that have consumed polluted water when they return from the field to prevent further deterioration of their life. Fourth, they also made drugs and potash available to improve the healthy condition of the livestock. Fifth, they made feed available for livestock during the period of scarcity (dry season) by purchasing cowpea and guinea corn chaff to avoid over reliance on the



available grasses in the field that may force them to go to areas that are full of mining pits. And finally, they also make contributions and treat their relatives who had injuries due to mining and provide food for their family.

## CONCLUSION

Mining is an activity that poses a serious threat to the environment as well as the life of people, especially in the mining communities of the developing world. Its operation affects other livelihood activities of people around the mining communities such as farming, lumbering and livestock rearing. Participation of herders in artisanal mining in Jema'a and Sanga local government areas of Kaduna state is linked to different factors. This study has indicated that herders are involved in artisanal mining due to economic hardship/poverty, quick/high income earning in mining, lack of livestock and availability of minerals in the area. This activity has had both positive and negative effects on the livelihood of the herders in Jema'a and Sanga local governments as it threatens their lives through loss of livestock and their young people to mining pits, diminishes available land for grazing and forceful migration. It is therefore important that adequate training be given to herders on modern methods of livestock keeping to discourage them from involving in mining of minerals. In order to reduce their vulnerability to mining of minerals, it is also recommended that government and private sectors should work towards reducing poverty and unemployment to all kinds of persons across the country.

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