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Cocoa farmers' choice of alternative livelihood in mining communities in Upper Denkyira West District, Ghana

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Mining and cocoa production are important livelihoods for people in Ghana, particularly in rural communities like Upper Denkyira West District. However, mining activities can have negative impacts on cocoa production and access to basic necessities for the sustenance of the people. This study sought to investigate cocoa farmers' perception of the impact of mining on socio- economic activities in Upper Denkyira West District and the determinants of their choice of alternative livelihoods. A structured questionnaire was used to collect primary data from 211 respondents who were selected via a multi-stage sampling method for the study. The study found that cocoa farming households agree that mining has negative impacts on socio-economic activities in the district. It was also revealed that about two-thirds of the cocoa farming households were engaged in farm-based and nonfarm-based alternative livelihoods, in addition to cocoa farming. Results from the empirical multinomial logistic regression model showed that sex, years of formal education, farm income, technical skills, extension services, and perception that mining have reduced farm sizes, and farm outputs significantly influence cocoa farming households' choice of alternative livelihood. The study recommends the need for policies aimed at promoting skills acquisition and facilitating access to markets for products of alternative livelihoods.

Key words: Mining, cocoa, alternative livelihoods, multinomial logistic regression, Upper Denkyira West District, Ghana.

INTRODUCTION

In Africa, Ghana comes second after South Africa in terms of gold production and the country is also a significant exporter of other minerals such as bauxite, manganese and diamond (Holmes, 2018). There has been an increasing influx of foreign mining firms into Ghana since the Structural Adjustment Programme of the World Bank was introduced into the country in the mid-1980s. This has increased the mining of minerals in the country, which has contributed positively to the economy (Owusu-Ansah and Smardon, 2015). The sector has

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been a major contributor in terms of GDP, with an average contribution of 6.63% from 2010 to 2017, and government revenues including taxes (Ghana Statistical Service (GSS), 2018). Moreover, mining firms have also contributed to the provision of roads, jobs, clinics and other social amenities in mining areas. Small-scale and artisanal mining also offer opportunities for individuals and groups with inadequate resources to engage in mining as a livelihood source. Mining without license, known as 'galamsey', is also an important livelihood source for people without the required equipment (Boateng et al., 2014).

Despite the benefits of mining to the economy, it has negative impacts on the environment, health, agriculture and the society in general. Mining has resulted directly in the removal of vegetation cover, pollution of water bodies, depletion of soils and degradation of lands in mining communities. Some major waterbodies in the country such as the River Offin which passes through Upper Denkyira West District and serve as source of water for irrigating farms and other uses, have been polluted by mining activities (Adjei et al., 2012). Moreover, the six hospitals in Upper Denkyira West District assert that malaria is the most reported health problem in the district. The hospitals recorded about 18,300 cases of malaria in 2009 and 24,700 cases in 2010 alone (Upper Denkyira West District Assembly, 2012). According to Hilson (2001), the open pits left uncovered by the activities of illegal miners serve as breeding grounds for mosquitoes. Boateng et al. (2014) asserted that between 1 and 20 ha range of cocoa lands have been taken over by galamsey activities in several cocoa producing areas in Ghana such as Upper Denkyira West District. About 24,000 acres of forest lands have been taken over by miners in Diaso, the capital city of Upper Denkyira West District alone (Dokosi, 2019). Removal of vegetation cover by mining activities affect the carbon cycle and soil fertility in the district, thereby negatively affecting the productivity of tree crops such as cocoa (David and Mark, 2005).

Mining and agriculture require natural resources for their operations. The two sectors face competition over the use of resources such as land, water and human capital. About 75.29% of rural households are into agriculture (Ministry of Food and Agriculture (MoFA), 2016). This means that agriculture is the main economic activity of rural areas in Ghana. However, the output of agricultural produce such as maize, cowpea, sorghum and cocoa has reduced over the years (MoFA, 2016). For instance, output of cocoa in the country reduced from 1,024,554 metric tonnes in 2010/11 season to 953,566 metric tonnes in the 2014/15 season (MoFA, 2016). According to Bangmarigu and Qineti (2018), Ghana was the leading producer of cocoa in the world for decades until Ivory Coast overtook Ghana in 2013. Mining has been noted to be a major contributor to the reduction of cocoa yields from an estimated 207.25 to 98.03 kg/ha in Ghana (Osei-Bagyina, 2012). According to Essabra-Mensah (2013), illegal miners have encroached between 1 and 2 million hectares of cocoa lands in Ghana. Moreover, contribution of cocoa to GDP has shown a declining trend over the years. According to GSS (2018), cocoa contribution to GDP has reduced from 3.6% in 2011 to 1.8% in 2017. The decline in the output and contribution of cocoa to the economy has been attributed in part to the rampant mining activities in the country.

Mining firms as part of their corporate social responsibilities introduce projects, termed as alternative livelihoods, which are intended to recompense and assist people who have been negatively impacted by their mining operations. These projects are sustainable when they can cope with, and maintain their capabilities and assets, to create opportunities for future generations, and in the short and long run, profit the locality and the world (Krantz, 2001). Unfortunately, expectations of sustainable livelihood activities have not been fully realized in the District and this has led to an active involvement of residents in small-scale mining, especially 'galamsey' (Addah, 2014). Engaging in mining, particularly galamsey, as a source of livelihood is as a result of poverty (Adjei et al., 2012).

As established by several studies that mining, even though contributes positively towards the development of the economy, has several adverse impacts on cocoa production and agriculture, which is the main economic activity of households in Upper Denkyira West District. Hence, cocoa farming households in the district have to engage in alternative livelihoods to augment their basic source of income. This study therefore sought to investigate factors that influence cocoa farmers' choice of alternative livelihoods. Specifically, the study assessed cocoa farming households' perception on the impact of mining on socioeconomic activities in the study area; identified alternative livelihoods of cocoa farming households in the study area; analyzed factors influencing cocoa farmers' choice of alternative livelihoods; and examined constraints faced by cocoa farming households in their alternative livelihoods in the study area. The study hypothesized that cocoa farmers' choice of alternative livelihood is influenced by their socioeconomic characteristics such as sex, formal education, access to credit, farm ownership and their perception of the impact of mining on agriculture.

METHODOLOGY

Description of the study area

Upper Denkyira West District has the lowest population in the Central Region of Ghana with a population of 60,054 (GSS, 2013) (Figure 1). This constitutes about 2.7% of the population of the Region. Furthermore, the district is a rural community (GSS, 2013). The district covers only about 3% of the land area of the region with a size of about 579.21 km^2. Upper Denkyira West District lies within

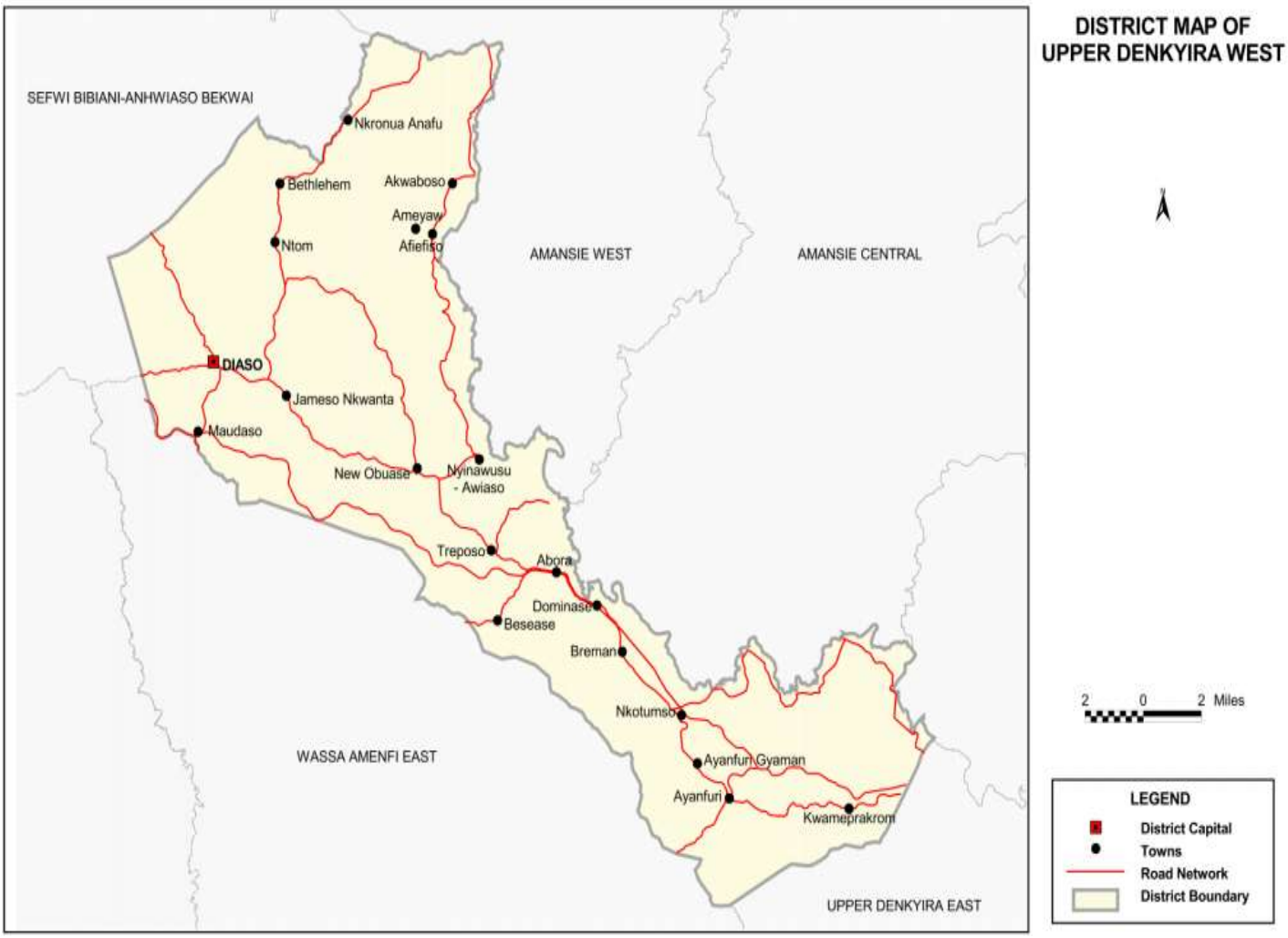

Figure 1. Upper Denkyira West District map.
Source: GSS (2013).

latitudes 5° 30' N and 6° 02' N of the equator and longitudes 1° W and 2° W of the Greenwich Meridian. Furthermore, the district falls within the semi equatorial zone with a mean temperature of 30°C per annum during hot periods and 26°C per annum during the cool periods. Also, the district has two rainy seasons in a year, with a mean rainfall of ranging between 1,200 and 2,000 mm (GSS, 2013).

Its capital is Diaso. The district is rich in minerals resulting in increasing mining activities, both legal and illegal in the area. Cocoa trees occupy about 50% of the total arable lands in the District. Also, about 71% of the workforce in the district is engaged in some form of agricultural activity such as crop farming and livestock rearing. In addition, about 7.9% of the populace are engaged in mining activities either by being employed formally or engaging in galamsey (GSS, 2013).

Population, sample size and sampling technique

The population for this study was 8,372 cocoa farming households (GSS, 2013). A household is defined to be a cocoa farming household, if at least one member in the household engages in cocoa farming. Multi-stage sampling technique was used to select 211 respondents for the study. First, five communities in the district where mining and farming occur simultaneously were chosen purposively. Second, the sample size from each community was determined proportionally based on the total cocoa farming households in the selected communities. Finally, a systematic random sampling technique was applied to select the cocoa farming households from each community. The systematic random sampling was done by selecting every tenth cocoa farming household in a community, starting with the first randomly interviewed cocoa farming household. The number of respondents interviewed from the five communities chosen for this study is shown in Table 1.

The sample size for this study was computed based on the following formula as provided by Yamane (1967):

$$n = \frac{N}{1+N(e^2)} = \frac{8372}{1+8372(0.06^2)} = 269$$

Where n = sample size, N = population size and e = level of

Table 1. Sampled respondents from each community.

Community	Cocoa farming households	Sample size (target)
Diaso	762	58 (73)
Jameso Nkwanta	710	52 (68)
Ayanfuri	647	41 (62)
Agona Portuguese	355	31 (34)
Maudaso	334	29 (32)
Total	2808	211 (269)

precision.

Therefore, the targeted sample size for the study was 269. However, a response rate of 78% representing 211 respondents was achieved during the data collection. According to Fincham (2008), the goal of every researcher is to have a response rate of at least 60% to minimize nonresponse bias. In addition, Perneger et al. (2005) concluded that even though nonresponse bias exists in surveys, it has less influence on the conclusion or outcome of the survey.

Data collection

Primary data and secondary information were used for this study. Secondary information were obtained from various sources including journals, articles, Ghana Statistical Services and Ministry of Food and Agriculture, relevant books and online sources. The secondary information provided information about the study area, relevant literature, and background to this study. Primary data focused on respondents' demographic characteristics, their perceptions on the impact of mining on socioeconomic activities and their alternative livelihoods. A structured questionnaire was used to collect primary data from the respondents.

Data analysis conceptual framework

According to the random utility theory, every individual is a rational decision maker, with the aim of choosing an option which offers the maximum utility from a choice set given some constraints (Loureiro and Umberger, 2007). Maximizing utility from a particular alternative livelihood motivates a household to choose a particular alternative livelihood. The individual assigns to each option among the available options a perceived value and chooses the option with the maximum benefit. The value given to each option is subject to the characteristics of the said alternative and of the individual. Therefore, it is assumed that, the cocoa farmers as rational beings, will choose from the set of alternative livelihood options, one which offers maximum utility, considering the attributes of themselves and that of the option. The utility for an individual *i* to choose option *j* in the available set of options *s, Uijs, is Uijs = Vijs + eijs*; where *Uijs* is the perceived utility the decision maker *i* assigns to each option *j*, *Vijs* is the vector of attributes related to option *j* and to the individual *i,* while *eijs* is the unobserved components of the function including the measurement errors, which are assumed to be independent of *Vijs*.

Empirical model

For this study, the outcome variable was the choice of alternative livelihood for cocoa farmers in the study area. The options were four categories, namely having no alternative livelihood (solely cocoa farming), having only farm-based alternative livelihood, having only nonfarm-based alternative livelihood and having both farm and nonfarm-based alternative livelihoods. Thus, a cocoa farming household has the option of a main alternative livelihood at a time. With the nature of a nominal variable with more than two categories, the multinomial logistic regression was appropriate to determine the factors that influence a cocoa farming household to select a particular alternative livelihood option as against others. The explanatory variables hypothesized to have effect on the dependent variable are presented in Table 2. Specifically, the econometric model for this study was specified as:

$$\mathrm{Yij} = \beta 0 + \beta_1 \mathrm{Age} + \beta_2 \mathrm{Sex} + \beta_3 \mathrm{Mar\_Stat} + \beta_4 \mathrm{Edu\_yrs} + \beta_5 \mathrm{HH\_Size} + \beta_6 \mathrm{Dep\_Ratio} + \beta_7 \mathrm{Tec\_Skills} + \beta_8 \mathrm{Ext\_Serv} + \beta_9 \mathrm{F\_Size} + \beta_{10} \mathrm{F\_Own} + \beta_{11} \mathrm{F\_Income} + \beta_{12} \mathrm{Credit} + \beta_{13} \mathrm{Percp\_Foutputs} + \beta_{14} \mathrm{Percp\_Fsize} + \mu i;$$

where Yij = Alternative livelihood options, β0 = Constant, β1-β14 = coefficient of explanatory variables, and μi = error term.

Cocoa farmers' perception on the impact of mining on socioeconomic activities in the district was assessed using a five-point Likert scale (strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5)) to estimate a perception index. Participants responded to specific perception statements which covered four socioeconomic or welfare indicators including agriculture, health, security and education. The mean score (MS) for each perception statement was calculated by this approach:

$$\frac{[(\mathrm{fsd}\times 1)+(\mathrm{fd}\times 2)+(\mathrm{fn}\times 3)+(\mathrm{fa}\times 4)+(\mathrm{fsa}\times 5)}{\mathrm{x}}$$

where fsd = frequency of strongly disagree; fd = frequency of disagree; fn = frequency of neutral; fa = frequency of agree; fsa = frequency of strongly agree, and x = total number of responses to the perception statement.

The overall perception index (PI) for the various perception indices was calculated using the following formula:

$$\frac{\mathrm{MS_{AGRI}}+\mathrm{MS_{HEALTH}}+\mathrm{MS_{SEC}}+\mathrm{MS_{EDU}}}{\mathrm{n}}$$

where MS = mean score for perception on each socioeconomic indicator's statements (including agriculture, health, security and education); n = number of mean scores; AGRI = perception on agriculture; HEALTH = perception on health; SEC= perception on

Table 2. Definition of variables for the regression model.

Variable	Measurement	Expected Sign
Age (Age)	Age in years	-
Sex (Sex)	1 if male, 0 if otherwise	+
Marital Status (Mar_Stat)	1 if married, 0 if otherwise	+
Education (Edu_yrs)	Years of formal education	+
Household size (HH_Size)	Number of persons in the household	+
Dependency Ratio (Dep_Ratio)	Dependent household members divided by independent household members	+
Technical Skills (Tec_Skills)	1 if Yes, 0 if otherwise	+
Access to Extension Services (Ext_Serv)	1 if Yes, 0 if otherwise	-
Farm Size (F_Size)	Acres	-
Farm ownership (F_Own)	1 if Owner, 0 if otherwise	-
Farm income (F_Income)	Annual cocoa income in GH₵	-
Access to credit (Credit)	1 if Yes, 0 if otherwise	-
Perception that mining has reduced farm outputs (Percp_Foutputs)	1 = strongly disagree to 5 = strongly agree	+
Perception that mining has reduced farm sizes	1 = strongly disagree to 5 = strongly agree	+

security, and EDU = perception on education.

Descriptive statistics such as percentages, frequencies, pie chart, radar chart and means were used to summarize responses on the alternative livelihoods of cocoa farming households in the district.

Based on a five-point Likert scale (very low = 1: very high = 5), mean scores were computed and used to rank the constraints that affect the alternative livelihoods of cocoa farming households in the district. The constraint with the highest mean score was ranked as the most important in affecting the alternative livelihoods in the district. The mean score for each constraint was computed using this formula:

$$\frac{[(fvl \times 1)+(fl \times 2)+(fm \times 3)+(fh \times 4)+(fvh \times 5)}{x}$$

where fvl = frequency of very low; fl = frequency of low; fm = frequency of moderate; fh = frequency of high; fvh= frequency of very high; and x = total number of responses to the constraint.

The Chi-square test of independence was conducted to ascertain if there exist a relationship between the alternative livelihoods and socioeconomic characteristics of cocoa farmers in the district.

Data collected from the respondents were subjected to statistical analysis with the use of Stata 14 and Microsoft Office Excel. Stata 14 was used to run the descriptive statistics and the multinomial logistic regression while Microsoft Office Excel was used to compute the perception index and create the charts.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the cocoa farming households

Table 3 presents the results of the socioeconomic characteristics of the respondents. The average age of the household heads was 54 years indicating that cocoa farmers in the district are in the working category, but an aging population. The mean age of cocoa farmers in the district is slightly higher than the national average which is 50 years (Lowe, 2017). Majority of the interviewed households (81%) were male-headed households, and about 70% of the household heads had no technical skills. The technical skills identified included carpentry, masonry, driving, mechanic, barbering, electrician, hairdressing, tailoring, plumbing, painting, footwear making and blacksmithing. About 66% of the respondents had formal education, implying a high literacy among the cocoa farmers in the district. This agrees with the finding by Amoah (2013) that about 62% of the cocoa farmers in Upper Denkyira West District are literate. The average years of formal education of the respondents was seven years with majority being basic education.

About 67% of the respondents were married and majority (88.63%) owned their farmlands. Among the tenants, some rented the lands while others practiced share cropping. The average farm size of the respondents was 9.5 acres with a minimum of 0.5 acres and a maximum of 40 acres. This result corroborates the findings by International Cocoa Initiative (ICI, 2017) about

Table 3. Socioeconomic characteristics of cocoa farming households (n=211).

Categorical variable	Frequency	Percentage
Sex		
Male	170	80.57
Female	41	19.43
Educational level		
No formal education	72	34.12
Primary	72	34.12
Middle school	47	22.27
Secondary	13	6.16
Tertiary	7	3.32
Marital status		
Married	141	66.82
Not Married	70	33.18
Technical skills		
No	147	69.67
Yes	64	30.33
Farm ownership		
Landlord	187	88.63
Tenant	24	11.37
Extension service		
No	107	50.71
Yes	104	49.29
Electricity access		
No	6	2.84
Yes	205	97.16
Credit access		
No	113	53.55
Yes	98	46.45
Alternative livelihood		
No	85	40.28
Yes	126	59.72

Continuous variable	Mean	Standard deviation	Minimum	Maximum
Education in years	7	5.45	0	20
Age (years)	54	13.02	27	82
Household size	7	3.19	1	18
Number of dependents	3.56	1.84	0	8
Dependency ratio	1.52	1.21	0	6
Farm Size (acres)	9.52	7.59	0.5	40
Farm income (GH₵)	4911.21	4243.58	900	19950

Source: Field Survey (2019).

cocoa farming in West Africa. International Cocoa Initiative (2017) found that the average size of cocoa farms is 8.6 and 9.88 acres in West Africa and Ghana, other crops such as vegetables, cocoyam, plantain and

cassava were grown mainly for subsistence with a few respondents indicating that they only sell the surplus. The average annual income from the sale of cocoa by the farmers was GH¢4,911.21 (USD917.14) with the minimum income being GH¢900 (USD168.07) and the maximum being GH¢19,950 (USD3725.56).

The average household size was seven persons, with the minimum being one person and the maximum being 18 persons. This concurs with the finding by ICI (2017) that the average household size of cocoa farmers in West Africa is eight. The household size comprised mostly of the household head with his or her nuclear family and/or other relatives. The average number of dependents in a cocoa farming household was found to be 3.56. The dependents in a cocoa farming household included children, aged and disabled household members, who do not engage in any economic activity. The average dependency ratio for the households was 1.52, with the highest being six and the lowest being zero. Moreover, more than half (53.55%) of the cocoa farming households did not have access to credit, whether formal or informal in the previous production season. That notwithstanding, only two cocoa farming households borrowed in the previous year; the amounts borrowed were GH¢600 and GH¢1,500 for their petty businesses, respectively. About 50.71% of the farming households did not have access to extension services. Majority (59.72%) of the cocoa farming households were engaged in alternative livelihoods in addition to their cocoa farming.

Cocoa farmers' perception on the impact of mining on socioeconomic activities

Perception index was used to assess cocoa farming households' perception of the impact of mining on socioeconomic activities in the study area. The socioeconomic activities included agriculture, health, security and education. Figures in parenthesis in Table 4 represent the scores of the level of agreement multiplied by the frequency of cocoa farmers who selected that level of agreement. The overall perception index was 3.91 (Table 4), implying that the cocoa farmers perceive mining to have negative impact on socioeconomic activities in the district. The mean score of 4.26 for the impact of mining on agriculture indicates that the respondents agreed that mining has negatively impacted agriculture in the district (Table 4). Specifically, the respondents agreed that mining has reduced the size of lands available for farming; this opinion is supported by the finding by Boateng et al. (2014) that agricultural lands have been taken over by miners in mining communities in Ghana. Furthermore, the respondents had a strong agreement (4.77) to the statement that mining has polluted water bodies needed for irrigation and domestic uses. This perception also corroborates the finding by Kitula (2005) that pollution of water bodies with mercury and dust is the most critical impact of mining in mining communities. The respondents also agreed to the statement that mining has reduced the supply of labour for farming activities. Moreover, they agreed that farm outputs have also reduced due to mining; this agrees with the finding by Adjei et al. (2012) that mining has reduced agricultural outputs in Ghana. Some respondents disclosed that they used to grow significant quantities of rice some years ago in marshy areas until mining started in the district and destroyed these marshy areas conducive for rice production.

Also, the perception index for health was estimated at 3.86, indicating an agreeing perception of the negative impact of mining on health. With a mean score of 4.89, the respondents had a strong agreement to the statement that mining has increased malaria cases; they attributed this to the pits left unfilled by the miners, which become breeding grounds for mosquitoes. This perception agrees with the assertion by Hilson (2001) that mining activities leave stagnated water which serves as a breeding ground for mosquitoes. However, in terms of the statement that mining has increased respiratory diseases in the district, the respondents had a neutral point of view, explaining their unawareness of any particular respiratory disease which is predominant among people in the district. However, the respondents had an agreeing perception towards the statements that mining has increased dust in the air as well as death cases in the district. Nonetheless, findings by Aswathanarayana (2003) indicate that the procedures involved in mining, especially processing of minerals result in respiratory diseases such as tuberculosis and silicosis. The respondents explained that the dust in the air is made worse during the harmattan season. They also had an agreeing perception to the statement that mining has polluted waterbodies making them unsafe for drinking. They linked this to the muddy nature of waterbodies and thus suspect their contamination with some chemicals from the mining activities. They further expressed their concerns that there are frequent water shortages because the rivers in the district have been polluted. The aforementioned opinions of the cocoa farming households about the negative impacts of mining on health agree with findings by Kitula (2005) and Hilson (2009) who reported that pits and underground excavations by miners are associated with risks and accidents.

Moreover, Table 4 shows that the perception index of the impact of mining on security (such as incidence of robberies) in the district was 3.58, indicating that the respondents agree that mining has negatively impacted security in the district. This result is in line with Kitula (2005), who reported that mining has increased robberies in mining areas due to the influx of migrants into mining areas in search of jobs. However, some respondents who disagreed to that statement explained that the increased robberies are as a result of the ban on galamsey in the

Table 4. Cocoa farmers' perception on the impact of mining on socioeconomic activities.

Perception statements	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	Mean score
Mining has reduced farmland sizes	6 (6)	17 (34)	15 (45)	105 (420)	68 (340)	4.00
Mining has caused decline in soil fertility	1 (1)	3 (6)	17 (51)	93 (372)	97 (485)	4.33
Mining has polluted waterbodies needed for irrigation	0 (0)	5 (10)	3 (9)	27 (108)	176 (880)	4.77
Mining has reduced labour supply for farming	2 (2)	16 (32)	10 (30)	114 (456)	69 (345)	4.10
Mining has decreased farm output	1 (1)	8 (16)	17 (51)	133 (532)	52 (260)	4.08
Perception Index on agriculture						**4.26**
Mining has increased malaria cases	1 (1)	0 (0)	0 (0)	20 (80)	190 (950)	4.89
Mining has caused increase in respiratory diseases	49 (49)	31 (62)	64 (192)	51 (204)	16 (80)	2.79
Mining has polluted waterbodies making them unsafe for drinking	17 (17)	35 (70)	2 (6)	23 (92)	134 (670)	4.05
Mining has increased dust in the air	3 (3)	29 (58)	58 (174)	84 (336)	37 (185)	3.58
Mining has resulted in deaths of people	7 (7)	5 (10)	47 (141)	75 (300)	77 (385)	4.00
Perception Index on health						**3.86**
Mining has increased robbery cases	3 (3)	11 (22)	14 (42)	40 (160)	143 (715)	4.46
Mining has increased rape cases	47 (47)	43 (86)	70 (210)	42 (168)	9 (45)	2.83
Mining has resulted in strives between residents and mining companies	10 (10)	33 (66)	60 (180)	58 (232)	50 (250)	3.50
Mining has increased drug abuse	2 (2)	23 (46)	68 (204)	90 (360)	28 (140)	3.56
Mining has increased prostitution	13 (13)	39 (78)	36 (108)	69 (276)	54 (270)	3.53
Perception Index on security						**3.58**
Mining has increased school dropout	6 (6)	35 (70)	18 (54)	39 (156)	113 (565)	4.03
Mining has increased truancy in school	6 (6)	14 (28)	11 (33)	72 (288)	108 (540)	4.24
Mining has increased child labour	34 (34)	35 (70)	19 (57)	54 (216)	69 (345)	3.42
Mining has reduced academic performance	7 (7)	15 (30)	22 (66)	70 (280)	97 (485)	4.11
Perception Index on education						3.95
Overall Perception Index						3.91

Source: Field Survey (2019).

country. The respondents also agreed that mining has resulted in strives between residents and mining companies. This finding concurs with that of Boateng et al. (2014) who found that mining is a major source of conflict between mining firms and residents of mining communities. The respondents agreed that mining has increased drug abuse and also that mining has increased prostitution in the district. This opinion is supported by the finding by Dogbe (1995) that mining has increased drug abuse and prostitution in mining areas.

Lastly, the respondents had an agreeing perception that mining has negatively impacted education in the district. Table 4 shows that the

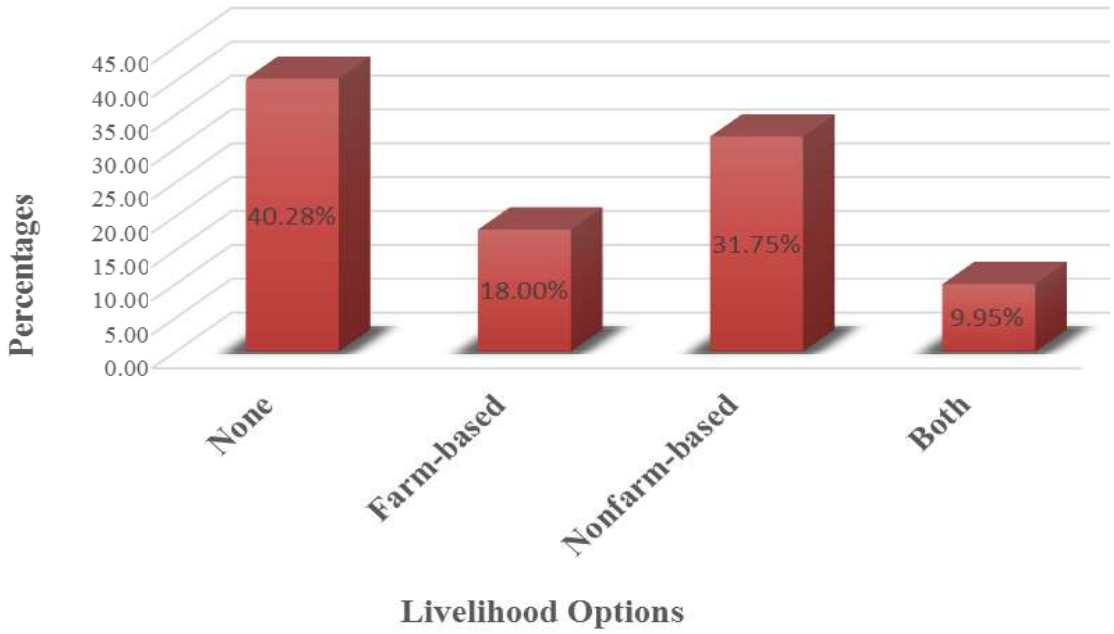

Figure 2. Alternative livelihood options.
Source: Field Survey (2019).

respondents agreed that mining have increased school dropouts and also truancy in schools. This, they attributed to the fact that the students find no reason for being in school if the aim of education is to make money in the future. The respondents indicated that the students believe a job after school is not guaranteed, but galamsey offers them the income needed for survival. Furthermore, the respondents agreed that mining has reduced academic performance of students in the district. According to Boateng (2017), students indulge in galamsey activities during school hours, which have resulted in the drop in the academic performance of students in mining communities. The respondents, however, had a neutral view on the statement that mining has increased child labour in the district.

Alternative livelihoods of cocoa farmers in Upper Denkyira West District

About 60% of the cocoa farming households interviewed were engaged in alternative livelihoods in addition to their cocoa farming (Figure 2). The results show that 18% of the total respondents engaged in only farm-based activities in addition to cocoa farming as their alternative livelihoods, 32.54% engaged in nonfarm-based activities in addition to cocoa production, and the remaining 9.95% engaged in both farm-based and nonfarm-based alternative livelihoods in addition to cocoa production. These findings agree with a study by Yizengaw et al. (2015) who reported that majority of rural farming households choose a nonfarm-based alternative livelihood as against a farm-based alternative to diversify risks. Since cocoa is the main income source of the cocoa farming households in the study area, income from the sale of food crops such as cassava and vegetables was considered as an alternative livelihood. The farm-based alternative livelihoods identified from the study were sale of food crops as well as rearing of livestock (Figure 3). The nonfarm activities included artisans, traders, among others (Figure 4).

Major alternative livelihoods

Figures 3 and 4 show the distributions of the farm-based and nonfarm-based alternative livelihoods of the cocoa farmers in the district, respectively. Livestock rearing was the major (69%) alternative livelihood among the farm-based alternative livelihoods (Figure 3), indicating that livestock rearing is a popular alternative livelihood among the cocoa farmers in the district. This result is inconsistent with a study by Njuguna (2015) who found that crop farming such as potato, beans and maize farming, was the major alternative livelihood among rural households in the Solio Settlement in Kenya. The major livestock reared by the respondents included chicken, sheep and goat. Most of the livestock farmers further revealed that they allow their livestock to free- range. This indicates the practice of agro-pastoral farming as recommended for perennial crop production like cocoa. Figure 4 shows that carpentry was the major alternative livelihood among the non farm-based alternative

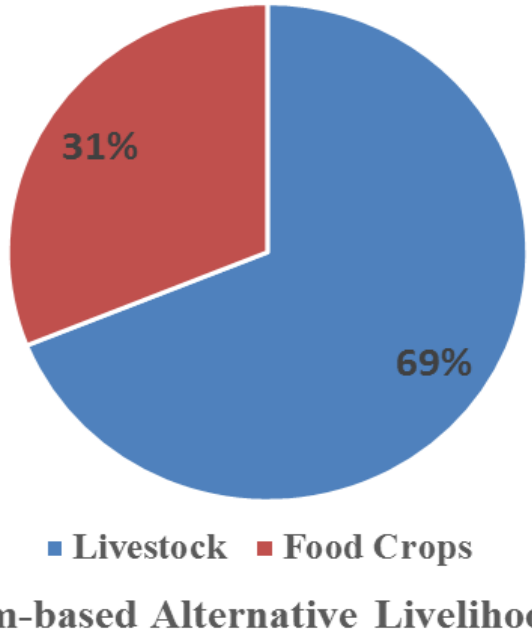

Figure 3. Farm-based alternative livelihoods.
Source: Field Survey (2019).

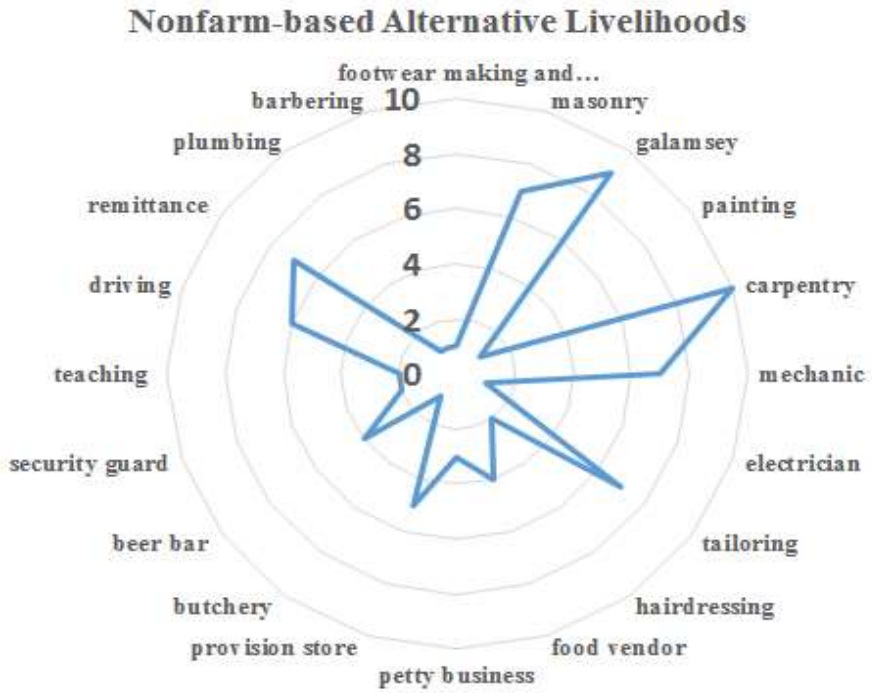

Figure 4. Nonfarm-based alternative livelihoods.
Source: Field Survey (2019).

livelihoods, followed by galamsey which explains the high incidence of mining in the study area. Most of the nonfarm-based alternative livelihoods of the cocoa farmers including carpentry and tailoring, among others, were skill-based. This shows that possessing a technical skill enhances the chance of a household to have a

Table 5. Relationship between cocoa farmers' socioeconomic characteristics and alternative livelihoods.

Variable	None [N (%)]	Farm-based [N (%)]	Nonfarm-based [N (%)]	Both [N (%)]	Total [N (%)]	Pearson chi^2 (3)	Prob.
Sex							
Female	15 (37)	7 (17)	13 (32)	6 (15)	41 (100)	1.32	0.73
Male	70 (41)	31 (18)	54 (32)	15 (9)	170 (100)		
Formal education							
No	41 (57)	18 (25)	12 (17)	1 (1)	72 (100)	**26.38*** **	**0.00*** **
Yes	44 (32)	20 (14)	55 (40)	20 (14)	139 (100)		
Marital status							
Unmarried	29 (41)	14 (20)	20 (29)	7 (10)	70 (100)	0.60	0.90
Married	56 (40)	24 (17)	47 (33)	14 (10)	141 (100)		
Technical skills							
No	80 (54)	37 (25)	21 (14)	9 (6)	147 (100)	**91.56*** **	**0.00*** **
Yes	5 (8)	1 (2)	46 (72)	12 (19)	64 (100)		
Farm ownership							
Tenant	11 (46)	4 (17)	7 (29)	2 (8)	24 (100)	0.36	0.95
Landlord	74 (40)	34 (18)	60 (32)	19 (10)	187 (100)		
Extension access							
No	41 (38)	19 (18)	41 (38)	6 (6)	107 (100)	**7.28***	**0.06***
Yes	44 (42)	19 (18)	26 (25)	15 (14)	104 (100)		
Access to credit							
No	45 (40)	20 (18)	37 (33)	11 (10)	113 (100)	0.11	0.99
Yes	40 (41)	18 (18)	30 (31)	10 (10)	98 (100)		

N = frequency Prob = Probability (* = significant at 10%, *** = significant at 1%).
Source: Field Survey, 2019.

nonfarm-based alternative livelihood. There is therefore the need to promote skills acquisition and market access for cocoa farmers in the district.

Relationship between cocoa farmers' socioeconomic characteristics and alternative livelihoods

Table 5 presents the results from the Chi-square test of independence on the relationship between the alternative livelihoods and socioeconomic characteristics of cocoa farmers in the district. The socioeconomic variables included sex, formal education, marital status, technical skills, farm ownership, access to credit and extension services (Table 5). The results showed that there is an association between formal education and choice of alternative livelihood. Household heads having no formal education were found to be more likely to have no alternative livelihood whereas household heads having formal education were more likely to engage in nonfarm-based alternative livelihoods. This is mainly because formal education creates opportunities for employment outside agriculture. This supports the assertion by Adi (2007) that literates have skills that can secure them employment off-farm. Again, Khatun and Roy (2012) stated that lack of education is a major barrier to entry into the nonfarm sector. Similarly, the results showed that there is an association between the alternative livelihood choice of a cocoa farming household and whether the household head possesses a technical skill or not. Household heads who do not possess technical skills were more likely to have no alternative livelihood whilst household heads with technical skills were found to be more likely to be engaged in nonfarm-based alternative livelihoods. This is because technical skills improve a person's chances of having a job in the nonfarm sector. This finding is consistent with Njuguna (2015) who found that possession of technical skills influences a household to diversify into a non-agricultural livelihood. Moreover, a cocoa farming household's choice of an alternative

livelihood option and access to agricultural extension services was found to be associated. Households without access to agricultural extension services were found to be more likely to be engaged in nonfarm-based alternative livelihood or have no alternative livelihood. However, households having access to agricultural extension services were more likely to have no alternative livelihoods. Access to extension services improves farm productivity and income, and it is assumed that farmers with extension services have adequate income from their farm activities.

Factors influencing the choice of alternative livelihoods

The results of the multinomial logit regression on factors influencing the choice of alternative livelihood are presented in Table 6. The empirical results show a Pseudo R^2 value of 0.29 which indicates that the explanatory variables explain the variations in the dependent variable by 29%. The empirical results also show that the LR Chi-square value (155.72) is statistically significant at 1% which indicates that the independent variables included in the model jointly explain the variation in the choice of alternative livelihoods by cocoa farming households in the district. The cocoa farming households were grouped into four categories according to their engagement in alternative livelihoods, namely none; farm-based; nonfarm-based, and both farm and nonfarm- based (Figure 2). The odds ratio (OR) was used to determine the influence of the independent variables on the likelihood of a household choosing a certain livelihood option compared to having no alternative livelihood. Having no alternative livelihood (solely cocoa farming) was used as the base category. The regression results revealed that a cocoa farmer's choice of an alternative livelihood is influenced by sex, possession of technical skills, access to extension services, years of formal education, farm income, perception that mining has reduced farm sizes and perception that mining has reduced farm outputs (Table 6). The results show that the relative probability of a household head to engage in a farm-based alternative livelihood was 67% more likely than having no alternative livelihood as the respondent perceives that mining has reduced farm sizes. On the other hand, households which perceive that mining has reduced farm outputs were 34% less likely to choose farm-based alternative livelihood compared to having no alternative livelihood. This implies that as a cocoa farming household perceives that mining has reduced farm outputs, the household would rather not have any farm-based alternative livelihood.

Also, households which perceive that mining has reduced farm sizes were 1.5 times interested in choosing a nonfarm-based alternative livelihood relative to having no alternative livelihood. This is because the non farm-based alternative livelihoods require very little or no land space for operations. Thus, a cocoa farming household would rather engage in a nonfarm-based alternative livelihood such as carpentry or driving which requires no land if the household perceives that mining has reduced farm sizes. This finding is consistent with that of Khatun and Roy (2012), who found that limitation of land suitable for agricultural production influences the choice of income and livelihood diversifications. Moreover, a household head was about 27 times more interested to engage in a nonfarm-based alternative livelihood in comparison with having no alternative livelihood if he or she possesses a technical skill. Thus, a household head would rather engage in an activity in which he or she has a technical skill to earn additional income compared to having no alternative livelihood. This result agrees with literature as a similar finding was made in Eastern Tigray, Ethiopia (Zerai and Gebreeziabher, 2011). Furthermore, a household which has access to agricultural extension services was about five times interested to engage in both farm and nonfarm-based alternative livelihoods relative to having no alternative livelihood. This finding agrees with the assertion by Hofs et al. (2006) that lack of extension service leads to poor performance of farmers. They found that access to extension services improve farm productivity and income. Thus, having access to extension services can improve the income from the cocoa farming thereby affording the cocoa farmers the financial capital to invest into farm-based and nonfarm-based alternative livelihoods in addition to cocoa farming. In addition, it was found that a household with the household head possessing a technical skill was about 22 times interested to engage in both farm-based and nonfarm-based alternative livelihoods as compared to having no alternative livelihood. The estimated model also indicates that the relative probability of a male-headed household to engage in both farm and nonfarm-based alternative livelihoods rather than having no alternative livelihood was about 91% less likely. This can be attributed to the fact that per the culture of Ghanaians, males are mostly family heads. Family heads are responsible for sharing family lands; thus, males have easier access to more farm sizes (FAO, 2012). This result disagrees with the finding by Njuguna (2015) that male-headed households are more likely to be engaged in a nonfarm-based alternative livelihood rather than having no alternative livelihood. This result also disagrees with the finding by Babatunde and Qaim (2009) that males are more likely to have alternative livelihoods because males have more access to employment opportunities both on and off the farm.

Again, as the farm income of a household increases, the less likely the household was engaged in both farm and nonfarm-based alternative livelihoods. However, the influence of farm income on the decision by a cocoa farming household to choose both farm and nonfarm-based alternative livelihoods compared to having no

Table 6. Multinomial regression results on farmers' choice of alternative livelihood.

Variable	Odds ratio	Std. error	z-value	p-value	(95% Conf. Interval)	
Farm-based						
Per_fsize	**1.669****	0.418	2.05	0.041	1.022	2.726
Per_foutput	**0.663***	0.156	-1.75	0.080	0.418	1.051
Sex	1.411	0.972	0.50	0.617	0.366	5.446
Eduyears	0.999	0.038	-0.01	0.995	0.928	1.077
Age	0.977	0.021	-1.07	0.284	0.936	1.020
Maritalstat	0.648	0.367	-0.76	0.444	0.213	1.969
Techskills	0.261	0.309	-1.14	0.256	0.026	2.652
Hhsize	1.005	0.085	0.06	0.951	0.851	1.187
Depratio	1.077	0.190	0.42	0.675	0.761	1.523
Farmownership	1.411	0.949	0.51	0.609	0.377	5.276
Farmsize	1.020	0.038	0.54	0.591	0.948	1.098
Extser	0.897	0.396	-0.25	0.805	0.377	2.131
Credit	0.931	0.393	-0.17	0.866	0.407	2.130
Farmincome	0.999	0.000	-0.19	0.849	0.999	1.000
Constant	0.723	1.359	-0.17	0.863	0.018	28.791
Nonfarm-based						
Per_fsize	**1.531***	0.376	1.74	0.083	0.946	2.476
Per_foutput	1.151	0.328	0.49	0.622	0.659	2.011
Sex	0.376	0.295	-1.25	0.213	0.081	1.750
Eduyears	1.009	0.049	0.18	0.861	0.917	1.109
Age	0.959	0.026	-1.53	0.125	0.901	1.012
Maritalstat	2.414	1.676	1.27	0.205	0.619	9.417
Techskills	**26.934*****	16.197	5.48	0.000	8.287	87.54
Hhsize	1.012	0.107	0.11	0.911	0.822	1.246
Depratio	0.776	0.164	-1.20	0.232	0.513	1.175
Farmownership	1.719	1.231	0.76	0.449	0.423	6.993
Farmsize	0.946	0.055	-0.95	0.342	0.845	1.060
Extser	0.780	0.379	-0.51	0.609	0.301	2.021
Credit	1.242	0.574	0.47	0.639	0.502	3.071
Farmincome	0.999	0.000	-1.17	0.243	0.999	1.000
Constant	0.689	1.405	-0.18	0.855	0.013	37.485
Both						
Per_fsize	1.479	0.459	1.26	0.208	0.804	2.718
Per_foutput	1.481	0.555	1.05	0.295	0.711	3.088
Sex	**0.086****	0.086	-2.45	0.014	0.012	0.612
Eduyears	**1.133***	0.083	1.69	0.091	0.981	1.308
Age	0.972	0.036	-0.78	0.433	0.904	1.044
Maritalstat	2.259	1.993	0.92	0.356	0.401	12.731
Techskills	**22.179*****	17.004	4.04	0.000	4.936	99.663
Hhsize	1.107	0.145	0.78	0.436	0.856	1.432
Depratio	0.692	0.196	-1.30	0.195	0.397	1.207
Farmownership	2.417	2.582	0.83	0.409	0.298	19.616
Farmsize	0.978	0.060	-0.36	0.717	0.867	1.102
Extser	**4.682****	3.311	2.18	0.029	1.171	18.720
Credit	1.404	0.869	0.55	0.584	0.417	4.724
Farmincome	**0.999***	0.000	-1.88	0.060	0.999	1.000
Constant	0.013	0.037	-1.56	0.118	0.000	3.003

LR chi^2 (42) = 155.72, Prob > chi^2= 0.0000, Pseudo R^2 = 0.2908, Log likelihood = -189.88 (* = significant at 10%, ** = significant at 5%, *** = significant at 1%).
Source: Field Survey (2019).

Table 7. Constraints faced in farm-based alternative livelihoods (n = 59).

Constraint	1*F	2*F	3*F	4*F	5*F	Mean score	Rank
Access to water supply	2	14	57	76	60	3.54	1st
Access to land	5	18	27	100	55	3.47	2nd
Access to extension services	10	8	36	68	80	3.42	3rd
Housing for livestock	4	18	57	84	30	3.27	4th
Access to credit	11	20	51	52	40	2.95	5th
Access to reliable markets	10	20	69	52	15	2.81	6th
Theft	22	20	27	60	15	2.44	7th
Pests and diseases	611	58	51	8	0	2.17	8th
Perishability of produce	53	0	0	8	20	1.37	9th

1=Very Low, 2=Low, Moderate=3, High=4, Very High=5 and F=Frequency.
Source: Field Survey (2019)

Table 8. Constraints faced in nonfarm-based alternative livelihoods (n= 88).

Constraint	1*F	2*F	3*F	4*F	5*F	Mean score	Rank
Access to credit	12	20	66	108	85	3.31	1st
Access to water supply	21	30	60	80	60	2.85	2nd
Access to reliable markets	18	40	108	40	20	2.57	3rd
Access to land	34	50	15	68	35	2.30	4th
Access to reliable electricity	47	42	39	28	0	1.77	5th
Legal Issues	75	0	0	24	35	1.52	6th
Fuel Prices	76	4	6	28	5	1.35	7th

1=Very Low, 2=Low, Moderate=3, High=4, Very High=5 and F=Frequency.
Source: Field Survey (2019).

alternative livelihood was almost at par. Lastly, it was also found that as the years of formal education of the household head increased, the more likely the household head was engaged in both farm and nonfarm-based alternative livelihoods compared to having no alternative livelihood. The relative probability for a household to choose both farm and nonfarm-based alternative livelihoods compared to having no alternative livelihood was 13% more likely as the years of formal education increases. Formal education creates the opportunity for a person to diversify the use of his/her resources; thus, a household head with formal education is likely to have an alternative livelihood in both formal and informal sectors aside the cocoa farming.

Constraints faced in farm-based alternative livelihoods

Table 7 shows the constraints faced by the respondents who were engaged in farm-based alternative livelihoods. From the study, the highest and lowest ranked constraints were access to water supply and the perishability of their food crop produce, mostly vegetables, respectively. The respondents complained that they face difficulties in accessing water to irrigate their farms. They mentioned that the waterbodies in the District have been polluted so they depend heavily on the rain to irrigate their crops. The farmers attributed this problem to the increasing activities of miners in the district. Findings by Babulo et al. (2008) revealed that infrastructure such as water supply affects intensity and the variety of agricultural produce cultivated in rural communities. Moreover, access to land for grazing and also cultivating arable food crops was found to be the second highest constraint since the farmers in this category were into livestock farming and crop farming as alternative livelihoods. They attributed this problem to the increasing houses being constructed as well as mining in the district.

Constraints faced in nonfarm-based alternative livelihoods

Table 8 shows the constraints faced by the cocoa farming households which were engaged in nonfarm-based alternative livelihoods. The highest and lowest ranked constraints faced by farmers in this category were access to credit and fuel prices respectively. The farmers attributed the access to credit being a major constraint to the fact that requirements of the financial institutions in

giving them loans are too stringent such as requesting for collaterals. They also attributed it to the fact that they themselves fear the risk of defaulting loan repayment. Moreover, access to water supply was ranked as the second highest constraint faced by the respondents. The respondents which were engaged in galamsey activities stated that they face legal complications due to the illegality of their alternative livelihood.

CONCLUSION AND RECOMMENDATIONS

This study sought to assess the perception of cocoa farming households on the impact of mining on their socioeconomic activities and the factors that influence their choice of alternative livelihoods. The results showed that cocoa farming households agree that mining has negative impacts on socioeconomic activities in the study area. They agreed that mining has negatively impacted agriculture, health, security and education in the district. The study also found that majority of the cocoa farming households were engaged in alternative livelihoods in addition to their cocoa farming. The alternative livelihoods identified were farm-based only, nonfarm-based only, and a combination of both. A Chi-square test of association between socioeconomic factors of cocoa farmers and the alternative livelihood options revealed that formal education, possession of technical skills and access to extension services have associations with the choice of an alternative livelihood by cocoa farmers. The multinomial regression results showed that sex, years of formal education, possession of technical skills, access to extension services, farm income, perception that mining has reduced farm sizes and farm outputs are factors that influence a cocoa farming household to choose a particular alternative livelihood as against having no alternative livelihood. The study found that the respondents face some constraints with regards to the alternative livelihoods they are engaged in. With regards to farm-based alternative livelihoods, the highest ranked constraint the respondents face was access to water supply for irrigation whilst the highest ranked constraint faced by respondents who were into nonfarm-based alternative livelihoods was access to credit.

The study recommends the need for the media and educational institutions to intensify education on the negative effects of mining activities on socioeconomic activities in the district. Increased education will help shape the idea of the people engaged in mining activities, especially illegal miners to help improve the quality of water sources and other resources in the district. It is also expedient to create job opportunities for the youth who are into mining in order to mitigate mining activities in the study area. The study showed that technical skills were associated with engagement in alternative livelihoods. It is therefore recommended that policy makers initiate a policy for promoting skills acquisition as well as facilitating access to markets for products of alternative livelihoods in the district. This will help lessen engagement in illegal mining activities. Moreover, the Ministry of Food and Agriculture should improve extension services in the district. An improvement in extension services, especially to the food crops will ensure that the cocoa farmers can increase their engagement in production of food crops to supplement their income from cocoa.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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