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Mushroom Cultivation as an Alternative Livelihood in Artisanal Goldmining Affected Communities in Ghana

Edwin Supreme Asare[1], Jonas Ayaribilla Akudugu[2], Michael Addaney[2], Amos Apraku[3*], Alfred Ohenenana Appiah[4]

Abstract
This paper examines the potential of mushroom cultivation as an alternative livelihood for people who engaged in un-regulated artisanal goldmining (galamsey) in rural Ghana. Kenyasi, Gyedu and Ntotroso communities in the Ahafo region have experienced an upsurge of artisanal goldmining activities since Newmont Ghana Gold Limited (Ahafo Gold Mine) started a large-scale mining project in the area two decades ago. Using a case study and drawing on mixed methods approach, the results revealed that majority of the people who engaged in galamsey were already aware that mushroom cultivation is gainful and expressed interest in its adoption if the needed training and financial assistance were provided. Thus, relying on the concept of alternative livelihood, the paper argues that the cultivation of mushrooms presents a viable livelihood option for those desiring to move out of unregulated artisanal goldmining. The findings underscore the role that government and other stakeholders could play to address the menace: provision of skill training and financial support to enable them to create sustainable alternative livelihood in mushroom cultivation.

Keywords
Alternative livelihoods; environmental degradation; mushroom cultivation; sustainable livelihoods; illegal gold mining

[1]Center for Migration Studies, University of Ghana, Legon, Ghana
[2]Department of Planning and Sustainability, University of Energy and Natural Resources, Box 214, Sunyani, Ghana
[3]Department of Languages and General Studies, University of Energy and Natural Resources, Box 214, Sunyani, Ghana
[4]Centre for Distance Education, University of Energy and Natural Resources, Box 214, Sunyani, Ghana
***Corresponding author**: amos.apraku@uenr.edu.gh

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1. INTRODUCTION

The gold mining sector in Ghana comprises of large-scale mining (LSM), small-scale mining (SSM) and artisanal mining (ASM). Ghana is one of the major producers of gold in the world and the goldmining sector is strongly influenced by the contributions of artisanal mining operators. There are an estimated one million artisanal miners, consisting mainly of informal miners operating without any formal licenses, producing about 30% of Ghana's total gold output (Arkorful et al., 2018). The mining industry in Ghana was a recipient of an estimated $7 billion in investments between 1990 and 2008 (Aubynn, 2006). The mines, comprising of both the LSM, SSM and ASM produces an average of one million ounces of gold annually, including 100,000 ounces being produced by ASM (Yankson and Gough, 2018). Between 80 and 100 million people are estimated to be involved in artisanal mining globally and rely on it for their livelihoods directly or indirectly (Azumah et al., 2021). In Ghana for example, an estimated 500,000 to one million people are engaged in unregulated artisanal gold mining commonly called 'galamsey' (Alhassan, 2014). Moreover, the ASM sub-sector largely comprises of the poor and working class. Mantey et al. (2017) conceptualizes 'galamsey' as the practice of illegally mining and/or extracting gold found either below soil or water surface in Ghana. Similarly, Baah-Ennumh (2010) theorizes illegal mining in Ghana as 'all mining activities that take place without appropriate licenses from regulatory bodies and adopts poor practices such as mining in water bodies, not observing appropriate buffer restrictions, and non-reclamation of lands after mining'. Aubynn (2006) also describes galamsey as the practice of 'discretely gathering minerals found just below the soil surface and selling them in contravention to state

laws'. For the purposes of discussions in this paper, the concept of galamsey encapsulates artisanal and all manner of illegal mining activities. Where necessary, galamsey and artisanal mining would be used interchangeably since majority of artisanal miners in Ghana operate illegally.

The ASM sub-sector in Ghana is highly informalized and lacks regulation. It is argued that majority of people practice this form of mining as a means of survival (Busumtwi-Sam and Hira, 2018). Galamsey has become a lucrative source of livelihood attracting people in need of income, particularly folks without formal educational qualification and/or employment. The galamsey subsector has long become a livelihood option for many poor and deprived people in resource-rich communities despite its deleterious ecological impacts (Aidoo, 2016: 58). Prior to the arrival of Newmont Ghana Gold Limited (Newmont) in 2006, the people in the Kenyasi-Ntotroso-Gyedu areas were predominantly subsistence farmers - growing plantains, maize, cassava and vegetables. The discovery of gold in the area made the natives aware that they were sitting on alternate wealth other than crop farming. As a result, illegal mining (galamsey) became a common livelihood activity for the indigenes. Although illegal gold mining operations have a significant positive impact on the local economies, its operations pose a number of environmental, economic, and social problems (Azumah et al., 2021). Hilson (2002) establishes that artisanal mining serves as vital source of employment and revenue; making it the backbone of the subsistence rural economy in Ghana. However, the adverse effects of ASM activities have dwarfed its contribution to livelihoods in most host communities (Wireko-Gyebi et al., 2020). Studies (e.g. Arkorful et al. 2018; Tschakert and Singha, 2007) portray galamsey as a highly damaging activity leading to public movements against the practice.

Most resource-rich rural areas across the country (Ghana) have become the nucleus for informal mining sites populated with citizens who have been driven into it as a means of establishing an economic livelihood for themselves and their families (Afriyie et al., 2016). However, illegal artisanal small gold mining in Ghana is not sustainable. Recent government intervention to sanitize the sector has driven many of the people out of mining. This has heightened calls for the creation of alternative livelihoods such people. This paper therefore explores mushroom farming as an appropriate viable alternative livelihood for people who have engaged in galamsey in rural Ghana and how mushroom farming can potentially be harnessed as a community-based functional tool to address the menace. Using the Kenyasi-Ntotroso-Gyedu gold mining enclave in the Asutifi North District of Ghana as a case study, the paper addresses two research objectives: (i) to examine the practicality of mushroom farming as a sustainable alternative livelihood option for people who engaged in galamsey; and (ii) to explore the perception of people who engaged in galamsey on mushroom farming and their willingness to adopt it as an alternative livelihood.

1.1 Mushroom farming and alternative livelihoods in the artisanal goldmining context: a 'localised' and conceptual briefing

There is a strong consensus that galamsey should be effectively curbed due to its environmental and human health outcomes and other associated social problems (Bansah, 2019; Palmer and Sackey, 2004). For instance, galamsey activities are regarded as environmental nuisance in Ghana as a result of the destruction of ecological and aquatic resources (Afriyie et al., 2016; Hilson and Maconachie, 2020; Clifford, 2017). However, Sinding (2006) argues that:

> galamsey has the potential to contribute to poverty reduction and boost local economic development but it somewhat perpetuates rather than diminishes poverty: through high sensitivity to physical hazards, accidents and lack of knowledge about more efficient, safer and environmentally friendly techniques.

This prevailing situation is keeping people engaged in galamsey in a continuous cycle of poverty and invalidates the sector's image as a viable livelihood option. Galamsey operations also pose numerous health risks (Hilson, 2002; Heemskerk, 2005). The most prevalent health risk is the exposure to mercury which is used in the final stages of gold extraction. Mercury is known to be very poisonous to humans, animals and plants and thus pose severe health dangers. Hilson and Banchirigah (2009) argue that during the burning of amalgam everyone at the site could be exposed to mercury, and is usually undertaken in water leading to pollution of water bodies.

Livelihood is conceptualized as the means of securing the necessities of life including food, water, shelter and clothing (Bizikova, 2011; Amayo et al., 2021). It is the material means that guarantees people a living (Niehof and Price, 2001). The concept of livelihood to an individual implies the ability to obtain the basic necessities of life (Mphande, 2016). Livelihood therefore constitutes the means of making a living comprising of the capabilities and assets (including both material and social resources) as well as activities required for a living. Chambers and Conway (1991) argue that a livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base. In Ghana, most of the people dwelling in rural and mid-sized towns have their livelihood dominated by agriculture involving food crops such as plantain, banana, maize, yam, cocoyam, vegetables and fruit crops such as oranges, pineapple, etc.

(see, Addaney et al., 2021). Cash crops such as cocoa, and cashew are also largely cultivated (Anaafo and Inkoom, 2016; Addaney et al., 2021).

Locating sustainable alternative livelihood to wean people engaging in galamsey from their trade has received prominence in national and international fora for decades (Aryee et al., 2003; Hilson and Banchiriga, 2009). Despite its appeal as alternative livelihoods, criticism has been levelled against such projects as they seem to be designed for foreign markets rather than for domestic job opportunities. There seems to be a disjoint between what the galamsey operators want and what is being proposed. The division between the alternative livelihood strategies commonly proposed and the basic needs of artisanal miners may potentially be as a result of lack of consultation and the active participation of the people engaged in galamsey who are the primary beneficiaries of such interventions. There are also concerns that in most cases, galamsey operators are rushed to adopt these projects even though they were not involved in their development and thus, leading to failures in implementation. Furthermore, in other cases, enough support in terms of start-up capital and continuous monitoring of progress is absent (Osano and Languitone, 2016; Seidu, 2017; Hilson et al., 2017).

Efforts to bridge the gap between galamsey as an income-generating activity should be anchored on the prospects of advancing sustainable community development through value-laden programmes that run synchronously with galamsey activities with the ultimate goal that such initiatives would replace galamsey as a livelihood option (Aryee, 2001). Considering the agrarian nature of affected communities, these programmatic interventions should promote activities such as mushroom and snail farming, fish farming, palm oil production, batik making, grasscutter rearing etc. (Aubynn, 2006). Tschakert (2009) asserts that these alternative livelihood interventions are implausible to foster sustainable livelihood systems and boost local resilience. Hitherto, starting and running a profitable off-farm economic venture requires heavy financial resources. Consequently, only few artisanal miners are able to diversify into productive off-farm economic activities. In Ghana, there have been complaints of the government failing to provide material opportunities which promote a living outside of illegal mining. This makes mushroom farming a more suitable alternative livelihood.

A study examining the pull and push factors that make men and women become engage and persist in artisanal gold mining activities by Tschakert (2009) discovered that half of the participants were willing to adopt alternative sources of livelihood such as mushroom and/or snail farming only if they could be assisted with seed capital and basic training to acquire the requisite skills. It must be noted that, in areas where galamsey operations are active, agricultural lands become a luxury of a few as land becomes scarce for commercial farming. Mushroom cultivation does not however need vast land - it requires little land; and it is an all-year activity (Zhang et al., 2014; Bhushan et al., 2019; Wendiro et al., 2019). Mushroom cultivation has also become a promising livelihood scheme because it does not require significant financial investment (Zhang et al., 2014; Bhushan et al., 2019). Yet, the venture is financially rewarding and presents prospects for improving household incomes, particularly for rural dwellers in the forest and transitional zones in Ghana. Mushroom production provides an avenue for many rural residents to participate in the local economic market and also earn income (Wendiro et al., 2019). In Ghana, wild mushrooms have always been collected for home use and sale during the raining season. Apetorgbor et al. (2005) observe that exotic tropical species of Pleurotus (e.g. P. eous, P. cystidiosus, P. ostreatus, P. pulmonarius) and Auricularia (e.g. A. auricular, A. polytricha) have been under cultivation in Ghana. Raman et al. (2018) outlined the optimum growth conditions for mushrooms including being produced in structures with controlled climate and environmental conditions. This conditions include climatic factors such as temperature, water, light, relative humidity and the growth medium can be manipulated to suit the crop's requirements.

Mushrooms are known to grow in organic media such as wheat straw and cow, chicken and horse manure and cotton seed. Obodai et al. (2002) categorized mushrooms into four categories: edible mushrooms (e.g. agaricus-bisporus; pleurotus tuber-regium; and volvarievolvacea); medicinal mushrooms (e.g. ganodermalucidium and lentinulaedodes); poisonous mushrooms (e.g. amanita muscaria and amanita phalloides); and miscellaneous mushrooms whose properties remain less defined. Wild edible fungi are important for three reasons: as source of food and health benefits, source of income as well as maintaining the health of forests (Dzomeku, 2009). Mushrooms could thus be used for economic, ecological and medical purposes as well as for reducing vulnerability to poverty and offer alternative livelihoods through the generation of a fast yielding and nutritious source of food and a reliable source of income. Requiring small land size for its cultivation, mushroom farming is a potentially viable and attractive livelihood option for both rural people and peri-urban dwellers. In particular, small-scale production of mushrooms does not require a significant financial investment as substrate can be prepared from any clean agricultural waste material and temporary clean shelters (Marshal and Nair, 2009). Also, mushrooms cultivation requires little maintenance making it a suitable livelihood option for creating job opportunities for the unemployed, people affected by galamsey activities, youth who are into menial jobs as well as subsistence farmers who need an additional source of income. From the discussion,

mushroom farming provides persuasive appeal for those previously engaged in galamsey as a suitable livelihood option.

2. STUDY SETTING AND RESEARCH DESIGN

2.1 Study setting

The study site, Kenyasi, Gyedu and Ntotroso, fall within the Asutifi North District, one of the six (6) districts and municipalities that constitute the newly created Ahafo region in Ghana. The district was purposively selected as it is one of the districts severely affected by artisanal small-scale mining activities in Ghana, and thus, fits perfectly for addressing the research questions of the study. The district lies within latitudes 6°40' and 7°15' North and Longitudes 2°15' and 2°45' West. With a total land surface area of 1500 sq.km, the district is one of the smallest in the Ahafo Region sharing boundaries with Sunyani Municipal on the North, Tano North and South Districts on the North East, Dormaa East District to North West, Asutifi South District in the West, Asunafo North Municipal in the South West and Ahafo Ano North District (Ashanti Region) in the South East. The major towns in the district includes Kenyasi I, Kenyasi II, Ntotroso, Wamahinso, and Gyedu. The population of the district according to 2010 population and housing census stood at 52,259 with 26,761 males 25,498 females (Ghana Statistical Service [GSS], 2014). The population is youthful (49.8%) depicting a broad base population pyramid which tapers off with a small number of elderly persons (6.7%).

The inhabitants are predominantly subsistence farmers. Nearly seventy (67.8%) percent of the population is rural. As high as 66.1% of households in the district engage in agriculture and cultivate mainly plantain, maize, cassava, bananas, and vegetables. The main rainy season is from May to July with the peak (maximum) in June, and the minor rainy season is from September to October with its peak (maximum) in October. The district is found in the Moist Semi-Deciduous Forest Belt and the nature of the land is water-logged in many places. Due to its endowments in gold (Szoke-Burke and Werker, 2021), mining activities are more pronounced, particularly in the Kenyasi-Ntotroso-Gyedu enclave, which have been selected for the study. In the last two decades, the Asutifi North District has experienced an upsurge in artisanal small-scale gold mining activities when Newmont Ghana Gold (Ahafo gold mine) started a large-scale mining project in the area. The Kenyasi, Gyedu and Ntotroso communities satisfy the variables for examining mushroom cultivation as an alternative livelihood in the context of small-scale mining-affected communities due to their agrarian economies (with varied, but good mix of farming and livestock production); and diversity of land-based actors (farmers including migrants, and livestock farmers). Having chosen the study area, the study sought to have a fair coverage of the affected communities in a holistic manner.

2.2 Research strategy

The study used primarily qualitative research methods including semi-structured interviews and observations for data collection. Three communities in the district were purposively sampled for the interviewing with key informants from governmental agencies, community leader and people engaged in galamsey. The study specifically focused on people engaged in galamsey who have attained the age of sixteen (16). The study focused on mining households within the three selected communities. However, at the time of carrying out the study, data on the numbers of mining households in the three communities did not exist. Therefore, this study relied on the 2010 population and housing census data to determine the number of mining households in the three communities. The 2010 census showed that about 4,265 households resided in the three communities with 1,719 households being involved in mining (GSS, 2014). The sampling of houses/households was done through a snowball method, using the community leader as the starting point in Kenyasi and the leader of the Artisanal small-scale mining association leaders in the remaining two communities as starting point. Individual study participants at the household level were chosen based on availability and willingness to partake in the study. Table 1 Shows the sample sizes for each of the three (3) study communities.

The research generated primary data using semi- structured questionnaires for household surveys, focus group discussions (FGDs) and key informant interviews from the June 31, 2021, to July 14, 2021. Overall 50 people engaged in galamsey were purposively sampled and interviewed across the three communities. The purposive sampling method was useful in gaining a greater depth of data from a small sample size and allowed for the selection of institutions with satisfactory knowledge, experience, and interest in the research topic (Guarte and Barrios, 2006). The study also recruited and interviewed three (3) actors drawn from community-based groups (1), officials of decentralised governmental bodies (1) and (1) official from the Newmont Ahafo Development Foundation to facilitate an understanding of the involvement of affected communities in the creation of alternative livelihoods. The semi-structured questionnaire used to collect data in this study contained both open-ended and closed-ended questions. The questions were framed around two subsections. Section A collected the demographic and socioeconomic data of the respondents. Section B contained questions on the perception of people who engaged in galamsey on mushroom farming and their willingness to adopt it as an alternative livelihood in the study communities.

These methods of data collection were preferred to create an atmosphere of trust and to offer clarity through

Table 1. Sampling Procedure

Community	No. of households	Estimated no. of mining households	No. sampled households interviewed
Kenyasi	2,158	774	23
Ntotroso	1,184	517	15
Gyedu	923	428	12
Total	4,265	1,719	50

discussions. For respondents with low literacy levels, the questionnaires were translated on a real-time basis. For consistency, the researchers translated keywords of the questions to avoid distortions in meanings. The study, however, acknowledges that slight variations in the way in which the interviews were conducted. For example, variations with respect to the ordering of the questions to allow the interview to be adapted to suit the respondent better may have occurred. A chi-square test [X2 (1, N = 70) = 3.278, p > .05] of independence was performed to examine the relationship between gender, age, educational levels and willingness to adopt mushroom cultivation as an alternative livelihood. A thematic content analysis approach was used to examine the qualitative data, thus "identifying, analysing and reporting themes within (the) dataset" in a systematic manner (Braun and Clarke, 2006: 79). Accordingly, the data were organized, cleaned, coded, and categorized. This study used a concept-driven coding approach to identify patterns and similarities between the various data obtained (Nowell et al., 2017).

3. RESULTS

This section deals with presentation and analysis of the data collected from the respondents. For easy understanding and coherence, the section is divided into sub-sections to deal with the various research objectives. To give readers background information as the basis to relate well to the findings, the section begins by giving a snap-shot of the basic socio-demographic characteristics of the respondents as well as some of the salient factors behind the pervasive illegal mining activities in the study communities. Even though some of these variables are not captured in the research objective, their inclusion in the paper would give audience some level of context-specific meaning to the findings of the study.

3.1 Basic socio-demographic characteristics of respondents

Findings from the study show that more than half of the respondents (76%) were unemployed with the remaining engaged in some form of employment including subsistent farming and driving commercial transport. As shown in Table 2, the most common form of employment to residents of the study communities is agriculture (mostly subsistence crop and animal farming), which provides jobs for 76% of the respondents. Other household employment includes carpentry, arts and crafts (6%), petty trading (10%), and unemployed (4%). The results indicate that males (adults) and the youths (26-35 age groups) are more likely to engage in galamsey as an alternative source of income because the economic gains they make from their farming and other economic activities are not enough to sustain their families. On the issue of education, about 60% of the respondents had secondary education (SHS/JHS graduates), while 28% had no formal educational training at all. This makes their employability into any formal sector difficult if not impossible. Probably this further explains why most of the youths see all forms of illegal mining activities as life-saving economic activities and immediate sources of income.

Table 2. Socio-Demographic Characteristics of Ex-Galamsey Respondents

Variable	**Sample Size (n)**	**Percentage (%)**
Gender		
Male	26	51
Female	24	49
Age (years)		
21-25	26	52
26-30	10	20
31-35	7	14
36-40	5	10
41+	2	4
Education		
No Education	14	28
Primary School	6	12
JHS	25	50
SHS	5	10
Occupation of prior to engaging in Galamsey		
Farmer	38	76
Petty Trading	5	10
Arts and crafts	3	6
Mason	2	4
Unemployed	2	4
Occupation after they stopped galamsey		
Subsistence farming	10	20
Driving	7	14
Unemployed	33	66

Source: Fieldwork.

3.2 Reason for engaging in galamsey

As mentioned earlier, even though reasons for engaging in galamsey was not one of the research objectives; highlighting such reasons would help to understand subsequent findings in the context of people's take on alternative livelihood systems in the study area. Figure 1 represents respondents' reasons for venturing into galamsey. Majority of them (40%) said they lost their lands to Newmont Ghana Gold Ltd which consequently made it impossible for them to engage in agriculture, hence their resort to galamsey. Even though compensations were paid to land owners whose lands fall within the concessional area of Newmont, they argued that the money paid was not enough to sustain them for a lifetime. This compelled them to engage in galamsey to support themselves and their families. This view was supported by another 21% of respondents who cited lack of employment as their reason for doing galamsey; whilst 6% said the land owners leased lands to galamsey operators. Another group of respondents (33%) intimated that they wanted quick income and that is why they are engaged in the trade.

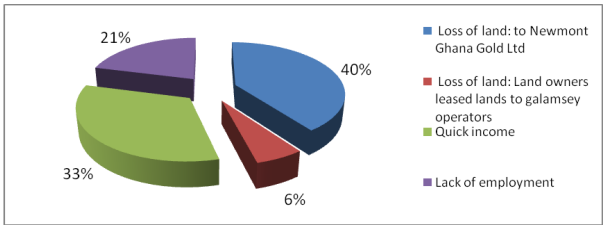

Figure 1. Reasons for engaging in galamsey

Concerning the gain/loss of engaging in galamsey, majority of the respondents (81%) said they gain or make profit from their galamsey activities. This alone is a great motivation to keep them in business. It again supports the earlier submission that people see galamsey as a cash-cow to sustain their families. Only 19% said they do not gain from engaging in galamsey activities due to the high cost involved in hiring of equipment and altercations with the various anti-galamsey law enforcement agencies.

3.3 Knowledge of and willingness to adopt mushroom cultivation as a livelihood option

All the respondents said they are aware of the mushroom cultivation technology. Concerning their willingness to adopt mushroom cultivation as an alternative source of livelihood, majority (66%) expressed their eagerness to undergo any form of training in mushroom cultivation as shown in Table 3.

However, the remaining (34% of the total respondents) were not interested in receiving training in mushroom cultivation. Thus, even though they are aware of its economic viability, they are still not interested in it due to personal occupational preferences. Some of the reasons cited showed that respondents thought it is time consuming to cultivate mushroom and also not profitable. Out of the total respondents, 66% (33 respondents) expressed desire to be trained in mushroom farming for both domestic and commercial uses. A Chi-square test of independence was performed to examine the relationship between gender and willingness to adopt mushroom cultivation as an alternative livelihood (see Table 3a). The association between the variables was significant [X2 (1, N = 50) = 27.904, $p < 0.001$.], indicating that there is enough evidence that there exists a relationship between gender and the willingness of people engaged in galamsey to adopt mushroom. Furthermore, the effect size for this finding, Cramer's V, was weak, 0.250 (see Table 3b). This indicates a weak association between the variables gender and the willingness to adopt mushroom cultivation.

In relation to age and willingness to adopt mushroom cultivation as an alternative livelihood, the relation between the variables was not significant, [X2 (2, N = 50) = 37.745, $p < 0.001$] indicating a connection between age and the willingness of people engaged in galamsey to adopt mushroom as an alternative livelihood as shown in Table 4a. Furthermore, the effect size for this finding, Cramer's V, was strong, 0.869 (see Table 4b), indicating a strong association between age and willingness to adopt mushroom variables.

Regarding education and willingness to adopt mushroom cultivation as an alternative livelihood (Table 5a), the relation between these variables was not significant, [X2 (4, N = 50) = 32.175, $p < 0.001$] indicating that there exists a relationship between level of education and the willingness of people engaged in galamsey to adopt mushroom as an alternative livelihood. The effect size for this finding, Cramer's V, was strong, 0.802 (see Table 5b). This indicates a strong association between variables education and willingness to adopt mushroom cultivation.

In addition to the quantitative data, during the semi-structured interviews, various narratives were proffered to support their standpoints on either they are willing to opt for mushroom cultivation as an alternative source of livelihood or not. These narratives confirm the statistical data provided above. At a focus group discussion in Gyedu, a 37-year old woman said:

> The issue of mushroom cultivation/hunting is not new to us. During the rainy season, we hunt for wild mushroom from our farms and sometimes in the forest, even though we do not have any form of training to cultivate our own mushroom in the backyards or establish mushroom farms. We eat some and sell the rest of whatever we get from our hunting [sic].

This kind of response was affirmed by many other respondents of both genders from the three study communities to indicate that indeed mushroom farming would be of great benefit to majority of the residents since they

Table 3a. Chi-Square Tests on gender and willingness to adopt mushroom cultivation

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	27.904[a]	1	0.000		
Continuity Correctionb	24.837	1	0.000		
Likelihood Ratio	35.129	1	0.000		
Fisher's Exact Test				0.000	0.000
N of Valid Cases[b]	50				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.16.
b. Computed only for a 2x2 table

Table 3b. Symmetric Measures

	Value	Approx. Sig.
Nominal by Nominal Phi	0.747	0
Cramer's V	0.747	0
N of Valid Cases	50	

Table 4a. Chi-Square Tests on age and willingness to adopt mushroom cultivation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.745a	2	0
Likelihood Ratio	43.451	2	0
N of Valid Cases	50		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .68.

Table 4b. Symmetric Measures

	Value	Approx. Sig.
Nominal by Nominal Phi	0.869	0
Cramer's V	0.869	0
N of Valid Cases	50	

Table 5a. Chi-Square Tests on education and willingness to adopt mushroom cultivation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.175a	4	0
Likelihood Ratio	41.189	4	0
N of Valid Cases	50		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.70.

Table 5b. Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	0.802	0
Cramer's V		0.802	0
N of Valid Cases	50		

already hunt for wild mushrooms for food and at the same time generate income from the sales of mushroom.

The official from the District Assembly indicated that, for there to be any chance of discouraging illegal artisanal mining in the communities, the alternative livelihoods being promoted and supported by the government and other stakeholders must be attractive. He clarified that:

> the government through the Assembly has been introducing grass-cutter, snail, and mushroom farming... however, there is the need for a more comprehensive approach to alternative livelihoods like skills and value addition.

This implies that few of the alternative income-earning activities being promoted in the communities are not innovative enough as they offer minimal value addition and limited appeal to the people. This however deviates from the responses from the semi-structured interviews as majority of the people interviewed were willing to adopt mushroom farming as alternative livelihood when given the needed support. The official from NADEF also suggested that the decision of Newmont to promote alternative livelihoods such as mushroom, oil palm, snails and fish farming was because these activities do not take much land. The government through the Assembly and NADEF generally seem to be implementing livelihood options that do not appeal to the communities. According to community leader from Ntotroso:

> The people have preference for becoming artisans such as fitters, mechanics, and technicians with the hope of being employed by Newmont instead of engaging in mushroom, fish and grass-cutter farming, so that after the mine closure, they will still remain skillful [sic].

According to the official from NADEF, Newmont has been implementing a dynamic alternative livelihood scheme known as the "Livelihood Restoration Program". The programme targets every household, tenant farmer and landowner whose lands have been or will be used by

the company as an attempt to restore their livelihoods. However, there remains a concern over whether the affected people wish to continue living as they were or not.

4. DISCUSSION AND CONCLUSION

Most local communities in Ghana and other developing countries affected by large scale and artisanal mining are mainly into subsistence farming, and thus being forcibly displaced or ineffectively relocated pushing most of the working force to embrace galamsey as a source of livelihood (Amoako et al., 2021; Owusu et al. 2019; Hilson, 2016). Studies from one of Ghana's mining towns, Prestea revealed that limited employment opportunities, and low earnings from agriculture are among a number of driving factors compelling people to undertake artisanal small-scale mining (Arthur et al., 2016). Essentially, people engage in artisanal small-scale largely in search of livelihood. There also seems to be a conjecture that a livelihood option which proves effective in one mining locality will be equally effective in others. For example, in Kenyasi, Gyedu and Ntotroso, there is considerable potential for mushroom and poultry rearing activities. With a suitable climate and a moderate growing season, people would welcome the expansion of local farming and poultry industry, which have been the economic backbone of the locality for decades. In Tarkwa-Nsuaem, however, where there is a richer mining tradition with a high percentage of educated youths, and enhanced access to Accra, Takoradi, and Kumasi, it is highly unlikely that an alternative livelihood based wholly on farming and poultry rearing would function effectively. Thus, the socio-economic and cultural features/variables of a locality should be cautiously considered when identifying alternatives.

Moreover, the results established that mushroom cultivation was not new in the study communities. The cultivation of mushrooms has been recognized as an important livelihood strategy in rural communities (Bhushan et al., 2019). Majority (66%) of the respondents expressed willingness to adopt it as an alternative livelihood system. This finding confirms an earlier assertion by Marshal and Nair (2009) that mushroom cultivation could reduce vulnerability to poverty and strengthens livelihoods in mining-affected communities. Similarly, an earlier study by Tschakert (2009) proved that respondents in Ghana were willing to adopt mushroom farming only if they could be assisted with seed capital. It has also been observed that increasing consumption and demand for mushrooms is gradually intensifying production in Sub-Saharan Africa (Wendiro et al., 2019). Whilst it is unrealistic to assume that everyone will abandon illegal artisanal goldmining if provided alternative livelihood, most of the vulnerable individuals, such as women and the elderly, would do so if suitable options were made available. As a community leader in Kenyasi explained, pointing at an elderly man,

> is it not sad to see an old man carrying that pan for about 10 times just for a few thousand Cedis. . . If only he had an alternative.

Based on these findings, the paper concludes that mushroom farming holds a potential in offering alternative livelihoods for people engaged in galamsey in the study communities and other areas with similar socioeconomic dynamics. Mushroom cultivation is particularly recommended as a viable alternative livelihood scheme for a number of reasons: it does not require an initial large financial outlay to set up, it does not require a lot of land to start with, there is market for mushrooms, mushroom production also has a short turnaround period compared to most agricultural and horticultural crops (Zhang et al., 2014; Bhushan et al., 2019). The government and other key actors such as traditional authorities in the communities severely affected by galamsey activities should pursue alternative livelihood interventions, such as mushroom cultivation, prioritizing the provision of start-up capital and skills training. Furthermore, continuous sensitisation campaigns on the dangers of galamsey activities should be carried out to educate and deter people from engaging in the menace. Such a community approach can involve the community-based groups, local advocacy groups, civil society organisations and NGOs and should target farmers, landowners, illegal miners and traditional leaders. Further to the above conclusion, the findings of the study could lead to policy revisions and further research into alternative livelihood systems in communities affected by artisanal mining in Ghana.

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