Contribution of Income Diversification Strategies to Smallholder Farmers' Livelihoods in the Upper East Region of Ghana

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ABSTRACT: *Many past studies on remote areas of Sub-Saharan Africa regarded income diversification strategies as insurance against food insecurity and a better quality of life. However, it is not yet clear how regional income diversification factors contribute to smallholder farmers' decision-making. For this reason, this paper examines the implication of localized income diversification strategies in the Upper East Region of Ghana. We conducted a questionnaire survey among 360 farm households in five rural districts of the Region. We found that smallholder farmers' income diversification had contributed on average 38% of the total household income. In particular, small-scale mining, livestock rearing, remittance, and petty trade contributed most to their livelihoods. We also used the Simpson's Diversity Index to quantify the diversity level of the respondents' income sources. The result showed that the average income diversification strategy of the study region was 0.5 out of 1 with strong district variations in diversification levels. Our correlation analysis revealed that age, educational background, farm experience, and farm size significantly influenced respondents' decision to choose specific income sources. More experienced farmers tended to rely more on on-farm income source diversification whereas young and inexperienced farmers tended to choose labor-intensive mining, firewood collection, and petty trading activities. Most of their household members had moved to urban areas either permanently or temporarily mainly in search of better social services.*

KEYWORDS: *Climate change adaptation; Ghana; Income diversification; Smallholder farmers; Upper East Region*

INTRODUCTION

In Sub-Saharan Africa, about 50% of farm households engage in various income diversification strategies (Barrett et al., 2006); as such, the implication of income diversification to the livelihoods of low-income rural smallholders has been examined from multiple angles (Gebreyesus, 2016; Dzanku and Sarpong, 2018). Whereas household income diversification

behaviors have been generally considered as a proactive distress alleviation response (Kassie, et al., 2017; Dzanku, 2015; Démurger et al., 2010), one study stressed that consequences of income diversification did not significantly help farmers improve crop productivity (Dzanku and Sarpong, 2018). Others argued that income diversification in Sub-Saharan Africa did enhance smallholder farmers' climate adaptation capacity (Loison, 2015; Schwarze and Zeller, 2005).

According to the IPCC, climate adaptation is a process of adjusting to the actual or expected climate and its effects with the intent to lessen negative impacts and/or exploit valuable opportunities (Field and Barros, 2014). This sounds crucial for smallholder households and communities as they must enhance preparedness and build their resilience to potential climate hazards like floods and droughts (Quandt, 2016). Despite emphasis being placed on the importance of adaptation strategies in building resilience (Keenan, 2015) and reducing vulnerability (Descheemaeker et al., 2018), smallholder farmers, especially those in developing countries, are still known to be highly vulnerable to the effects of climate change (Anuga et al., 2019).

Case studies emphasized that smallholders' income diversification responses varied partly by household conditions (Asante et al., 2018), including gender discrimination and poverty (Newman and Canagarajah, 2000). These conditions affected household farming decisions (Ellis, 1998), welfare access (Owusu et al., 2011; Ogot et al., 2018), and food security (Owusu and Abdulai, 2011). In southern Ethiopia smallholders diversified their income through livestock rearing, remittances, and handcraft sale (Eneyew and Bekele, 2012). In Kenya, a study (Eneyew and Bekele, 2012) highlighted smallholders' attempts to sell gift items or engage in temporarily available public sector works (Wan et al., 2016). A study of Ghana's smallholders found food processing, charcoal production, and firewood sale as their diversification strategies (Anang, 2019; Marchetta, 2013).

In the past several years, there has been a growing number of income diversification studies that examined how climate change can also be a factor for smallholders to diversify their income sources (Nyantakyi-Frimpong and Antwi Agyei, 2021). Some climate adaptation actions included diversifying crop types (Asare-Nuamah et al., 2019) and coping strategies (Zakaria and Matsui, 2020). Many farmers migrated to urban areas, believing that more income sources are available there (World Bank, 2007). Considering these localized and complex adaptation strategies, we still do not know much about the following points: (1) what are local circumstances that influenced smallholders' climate change adaptation strategies?; (2) did climate change contribute to smallholder's migration to urban areas as part of income diversification strategies?; and (3) what determines the way smallholder households make decisions for income diversification? The objective of this paper is to answer these questions. It focuses on households' income diversification strategies for climate change adaptation from the adverse impact of drought and flood in the Upper East Region of Ghana.

METHODOLOGY

The Study Area
The study area we selected encompasses six administrative districts of Ghana's Upper East Region (Garu, Pusiga, Bawku Municipal, Bawku West, Binduri, and Tempane). The overall population of the selected districts is 579,626 or 50% of the entire Upper East Region. In this region, 79% of the households are in rural areas. Rain-fed crop farming and animal rearing are

predominant (Tambo and Wünscher, 2017). They mainly grow rice, millet, guinea-corn, maize, groundnut, beans, sorghum, dry season tomatoes and onions (Ghana Statistical Service, 2021).

Among agricultural officers of the Ministry of Food and Agriculture, this area has been known as the poorest and most vulnerable to climate change (Antwi et al., 2019; Macnight Ngwese et al., 2018; Aniah et al., 2016). According to the Ghana Statistical Service (2021), 44% of the population in the Upper East Region lived on less than \$1.9/day. Floods and drought are said to have reduced crop yield and wild fruits in the Region (Atitsogbey et al., 2018). As a result, households are food insecure in terms of grain shortage and poor nutritional diversity (Owusu et al., 2013). One study emphasized that household members had attempted to escape from this difficulty by moving to urban areas (Ampadu et al., 2018). In particular, out-migration among the youths in small communities has increased (Adam et al., 2016).

Methods of Sampling and Analysis
Multistage sampling was used by following similar past studies (Oluwatusin and Sekumade, 2016; Sime et al., 2020). This method is mostly preferred to minimize biased selection (Alvi, 2016). In the first stage, purposive sampling was used to select the six most climate-vulnerable districts in the region. In the second stage, five agrarian communities were chosen from each district. In the third stage a simple random sampling was conducted among household heads. Out of 3,827 farming households in the six districts, the valid answers were collected from 360 (representing 9%) respondents. This means 12 households from each community.

A semi-structured questionnaire was used for the data collection from April to June 2022. The in-person questionnaire was conducted with the cooperation of trained Ministry of Food and Agriculture staff. The questionnaire asked about the household's socio-economic characteristics, such as household size, age, gender, education, farm size, household income, on-farm/off-farm income, and ecosystem service income. The income diversity index (I_{div}) was employed as the econometric approach to calculate the level of income diversified while frequencies and percentages were employed for the descriptive statistics.

In this study, income diversification refers to rural households' diverse livelihood portfolios. These households combine resources and assets to meet their needs, improve their living standards, and manage risks (Niehof, 2004). Income diversification indices (IDIs) are both the number of sources and household income contribution (Minot et al., 2006). IDIs are composed of I_{div} (Wan et al., 2016). The Simpson diversity index (SDI) or (I_{div}) measures agricultural diversification (Ibrahim et al., 2009).

Mathematically, $I_{div} = SDI = 1 - \sum_{i=1}^{n} P_i^2$ where SDI=Simpsons Diversity Index, n=number of income strategies, Pi=Proportion of income coming from the source, I_{div} =income diversity index. The value of SDI ranges between zero (0) and one (1). The value closer to zero represents specialization (only one source of income), and the value closer to one means the high diversification level. Some studies used this index to measure livelihood diversification (Babatunde and Qaim, 2009; Saha and Bahal, 2010). This study followed these studies because of its computational simplicity, robustness, and wider applicability.

In the second part of the analysis, we used a Pearson correlation analysis to identify respondents' socio-demographic characteristics and their income diversification strategies. The expectation was to observe statistically significant relationships between households' socio-demographic characteristics and the income diversification strategies they choose. The data for this study were entered and analyzed using SPSS version 24.

RESULTS AND DISCUSSION

Income Diversification Sources of Rural Households
In this study, we divided income diversification into on-farm, non-farm, and ecosystem services activities (Figure 1). The result showed that 34% of our respondents diversified their on-farm income with a heavy focus on livestock rearing (e.g., poultry, cattle, goats, sheep). Also, the respondents cultivated miscellaneous crops (e.g., millet, soybean, maize) (23%) and vegetables (e.g., onion, tomato) (22%). While men traditionally dominated livestock rearing, women predominantly engaged in vegetable and crop production. In the study area, crop farming was frequently affected by climate impacts like floods and drought. Mortimore and Adams (2001) similarly found the connection between drought conditions and crop failure that eventually led farmers in northern Nigeria to adopting livestock rearing.

Regarding income sources from non-farm activities, our respondents practiced small-scale mining (39%), petty trading (41%), agro-processing (21%), and food sales (19%). About 32% also gained additional income through remittances from migrated family members, especially males. Here the women respondents mostly engaged in petty trading while the men engaged in small-scale mining. Kuuire et al. (2013) made similar findings among smallholders in central Ghana, where women adopted petty trading as a key income diversification strategy.

The respondents generated income from ecosystem services, such as harvesting firewood (30%), producing/trading charcoal (24%), selling wild fruits (18%), sand mining (16%), and game hunting (10%). In the study area, patriarchal norms often determine gender roles and asset ownership. The men tend to own assets like land, farm machinery, and livestock (including manure) (Jost et al., 2016; Abdulai and Matsui, 2022). These inequalities behoove women to rely more on ecosystem services. Ecosystem resources are also the main sources of energy for most local communities (Bahuguna, 2000). This means that climatic change affects women's income sources more (Palanisamy et al., 2012). Thondhlana and Muchapondwa (2014) similarly noted that poorer households in South Africa depended more heavily on ecosystem services.
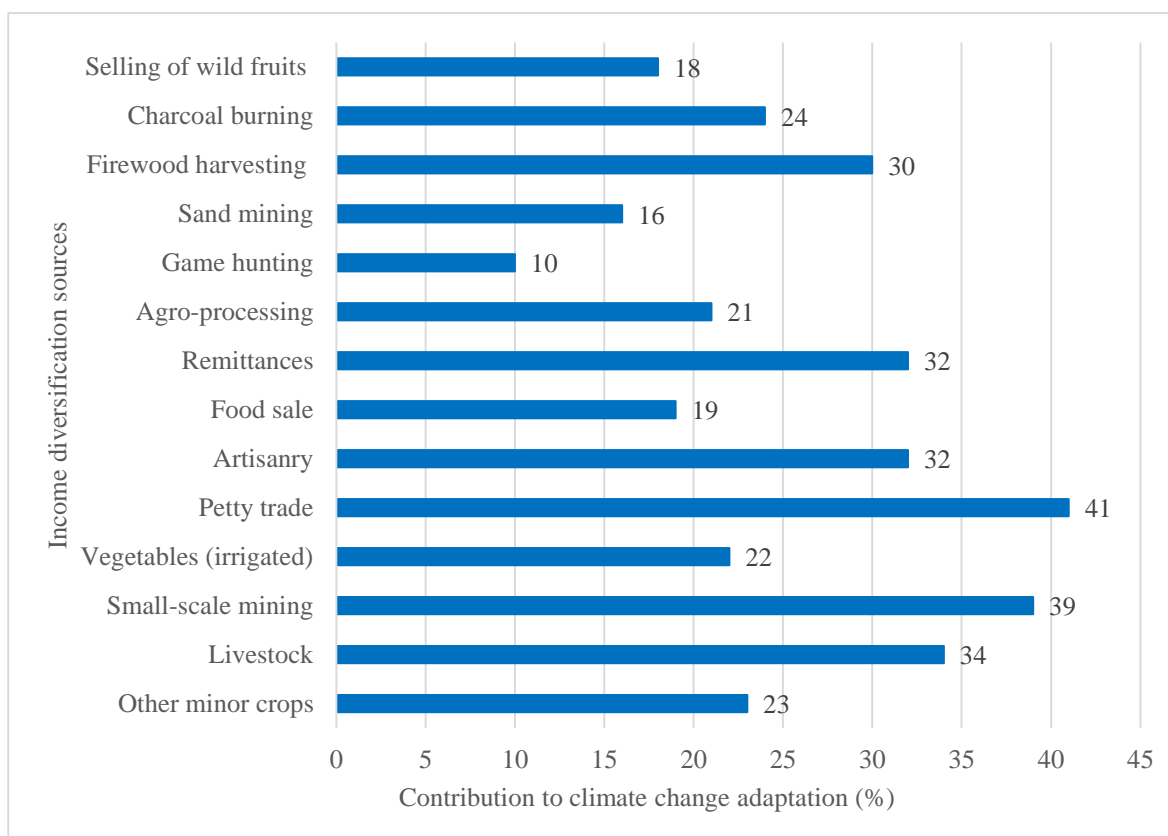
Figure 1: Income diversification contribution to climate change adaptation in the study area.
Source: Field survey (2022)

Level of Household Income Diversification in Districts.
In this section, our questionnaire survey attempted to know the level of income diversification practices the responding households had adopted as part of climate change adaptation. The level was assessed on a scale of 0-1, where 1 means the highest diversification whereas 0 means the lowest. We computed the diversified income strategies of the selected six districts using SDI. The district with the most diversified income strategies had the highest index (I_{div}) of 1 and those with the least sources had the least 0 (Figure 2).

The results show that Tempane district had the highest I_{div} value of 0.7 whereas Bawku municipality had the lowest at 0.2. The push factors for the Tempane respondents to diversify income were attributed to its high poverty rate (Ghana Statistical Services, 2021). The pull factors can be due to its large agricultural land and market access to Burkina Faso and Togo. The average value of I_{div} in the study area was 0.5. The mean degree of diversification of 0.5 was also found by Babatunde and Qaim (2009) in their study about rural Nigeria smallholders. In contrast, Dev et al. (2016) found an extremely low rate of income diversification among rural households in Bangladesh with an average SDI of 0.2. The differences in farmers, crops, and locations could have accounted for this variation. The higher degree of diversification recorded by farm households in the study area could be attributed to its good accessibility to city, mining activities, and food trade opportunities with Burkina Faso and Togo.
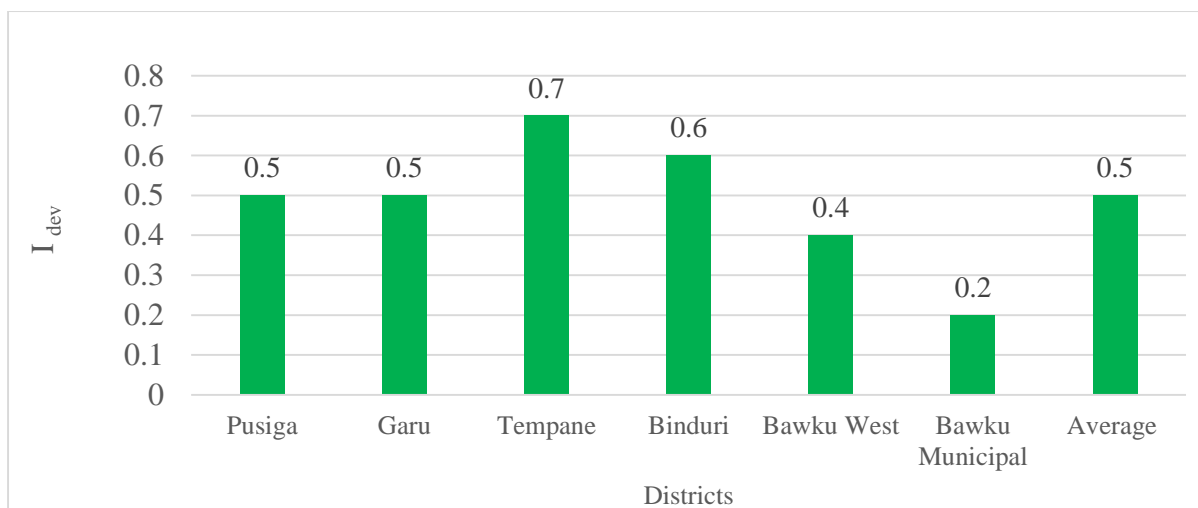
Figure 2: The degree of household income diversification practices in the study area.
Source: Authors (2022)

Respondent's Migration as Part of Income Diversification
In this section, we asked the respondents if any household member had migrated to a city to improve their livelihood and sent remittances for the past 5 years. This was considered as part of income diversification. In response 97% of them were affirmative. This response indicates that remittance is an essential part of rural household income.

We then attempted to find factors that had contributed to household members' migration to urban areas as part of income diversification strategies. We asked them to rate their perceptions about reasons for moving to urban areas as: (1) job opportunities, (2) higher payment, (3) better facilities, (4) higher expenses, and (5) noisy environment.

The results showed that the prospect of having better facilities (82%) was the most important factor for them to move, followed by higher wage payment (69%) and more job opportunities (61%). The respondents also recognized the downside of urban living as 71% identified city living as noisy and expensive (Figure 3). Similarly, Amrevurayire and Ojeh (2016) identified amenities such as job opportunities, better educational facilities, good schools, jobs, health facilities, and transportation systems in rural areas and the availability of those amenities in urban areas served as both push and pull factors for out-migration in Nigeria.

Considering the reasons behind leaving rural areas, the responses to our question indicate that the main reasons were not so much for income diversification; rather, the respondents had concerns about the quality of life in terms of welfare and social service accessibility. Warner et al. (2010) observed that a combination of environmental push and pull factors determined many migration flows, although they never act alone. Deshingkar (2004) similarly found that household incomes may or may not increase after urban migration. De Haas (2006) argued that farmers' migration to urban areas lead to the decline of farm production and more dependence on remittances.
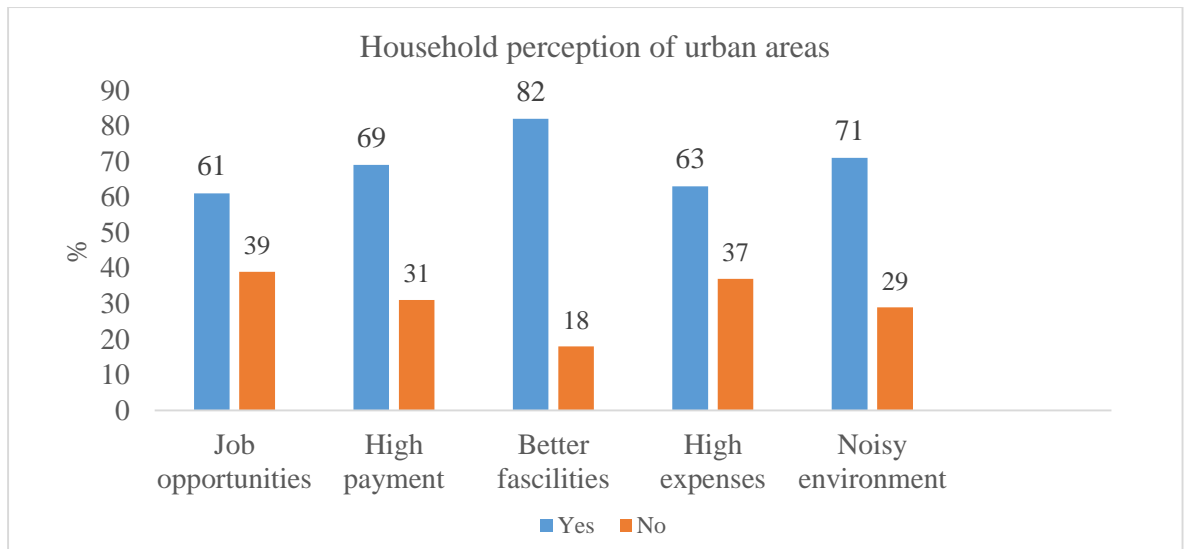
Figure 3: Rural households' perception of migration as an income diversification source
Source: Field survey (2022)

Correlations between Socio-Demographic Characteristics and Income Diversification Strategies

To have more insights into the relationship between farmers' socio-demographic characteristics and their income diversification strategies in northeastern Ghana, we performed a Pearson correlation analysis (Table 1). The socio-demographic factors include age, education, gender, household size, farm size, farming experience, and marital status.

The analysis results show that, overall age, education, farming experience, and farm size were statistically significant with our respondents' income diversification choices for petty trading, small-scale mining, firewood selling, irrigated vegetables and livestock rearing in varying degrees. Here, age was negatively correlated with labor intensive firewood selling and petty trading. These activities are done mainly by young farmers. A similar result was found by Apata (2010) and Karugia et al. (2006) regarding Nigeria and western Kenya, respectively. A low education level was significantly correlated with small-scale mining and petty trading. A similar finding was discussed by Watete et al. (2016) regarding the case in northern Kenya.

Regarding farm size and experience, we found that respondents' household income increase was significantly correlated to a farm size increase. A similar result was found in India's West Bengal and Assam Plains, where land size was identified as one of crucial factors that induced off-farm diversification (Mandal and Bezbaruah, 2013). Regarding farming experience, we found that as farmers were gaining more experience, they specialized in farming activities (vegetables and livestock rearing) and rely little on non-farm income diversification. In contrast, Ullah et al. (2015) reported that the farming experience had negative decisions of adopting on-farm diversification to manage risk in rural Pakistan.

Table 1: Correlation between socio-demographic characteristics and income from diversifying the following strategies.

Variable	Firewood selling		Small-scale mining		Petty trade		Vegetables (irrigated)		Livestock rearing	
	r	*P-value*	*r*	*P-value*	*r*	*P-value*	*r*	*P-value*	*r*	*P-value*
Age	-0.16	0.004*	-0.04	0.461	-0.16	0.004*	0.09	0.160	0.124	0.18
Education	0.08	0.154	0.11	0.049*	0.12	0.028*	-0.08	0.180	0.154	0.11
Farm size	0.04	0.472	0.45	0.001*	0.12	0.032*	0.21	0.068	0.272	0.45
Farming experience	-0.03	0.190	-0.05	0.332	-0.10	0.071	0.13	0.019*	0.120	0.02*

*P-value <0.05, r = the correlation coefficient
Source: Authors computation (2022)

CONCLUSION AND RECOMMENDATION

This paper examined how income diversification strategies contributed to smallholder farmers' livelihoods in the Upper East Region of Ghana. As rain-fed agriculture is the primary source of livelihoods for smallholder farmers, it has compelled them to look for income diversification strategies to adapt to their climate vulnerability. Most of our respondents had diversified their off-farm income sources, such as firewood selling, petty trade, and small-scale mining. Relatively more experienced farmers found ways to diversify income sources on farms by irrigating vegetables and adding more animals for livestock rearing. Smallholder farmers' income diversification contributed on average 38% of the total household income. The SDI analysis results indicated different levels of income diversification strategies among districts. The Tempane respondents diversified more than those in other districts due largely to their foreign market accessibility, land availability and poverty. Remittances were an essential part of household incomes for the respondents although most of the respondents were not simply pushed by difficult economic conditions. More than 80% had migrated either permanently or seasonally to urban areas mainly in search for both better facilities and higher income opportunities. Our correlation analyses found that age, education, farm size, and farming experience significantly impacted the respondents' income diversification choices. Considering these determining factors, we argue that smallholder farmers can still have room for sustainable living in the study area if they can obtain better education through agricultural extension officers along with better social facilities and market accesses. Another long-term solution can be done by better roads and mobility to allow smallholders to commute to cities without compromising their farming activities.

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