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INCOME DIVERSIFICATION, SOCIAL CAPITAL, AND SUSTAINABLE LIVELIHOODS IN GHANAIAN MINING COMMUNITIES

BY

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ABSTRACT

Income diversification is an essential strategy for managing economic and environmental shocks and reducing rural poverty in developing countries and as such, the study examined the income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities. Guided by the explanatory research design, the study utilised the quantitative research approach to measuring and also employed the Partial Least Squares Structural Equation Model (PLS-SEM version 3.0) for data analysis as demanded by the specific objectives. The findings suggest that individuals in mining communities in Ghana employ a variety of income diversification strategies, including entrepreneurship, agricultural activities, remittances from family members working elsewhere, ecotourism and community-based tourism, micro or small-scale businesses, to mitigate the risks associated with reliance on a single income source from mining activities. Additionally, the study notes that social capital alone has an insignificant impact on sustainable livelihoods, and social capital endowment exhibits a negative and statistically significant influence. In light of the identified constraints, the study recommends targeted interventions. Improving market access and financial services, providing training and technical assistance, and advocating for government support emerge as critical strategies to promote income diversification and enhance the overall livelihoods of community members.

KEYWORDS

Income Diversification

Social Capital

Sustainable Livelihoods

Partial Least Squares Structural Equation Model

DEDICATION

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CHAPTER ONE

INTRODUCTION

Ghanaian mining communities have historically depended on mineral extraction as their primary economic activity. However, the volatility of global commodity prices and the environmental degradation associated with mining have underscored the necessity for income diversification to ensure sustainable livelihoods (Owusu et al., 2020). Social capital, encompassing networks, trust, and community engagement, plays a pivotal role in facilitating access to alternative economic opportunities and resources (Asante et al., 2023). In regions like the Tarkwa-Nsuaem Municipality, the interplay between income diversification and social capital is critical, especially as communities face challenges such as environmental degradation and resource depletion (Yeboah, 2020). This study aims to explore the relationship between income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities, providing insights into how households navigate economic uncertainties and leverage social networks for improved well-being.

Background to the Study

Ghana is one of Africa's leading gold producers and ranks among the top ten gold producers worldwide. The mining sector is crucial to Ghana's economic development, significantly contributing to the country's gross domestic product (GDP) and accounting for over half of its export and foreign exchange earnings. According to the Ghana Investment Promotion Centre (2022), the mining industry consistently contributed more than 7 percent to Ghana's GDP from 2018 to 2020.

However, in 2021, this contribution dropped to 5 percent due to decreased gold and bauxite production. In 2020, the mining sector was the fourth-largest contributor to the country's GDP, following crop production, manufacturing, and trade.

The mining industry has significantly contributed to the government's fiscal revenue from 2018 to 2021. There was a 60 percent increase in revenue from the sector between 2018 and 2019, driven by higher commodity prices. The 5 percent mineral royalty on the total revenue generated from mining operations, paid annually to the government's revenue authority, provides a notable boost to the country's fiscal performance. Moreover, in 2020, the mining sector accounted for 18.12 percent of the total revenue collected. Ghana overtook South Africa as Africa's leading producer of gold in 2021. With a total mining production of 117.6 metric tons in 2021, Ghana is the top gold-producing nation in Africa. This statistic is a significant rise above Ghana's gold output volume of 87.6 metric tons in 2011, which was a decade earlier.

Notwithstanding the industry's enormous contributions, mining operations can have a detrimental effect on the environment and the social cohesion of the areas in which they are located. Furthermore, mining communities sometimes depend entirely on mining for their income, making them susceptible to changes in commodity prices and shocks connected to the mining industry. According to Aboka, Cobbina, and Doke (2018), Ghanaian communities engaged in small-scale mining have been plagued by a number of socioeconomic problems, environmental pollution, and land degradation. The authors claim that the

majority of these unfavourable consequences stem from regulatory bodies' inadequate supervision of the mining sector. Ghana's growth has been significantly influenced by mining. But just like any other industry, mining provides advantages as well as disadvantages for the local population in areas where minerals are located. The management of these health and environmental effects by the government, neighbouring towns, and mining firms has the potential to either make matters worse for local residents or make them better.

Globally, there is an increasing recognition of the need to promote sustainable livelihoods and reduce poverty in developing countries, particularly in resource-dependent communities such as mining communities. Alternative livelihood and income diversification strategies have been proposed as a means of promoting sustainable development in mining communities in Ghana. Income diversification is considered one of the important household strategies for securing rural livelihoods (Loison & Bignebat, 2017). This is a strategy for alleviating poverty among rural households in developing countries. Many decades ago, farming was the primary source of income for rural residents. The reallocation of labour from agricultural to non-agricultural activities has helped to improve household income in industrialised countries in the hunt for higher earnings. Diversification has recently become a typical occurrence among households, since they obtain money from a variety of sources, which may differ across households of various socioeconomic and spatial dimensions (Mahamaa & Nkegbe, 2021). Diversification is a critical adaptation method for farmers to react to market dynamics and ongoing political changes (Forleo, Giaccio, Mastronardi

& Romagnoli, 2021). It enables farmers to utilize more family labour in farm tasks while also lowering their business's economic risk.

These present the need to explore alternative livelihood and income diversification strategies as a means of reducing dependency on mining and promoting sustainable development in these communities. Thus, there is a need for empirical evidence on the determinants of income and livelihood diversification strategies, the relationship between alternative livelihood and income diversification, the moderating role of social capital endowment, and the constraints associated with alternative livelihood in mining communities.

Statement of the Problem

Illegal mining operations have increased most recently in Ghana, affecting the whole nation. The reasons for this are that there are less job prospects in the formal sector, young people are not interested in farming, and gold mining is seen as profitable (Hilson, 2010; Hilson, Amankwah & Ofori-Sarpong, 2013; Kwadwo et al., 2016; Obeng et al., 2019). Even while several studies (Hilson et al., 2013; Kwadwo et al., 2016) have already mentioned illicit gold mining as a means of diversifying one's source of income, the activities are most well-known for their terrible consequences on the environment, especially on water bodies and agricultural land. Because of this, a lot of people think that the practice is unclean, unproductive, and unsustainable (Ofosu-Mensah, 2010; Henseler, Ringle & Sarstedt, 2015; Ericsson & Löf, 2019; Atta & Tholana, 2021).

The issues of small-scale and illegal mining activities and the challenges associated with them have become a topical political discourse at the national level (Amoako, Adarkwa & Koranteng, 2022). It has engendered the interests of politicians, traditional leaders, international development organisations, and other interested stakeholders. Successive governments have embarked on policy initiatives aimed at regulating and controlling the sector, in a bid to minimise or curtail the negative consequences associated with illegal mining activities (Saaka, 2022). The current government, through its Ministry of Environment, Science, Technology, and Innovation implemented Operation Vanguard, Galamstop Taskforce, and other policies which led to the seizure of mining machinery such as excavators and the arrest, detention, and deportation of Chinese who were found to be engaging in such activities. There have been several arguments that the fight against illegal mining has become daunting and very problematic owing to the roles played by known politicians and traditional leaders (Gaisie, 2024).

Mining is a crucial sector of the Ghanaian economy, which contributes considerably to the economy's foreign exchange earnings, employment opportunities, and socio-economic development (Yeboah & James, 2022; Boateng, Wisdom & Atiku, 2025). Despite its importance, mining activities often lead to negative environmental and social impacts, including the displacement of communities, land degradation, and loss of biodiversity. Moreover, mining communities often rely solely on mining for their livelihoods, leaving them vulnerable to fluctuations in commodity prices and mining-related shocks (Moejane, 2022). Alternative livelihood and income diversification initiatives

have been proposed as strategies aimed at mitigating the negative implications of mining and promoting sustainable development in mining communities. These initiatives seek to provide alternative sources of income and employment opportunities, reduce dependency on mining, and enhance the overall well-being of these communities (Money & Money, 2025).

Although the issue of illegal mining has become a major concern, attracting the attention of policymakers, environmentalists, and researchers, much of the existing research has primarily focused on its environmental and health impacts (Yamarak & Parton, 2021). Studies have examined issues such as land degradation, water pollution, and occupational health hazards in mining communities (Mensah et al., 2022; Adu-Gyamfi, 2023). However, limited empirical evidence exists on the economic resilience of residents, particularly regarding alternative livelihood options and sustainable livelihood strategies. This gap in the literature leaves critical questions unanswered about how mining communities can achieve long-term economic sustainability beyond extractive activities. The present study seeks to address this gap by examining the role of income diversification and social capital in enhancing sustainable livelihoods in Ghanaian mining communities, offering empirical insights to inform policy and community interventions.

Purpose of the Study

The purpose of this proposed study is to explore the relationship between income diversification and livelihood sustainability in mining communities in Ghana.

Objectives of the study

The specific objectives of the study are:

1. To explore the determinants of income and livelihood diversification strategies.

2. To investigate the relationship between income diversification and sustainable livelihood.

3. To examine the moderating role of social capital endowment in the relationship between alternative livelihood and income diversification.

Research questions

The research would find answers to the following questions:

1. What are the determinants of income and livelihood diversification strategies?

2. What is the relationship between alternative livelihood and income diversification?

3. What is the moderating role of social capital endowment in the relationship between alternative livelihood and income diversification?

Significance of the study

Firstly, the proposed study would make significant contributions to the empirical literature and body of knowledge in several ways. The findings will contribute to the existing literature on sustainable livelihoods and help to identify the factors that promote or hinder income and livelihood diversification strategies in resource-dependent communities. The findings will provide insights into the extent to which alternative livelihood options can reduce dependency on mining

and promote sustainable development in mining communities. Also, the findings will contribute to the existing literature on social capital and livelihoods and help to identify the conditions under which social capital can enhance the effectiveness of alternative livelihood options in mining communities.

Finally, the proposed study makes significant contributions to the decision-making framework of practitioners by providing empirical evidence that can inform their decision-making about interventions aimed at promoting sustainable livelihoods and reducing poverty in mining communities. Practitioners can make decisions about interventions that promote the development of social capital in mining communities as a means of enhancing the effectiveness of alternative livelihood options. The findings can help practitioners to make informed decisions about interventions that are tailored to the needs of mining communities and promote sustainable development in these communities.

Delimitation of the Study

This study focuses on examining income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities. The research is specifically limited to mining communities in Ghana, assessing how income diversification strategies and social capital contribute to the sustainability of livelihoods. The study will analyse key factors influencing income diversification, including economic, environmental, and institutional determinants, while also exploring the role of social capital in enhancing access to resources and financial opportunities. Additionally, the research will provide insights tailored to the unique socio-economic and policy context of Ghanaian mining communities.

While the findings may have broader implications for other resource-dependent communities, the study's recommendations are designed specifically for mining communities in Ghana.

Limitations of the Study

Despite its contributions, the study has some limitations. First, data collection is limited to selected mining communities in Ghana, which may restrict the generalizability of the findings to other regions or countries with different socio-economic conditions. Additionally, the study relies on self-reported data from respondents, which may introduce potential biases or inaccuracies due to recall issues or subjective perceptions. Another limitation is the dynamic nature of income diversification strategies, which are influenced by external factors such as policy changes, market fluctuations, and climate variability; these evolving conditions may impact the long-term applicability of the study's findings. Furthermore, constraints in accessing detailed financial records and business data of community members may limit the depth of financial analysis. Despite these challenges, the study employs robust methodological approaches to ensure the reliability and validity of the findings.

Organisation of the Study

The study would be organised into five chapters. The first chapter will introduce the background, purpose, research questions, and significance of the study. Key concepts such as income diversification and sustainable livelihoods in mining communities will be defined. The second chapter will present a literature review examining existing research on income diversification strategies and their

impact on sustainable livelihood outcomes in mining communities around the world. Chapter three will outline the research design and specific methods utilized to collect and analyse data, including study location, sample, instruments, procedures, and analysis plan. Findings will be presented, interpreted and discussed in relation to previous literature and the study context in chapter four. The chapter five will summarize key findings and policy recommendations related to income diversification and livelihood sustainability and suggest directions for future research.

CHAPTER TWO
LITERATURE REVIEW

Introduction

This section of the paper elaborates on theoretical review, empirical review and conceptual framework of the entire write-up. It begins with review on mining sector in Ghana, environmental and social impacts of mining activities in communities, and income diversification and its relevance to rural livelihoods. It then continues with review of theoretical underpinnings and empirical studies on the relationship between income diversification and livelihood sustainability in mining communities in Ghana. Finally, conceptual framework and literature gaps are established at the end of this section.

Theoretical Review

There are three theories around which the current study was built and thus underpin the study. These are the Sustainable livelihoods framework, Income diversification theory and savings, and the Income diversification theory. These theories are discussed in the study in the next subsection.

Sustainable livelihoods framework

The sustainable livelihood framework serves as a comprehensive tool designed to comprehend the multitude of factors that either restrict or enhance livelihood opportunities and their interrelationships. This holistic approach aims to augment the livelihood assets of diverse households, recognizing that the poor often face trade-offs and choices in this pursuit. Livelihood assets are the skills,

resources, and endeavors required to maintain a standard of life. When a means of subsistence can withstand shocks and strains and bounce back, maintaining or increasing its resources and capacities without endangering the foundation of natural resources, it is said to be sustainable (Horsley, Prout, Tonts & Ali, 2015; Serrat, 2017).

Serrat (2017) emphasised that the sustainable framework adopts a people-centered approach, prioritizing individuals over the resources they employ. It acknowledges that households have disparate access to livelihood assets and endeavors to broaden these assets to enhance livelihood opportunities. According to Saaka (2022) the framework consists of five main parts: livelihood assets, livelihood strategies, livelihood outcomes, livelihood context, and livelihood processes. The resources and talents that individuals use to pursue their livelihood goals are referred to as livelihood assets. These assets can be classified as human, natural, physical, financial, or social. Natural assets include land, water, forests, and biodiversity; human assets include knowledge, abilities, and health. According to Saaka (2022), there are three types of assets: financial, social, and network. Financial assets include savings, credit, and remittances. Physical assets include infrastructure, tools, and equipment.

Livelihood strategies, the activities and choices individuals make to attain their livelihood objectives, fall into four categories: agricultural, non-agricultural, off-farm, and migration. Agricultural strategies involve crop production, livestock rearing, and fishing, while non-agricultural strategies encompass small-scale enterprises, wage labor, and self-employment. Off-farm strategies include

remittances, pensions, and social welfare, and migration strategies involve temporary or permanent migration for work or other reasons (Serrat, 2017). Livelihood outcomes, the results of people's livelihood strategies, span five categories: income, consumption, assets, human development, and social capital. Income outcomes measure the amount and stability of income, consumption outcomes assess the quantity and quality of food, housing, and other goods and services, asset outcomes gauge the accumulation and diversification of assets, human development outcomes evaluate improvements in health, education, and overall well-being, and social capital outcomes consider enhancements in social networks, relationships, and institutions (Serrat, 2017).

The livelihood context represents the broader environment where people pursue their livelihood strategies, divided into policy and institutional context, economic context, and socio-cultural context. The policy and institutional context involve laws, regulations, and institutions affecting livelihood opportunities. The economic context encompasses market conditions, prices, and competition, while the socio-cultural context includes social norms, values, and beliefs (Serrat, 2017). Livelihood processes are the dynamic interactions between the other four components, categorized into transforming structures and processes, influencing factors, and livelihood strategies. Transforming structures and processes refer to changes in the broader environment affecting livelihood opportunities. Influencing factors shape people's livelihood strategies, and livelihood strategies represent the activities and choices individuals make to achieve their livelihood objectives (Serrat, 2017).

The sustainable livelihood framework has found widespread application in development practice, adopted by various agencies, including the British Department for International Development (DFID). DFID's version of the framework aligns with Chambers Conway's definition, emphasizing that a livelihood is sustainable when it can cope with stresses and shocks, maintain, or enhance capabilities and assets, and not undermine the natural resource base (Bakker & Kochany, 2022). Emerging in the 1990s as a response to disillusionment with neoliberal development approaches, the sustainable livelihood framework marked a shift away from top-down, interventionist responses that viewed people as passive recipients. Its historical roots can be traced to Nobel laureate Amartya Sen's work on capabilities and wellbeing, introducing the notion that freedom to choose one's life is contingent upon social arrangements and the policy environment provided by the state (Bakker & Kochany, 2022; Horsley, Prout, Tonts and Ali, 2015; Serrat, 2017).

The Sustainable Livelihood (SL) framework considers various dimensions of livelihood, encompassing social, economic, environmental, and institutional aspects. This all-encompassing perspective facilitates a nuanced understanding of the intricate interactions influencing livelihood strategies. The framework's adaptability at both macro and micro scales makes it suitable for diverse contexts (Gaisie, 2024). Its versatility empowers researchers and practitioners to apply it to specific cases, ranging from individual households to entire communities, ensuring its relevance in various development scenarios.

A notable strength of the SL framework lies in its evidence-based and participatory methodology. It actively involves communities in assessing and defining their own livelihoods, fostering more inclusive and sustainable development interventions (Henfrey, Feola, Penha-Lopes, Sekulova, & Esteves, 2023). The people-centered approach of the SL framework prioritizes the agency of individuals and communities in shaping their own development paths. This emphasis on participation aligns with principles of empowerment and bottom-up development (Carney, 1998). The SL framework has demonstrated its policy relevance by providing a coherent conceptual and practical framework for selecting indicators to measure the interaction between mining and development (Horsley et al., 2015). This underscores its utility in addressing real-world development challenges.

Despite the usefulness of the Hilson and Banchirigah (2019) posit that despite being a widely used tool, the Sustainable Livelihood Framework (SLF) is not without its drawbacks. One primary concern raised by scholars is the conceptual ambiguity of the SLF. Despite over two decades of empirical studies, the term “sustainable livelihoods” remains highly contested. The absence of a universally accepted definition has led to diverse interpretations, potentially affecting the framework's consistency in application. This lack of conceptual clarity may pose challenges in precisely defining the scope and objectives of sustainable livelihoods.

Additionally, critics argue that the SLF tends to overemphasize livelihood strategies while inadequately addressing power relations, inequalities, and

structural issues that shape livelihood outcomes (Scoones, 2009). This limitation may hinder the framework's effectiveness in promoting transformative change, as it may not fully capture the underlying dynamics of social and economic disparities. Another critique of the SLF revolves around its representation of livelihood assets as static and external to social relations. Scholars such as Leach and Fairhead (2000) argue that by not accounting for the dynamic and relational nature of assets, the framework oversimplifies the complexities of social networks and power structures. The static portrayal of assets may overlook the fluid and interconnected nature of social relationships, potentially undermining the framework's ability to address the intricacies of community dynamics.

While the SL Framework incorporates environmental aspects, some argue that it falls short in fully integrating the dynamic relationship between livelihoods and ecosystems (Li, Cui, Lv, Song, Cui, & Tang, 2022). This limitation may compromise its effectiveness in addressing environmental sustainability challenges, as it may not capture the nuanced interactions between human activities and ecosystems. Furthermore, the evolution and shifts in focus of supporting entities, such as the UK Department for International Development (DfID) and the United Nations Development Program (UNDP), away from the SL Framework raise questions about its ongoing relevance (Small, 2007). Changes in priorities and strategic directions of these influential organizations may impact the framework's influence and adoption in development practice. As the emphasis shifts towards alternative approaches, the SL Framework's prominence and

applicability may be subject to reassessment in the evolving landscape of development initiatives.

Scoones (2019) highlighted four recurring shortcomings of the SL framework. Firstly, due to its roots in a complex disciplinary heritage that prioritizes local perspectives, the framework struggles to effectively address significant changes in the global markets and political landscape. Secondly, there has been a notable oversight in considering power dynamics and political aspects, resulting in a failure to connect discussions on livelihoods with broader debates on governance and development. Thirdly, the framework has been critiqued for not rigorously addressing the challenges posed by long-term secular changes in environmental conditions, such as the complexities of climate change. Lastly, discussions of long-term changes in rural economies and more comprehensive investigations of agricultural transformation have not been sufficiently addressed by livelihood studies conducted within the SL framework.

However, Horsley, Prout, Tonts & Ali (2015) argued that the criticisms of the Sustainable Livelihoods (SL) framework do not diminish its potential usefulness in the context of resources. They provide several reasons to support this view: (a) the SL framework can be understood as a set of principles, an analytical tool, and a development goal, allowing it to be adaptable and compatible with other models and theories; (b) its evidence-based approach can be effectively used to evaluate various theoretical assumptions about the positive and negative effects of mining; (c) the framework's ability to focus on the micro level is a valuable asset that can deepen the analysis of the mining sector's impact

on development, which has often been examined at the macro level; (d) the SL framework goes beyond merely organizing information—it helps users reframe information and knowledge from different angles, filling a gap in the resource literature; and (e) its focus on participatory methods can enhance decision-making processes in both public policy and private investment in resource-based economies.

Income diversification theory

The theory of income diversification has undergone a gradual evolution, emphasizing the idea that spreading income sources can mitigate the risk of financial loss and enhance overall income stability. Although the notion of diversifying income has historical roots, it was formally recognized as a theory in the 1960s (Jackson, 2019). Subsequently, the theory has advanced to incorporate a more nuanced comprehension of the factors influencing income diversification. Research by the American Economic Association proposed that countries also diversify their economic activities across various sectors. However, the study identified a point at which nations revert to specialization (Imbs & Wacziarg, 2003).

One may choose to diversify their income or be forced to do so. When diversifying out of need, it refers to circumstances in which a household's agricultural income is not enough to sustain a reasonable quality of life. However, diversification by choice is motivated by free will and is frequently linked to a desire for greater returns from non-farm endeavors. As households with diversified income are less vulnerable to economic shocks than those with a more

solitary emphasis, having a variety of income sources may also be seen as a risk management approach (Ellis, 2000).

The theory fails to acknowledge the drawbacks and expenses associated with diversification, such as heightened complexity, diminished focus, and the potential loss of comparative advantage. It also overlooks the diversity and variations in the dynamics of diversification across distinct regions, sectors, and time periods (Zouaoui & Zoghlami, 2023). Furthermore, the theory does not tackle the issue of determining the optimal degree and extent of diversification suitable for different farm types and markets. Additionally, the theory does not integrate the impact of entrepreneurship, innovation, and policies in facilitating and augmenting diversification efforts (Adem, 2023). However, it continues to be useful for research work and policy making. Promoting greater access to nonfarm work in Kenya has been acknowledged as a critical strategy for reducing household vulnerability (Christiaensen & Subbarao, 2005). It is crucial to take into account both the methods used by a family to diversify its income and whether or not it has a varied income portfolio in order to fully capture the many kinds of diversification.

Cimino, Vassallo, Henke, and Vanni (2021) investigate the impact of peri-urban conditions on the diversification of farm income in Italy. The study delves into the push and pull factors that empower peri-urban farmers to restructure their enterprises, formulating diversification strategies intricately linked to the urban society's demand for goods and services. Employing structural equation modeling (SEM), a statistical technique, the researchers analyze the direct and indirect

causal relationships among multiple variables. The findings reveal that peri-urban conditions significantly shape the mix and influence of factors propelling on-farm diversification. Le and Le (2020) results reveal a robust correlation between income diversification and the labor capacity of households. Unobservable, time-invariant characteristics like household ability and motivation are not thought to be responsible for the relationship between family labor capacity and greater engagement in non-farming wage activities. Rather, it is propelled by households' increased work capability. The theory of income diversity is unconstrained.

Social capital theory

Social capital is individuals investing in social connections to access embedded resources, ultimately improving the anticipated outcomes of practical or expressive endeavors. The expected returns encompass both economic outcomes (such as income) and social outcomes (social status, life satisfaction, and physical health) (Lin, 2017). Building connections based on reciprocity and trust is a necessary step in cultivating social capital (Richardson & Bourdieu, 2015). Over time, more engagement between network members can strengthen reciprocity and trust, resulting in resource sharing and a sense of duty.

Members of social networks that are based on connections characterised by reciprocity and trust have both benefits and drawbacks. Restrictions include discrimination against outsiders, group norms and punishments restricting autonomy, and the leveling of norms; benefits include lower transaction costs, solidarity, a sense of security, and access to information conduits (Coleman, 1988). According to Navarro (2016), participation, cooperation, and cohesion

inside the company increase a person's capacity for strength, creativity, and competitiveness. Thus, increasing social capital aims to increase total capital by raising the number of people who possess social capital.

Agency is a key component in utilizing social capital. On page 482 of their 2005 book, Newman and Dale assert that "social capital is a potential, agency activates it" Giddens (1979) defined agency as a person's ability to act, involving both choice and power (Newman & Dale, 2015). When people have the ability to make decisions and have access to knowledge about possible courses of action, they are said to have agency. Social capital, measured by trust and participation in social networks, was found to have a favorable impact on poverty reduction and income diversification in Chinese research. However, as the moderating effect suggests, this influence was shown to be dependent on landholding and education (Plan, 2018).

Social capital may be advantageous to both the person and the greater community. According to Putnam (2020), a person with good connections in a society with low connections is not as productive as a person with good connections in a community with strong connections. Furthermore, living in a community with strong relationships may benefit even the most isolated person. As a result, lower social capital may also have an adverse effect on group and individual productivity.

In situations where social ties are characterized by trust and positivity, networks serve as valuable social capital by impacting the effectiveness of both individuals and groups (Coleman, 1988; Paxton, 1999; Putnam, 2000). Social

capital has the potential to promote individual and private-level benefits, as illustrated by Paxton's (1999) example of a mother choosing to ask a friend for childcare rather than hiring a babysitter. Contrary to the positive effect of social capital, Navarro (2002) argued that theory has set of values that oppose the objective of solidarity from social networks. Ritchie and Gill (2007) assert networks and accompanying reciprocity norms generally bring benefits to those within the network. But social capital's external effects aren't always favorable. Negative effects like ethnocentrism and corruption may occur, even while beneficial traits like trust, collaboration, and mutual support may not always manifest. The notions of "bridging" and "bonding" social capital serve as a summary of these principles (Putnam, 2000). Coleman (1988) contended that in some situations, a particular kind of social capital that is helpful in enabling certain behaviors may be ineffectual or even harmful. Social capital's related norms and punishments have the power to both permit and restrict individual and collective behavior.

Conceptual Review

The conceptual review provides a foundation for understanding the key constructs of this study—income diversification, social capital, and sustainable livelihoods—within the context of Ghanaian mining communities. This section explores the definitions, dimensions, and interrelationships among these variables, drawing from existing literature and theoretical perspectives.

Overview of the mining sector in Ghana

Mining has played a pivotal role in Ghana's economic landscape for an extended period. The nation boasts a rich history of gold mining dating back to the 15th century. During the colonial era, gold extraction emerged as a primary economic driver in Ghana, with the British establishing numerous gold mines. By the early 20th century, Ghana had ascended to the position of the world's leading gold producer. Following Ghana's attainment of independence in 1957, the government assumed control of the mining sector (Sasu, 2023). In subsequent years, the state took active steps to assert its presence in the mining industry. Between 1957 and 1983, Ghana's mining sector was predominantly under state control. In 1961, the Ghana State Gold Mining Corporation took ownership of assets from five mines—Prestea, Tarkwa, Dunkwa, Bibiani, and Konongo. British companies opted to sell these mines due to factors like escalating production costs, a fixed gold price at US$35 per ounce as per the gold standard since 1934, and other considerations (Akabzaa & Darimani, 2001)

Presently, Ghana holds the distinction of being the largest gold producer in Africa, surpassing South Africa in 2019 by producing 4.8 million ounces. Gold stands out as the primary mineral contributing significantly to Ghana's mineral revenue, making up approximately 95% of the total (International Trade Administration, 2022). Besides gold, Ghana also commercially exploits minerals such as manganese, bauxite, and diamonds. Sasu (2023) posits Ghana holds a prominent position as a leading mineral producer in Africa, boasting significant resources such as gold, aluminum, bauxite, and mineral fuels gold mining remains

the predominant force in Ghana's mining landscape, contributing to over 90% of the country's mineral exports (Yeboah & Nyarkoh, 2022). Besides gold, Ghana also extracts other minerals like bauxite, manganese, and diamonds. According to Sasu, as of 2020, Ghana ranked as the sixth-largest manganese producer globally, with a production volume of 1.4 million metric tons.

Mining sector contribution to economic growth in Ghana

The mining industry significantly contributes to Ghana's economic advancement through several means, including the generation of revenue for the government via royalties, taxes, and dividends. In 2019, the mining sector alone accounted for 19.8% of the total domestic revenue, as noted by Sasu (2023). Furthermore, the sector plays a crucial role in providing employment opportunities for both skilled and unskilled workers. As of 2019, direct employment in the mining industry reached around 28,000 individuals, with an additional 100,000 people employed indirectly (Yeboah & Nyarkoh, 2022). Aryee (2013) states that the large-scale mining sector provides employment for 28,000 individuals, while more than 1,000,000 people are involved in small-scale activities such as gold mining, diamond extraction, sand winning, and quarry industries.

Yeboah and Nyarkoh (2022) sees gold as the prominent mineral resource in Ghana.to them the nation holds the position of the largest gold producer in Africa and is ranked among the top ten globally. The significance of gold mining extends beyond mere extraction, serving as a pivotal driver of economic growth, a source of foreign exchange earnings, and a major contributor to export revenue

for Ghana. In the year 2011, Ghana achieved a historic milestone by producing 3.6 million ounces of gold, leading to export revenues exceeding US$5 billion. Notably, small-scale miners played a significant role, contributing approximately 28% to the total gold production in that year. The cumulative Direct Investment (DI) injected into the minerals and mining sector from 1983 to 2011 amounted to a substantial US$11.5 billion (Aryee, 2013).

The income derived from mining operations has played a crucial role in facilitating the development of infrastructure and the allocation of funds to essential social services, pivotal for both economic advancement and the overall well-being of society. These investments have contributed to the enhancement of transportation systems, the construction of educational institutions and healthcare facilities, and the improvement of public utilities, among various other developmental endeavours (World Bank, 2020). The mining sector contributes to infrastructure development not only within mining communities but also beyond. Investments have been made in essential amenities such as roads, schools, health facilities, water and electricity supply, as well as other social infrastructure, as highlighted by the International Trade Administration (2022). Additionally, the mining industry actively supports local content and value addition initiatives. This is evident in the sector's efforts to encourage the utilization of local products and services, as well as the processing and refining of minerals within the country, as observed by Sasu (2022).

Environmental and social impacts of mining activities in communities

There has been a growing concern about the environmental and social repercussions of mining activities, particularly within local communities. The diverse effects of mining in Ghana encompass its impact on the environment, public health, and the socio-economic structure of the communities affected. One of the foremost challenges has been the pervasive issue of illegal mining, colloquially known as "galamsey." This illicit practice has deleterious effects on both the environment and the economy (Dery Tuokuu, Idemudia, Bawelle, & Baguri Sumani, 2020).

According to Mensah et al. (2015) revealed mining activities, particularly those associated with illegal small-scale mining, commonly referred to as “galamsey” have led to the depletion of environmental resources. This includes water, soil, the landscape, vegetation, and the overall ecosystem. The study is supported by plethora literature (see Ghana Environmental Protection Agency, 2019; Owusu et al., 2019; World Bank, 2020). These studies conclude that significant environmental degradation has occurred, particularly evident in major rivers within the region, heavily polluted due to illegal small-scale mining. The areas surrounding the mines have experienced substantial land degradation, rendering them barren and more prone to erosion, consequently diminishing their suitability for agricultural purposes and other uses. Additionally, the escalated clearing of vegetation in mining areas has negatively impacted the hydrological regimes and patterns in the western region of Ghana (Yiridomoh, 2021).

Recognising the severity of the problem, the government has implemented various measures, including the establishment of a task force dedicated to

combatting illegal mining (International Trade Administration, 2022). Addressing the issue of illegal mining represents a critical juncture for the Ghanaian mining sector. The negative repercussions on the environment and the broader economy necessitate stringent measures. The establishment of a dedicated task force signals the government's proactive stance in tackling this issue, demonstrating a commitment to preserving the ecological integrity of mining regions and safeguarding the long-term viability of the sector (Bukari, Tuokuu, Suleman, Ackah & Apenu, 2021; Hilson & Maconachie, 2020). Several campaigns against illegal mining and their harmful effect on the environment by some politicians, journalist, non-profit organization and the general public led to ban of Artisan Small Scale Mining in March 2017 and December 2018 by the Ghanaian government (Hilson, 2017; Owusu, Bansah, & Mensah, 2019). Addressing the environmental and social challenges is essential to foster sustainable mining practices in Ghana. Achieving a harmonious equilibrium between economic advancement and environmental conservation is pivotal. Crucial steps include the strict implementation and enforcement of environmental regulations, the promotion of responsible mining approaches, and the active involvement of local communities in decision-making processes. These measures are imperative for attaining sustainable outcomes in the mining sector (Aryee, 2016; World Bank, 2020).

Ghana has passed environmental laws and policies targeted at guaranteeing ethical mining methods in order to address these environmental issues. In order to minimize the effects on the environment, mining operations are

regulated and supervised by the Ghana Environmental Protection Agency (EPA). In order to reduce their ecological imprint, mining companies are required to get environmental permits and follow prescribed guidelines. Encouraging sustainable mining practices is essential to reducing the negative effects on the environment. This includes investing in environmental monitoring and rehabilitation programs, implementing efficient waste management systems, and adopting technologies and processes that reduce the use of hazardous chemicals. Additionally, fostering stakeholder engagement and facilitating collaboration among the government, mining companies, and local communities are crucial components for effective environmental management within the mining sector (World Bank, 2020).

Additionally, Ghana's mining industry is governed by a set of regulations that set forth and monitor its operations. This legal framework, which is governed by the Minerals and Mining Act of 2006 (Act 703) and its later changes, lays out the rules for mining activities. The main body of legislation governing Ghana's mining industry is this legislation. It outlines the legal requirements, procedures, and obligations for obtaining mineral rights, carrying out exploration and mining operations, and promoting social and environmental responsibility in the industry. The Ministry of Lands and Natural Resources, whose duties include developing policies and encouraging the growth of sustainable industries, is in charge of overseeing the sector. The principal regulatory body is the Minerals Commission, which is in charge of granting permits and monitoring compliance with mining laws (Yeboah & Nyarkoh, 2022).

Despite grappling with these environmental challenges, the mining sector in Ghana remains a vital contributor to the nation's economy. The sector serves as a substantial employer, engaging thousands of individuals, and stands as a considerable revenue generator for the government. In a bid to foster investment, the government has proactively established the Ghana Investment Promotion Centre (GIPC), tasked with promoting and facilitating investments within the country. Looking ahead, the prospects for Ghana's mining sector appear promising. The government has undertaken strategic measures to address the sector's challenges and has implemented policies to stimulate investment. Furthermore, the establishment of the Ghana Integrated Aluminum Development Corporation (GIADEC) reflects a commitment to advancing the country's bauxite industry. (International Trade Administration, 2022).

Additionally, the government has entered into various agreements with mining companies to initiate new mining projects and expand existing ones. Notably, in 2021, a pivotal agreement was inked with Gold Fields for the development of the Tarkwa and Damang mines. This agreement is anticipated to yield substantial revenue for the government while concurrently generating employment opportunities on a significant scale. The collaborative efforts between the government and mining companies signal a positive trajectory for the future development of the mining sector in Ghana, showcasing a commitment to sustainable growth and economic advancement (Sasu, 2022).

Income diversification and its relevance to rural livelihoods

Income diversification involves the deliberate allocation of resources and efforts by individuals or households to generate income from various sources beyond traditional or primary means. In rural livelihoods, this strategy plays a pivotal role in bolstering economic resilience and enhancing overall well-being. Income diversification serves as a safety net for rural communities in the face of economic and environmental shocks. It provides opportunities for increased income and an improved standard of living. However, it is crucial to recognize that income diversification alone cannot fully address the negative impacts of mining activities. Policies promoting sustainable mining practices and safeguarding the rights and livelihoods of rural communities are essential for fostering a balanced and equitable coexistence with the mining industry.

It serves as a risk mitigation approach for rural households, countering vulnerabilities associated with overreliance on a single income source, often linked to agriculture, which exposes families to risks like crop failure or market fluctuations. Income streams diversification acts as a buffer against such uncertainties (Ellis, 2000). The broadening of income sources also contributes to the enhancement of livelihoods by creating additional economic opportunities. Rural households, beyond agriculture, can participate in activities like small-scale businesses, livestock rearing, or non-farm employment, thereby augmenting income and elevating standards of living (Ellis; Reardon, Berdegué, Barrett & Stamoulis, 2007).

Given the susceptibility of rural communities to environmental shifts, climate variability, and market dynamics, income diversification becomes a

mechanism for households to adapt to changing conditions. This adaptability fosters flexibility and resilience in the face of uncertainties, as noted by Barrett, Reardon, and Webb (2001). Furthermore, diversified income streams empower rural families to invest in crucial aspects like education and healthcare. The augmented financial stability allows them to access better schooling and healthcare services, contributing significantly to the development of human capital (Fiszbein & Schady, 2019).

Salifu (2019) asserted that numerous impoverished rural households have not fully harnessed the advantages of income diversification, primarily because of constraints related to capital, tenuous connections to political power structures, and conflicts that negatively impact these households. In essence, the potential of income diversification as a poverty-alleviating approach can be significant if continuously scrutinized and evaluated as a policy strategy, considering its political economy dimensions. This evaluation should encompass aspects such as productivity, equity, and the sustainability of rural livelihood activities, with a specific focus on vulnerable and marginalized groups.

Mining industry significantly influences the economic and social well-being of rural communities by offering employment opportunities, fostering infrastructure development, and delivering economic benefits to the local population. While mining activities bring positive impacts, they can also pose challenges to the environment, health, and livelihoods of local residents. In Boakye Danquah, Fialor, and Aidoo (2017), mining activities was noted to exert a noteworthy impact on rural livelihoods. The study reveals adverse effects on the

income, yield value, and labor cost of non-mining communities. It further notes that farmers in mining areas diversified their livelihood strategies into non-farm and off-farm activities to augment or sustain their income. The study concludes that inadequate relations and inefficacious performance of stakeholder and regulatory institutions result in unregulated exposure and depletion of vital livelihood resources such as land, forests, and water bodies in mining communities.

Kabote (2015) underscored that mining activities contribute to the de-agrarianisation of rural communities. The research finds that mining-induced displacement of farmers from their land results in a decline in agricultural production and the loss of traditional agricultural knowledge and practices. The impact of mining on rural livelihoods extends beyond economic facets, encompassing negative effects on social and environmental aspects. For instance, mining activities may lead to community displacement, resulting in the loss of social networks and cultural practices. Additionally, mining can contribute to environmental degradation, causing the loss of biodiversity and ecosystem services

Empirical Review

This section examines existing studies on income diversification, social capital, and sustainable livelihoods in mining communities. It explores the findings of previous research, highlighting key themes as well. By analysing these studies, this review identifies gaps in the literature and provides a foundation for

understanding how income diversification and social capital contribute to sustainable livelihoods in Ghanaian mining communities.

Sustainable livelihood framework: Understanding livelihood assets and resilience

Early in the 1990s, the term "livelihoods" became more widely used in the context of international development, especially in the wake of the seminal study "Sustainable Rural Livelihoods: Practical Concepts for the 21st Century" by Chambers and Conway (Chambers and Conway, 1992). Despite being credited with coining the term "sustainable livelihoods," Wilson and Banchirigah (2009) noted that the word is still hotly debated despite its contributions to a growing body of research and more than 20 years of empirical investigations. According to Brocklesby and Fisher (2003), as viewpoints on poverty, participation, and sustainable development changed, so did the Sustainable Livelihoods (SL) framework (Chambers and Conway, 1992; Moser, 1998; Swift, 1989). They drew attention to the phrase "sustainable livelihoods," which was used by the World Commission on Environment and Development (WCED) in debates on resource ownership, basic necessities, and the security of rural livelihoods in 1987 (WCED, 1987; Conroy and Litvinoff, 1988). Sustainable livelihoods were further ingrained as a way to combine environmental and socioeconomic problems during the 1992 UN Conference on Environment and Development (Brocklesby and Fisher, 2003).

Solesbury (2003) noted that throughout the 1990s, empirical research on sustainable development was being conducted in various regions. Based on the growing body of evidence from both theoretical studies and practical experiences, some donor and development agencies decided to invest in a comprehensive program focused on the Sustainable Livelihoods (SL) framework (Horsley et al., 2015). By the late 1990s, the idea of sustainable livelihoods had evolved into a specific approach, or a set of closely related approaches, that was adopted and implemented by intergovernmental organizations (such as the Food and Agriculture Organization, the World Food Programme, the International Fund for Agricultural Development, and the United Nations Development Programme), bilateral donors, non-governmental organizations (such as CARE International and Oxfam), the British Department for International Development, and research institutions like the Overseas Development Institute in London.

The UK Department for International Development (DfID) gained prominence as a proponent of the SL framework, but with a recent change in emphasis towards rights-based methods. The UNDP, which was once a supporter of the SL framework, has also changed its focus, prioritizing the Sustainable Development Goals and, more recently, the Millennium Development Goals (Horsley et al., 2015; Small, 2017). However, the SL framework has endured in development discourse because of its crucial role in reframing human livelihood concerns as a key component of sustainability challenges.

According to Horsley et al. (2015), the SL framework made links between inputs—referred to as "capitals" or "assets"—and outputs—represented by

livelihood strategies—that linked these to a range of outcomes, including both well-known components like employment levels and poverty lines and more general framings related to well-being and sustainability (Scoones, 2019). The livelihood framework's income components—which included inputs and outputs—were easy for economists to identify and could be studied quantitatively. Sadly, as Scoones (2019) notes, some evaluations of livelihoods have been limited by this approach, ignoring more extensive social and structural aspects. The conversation has mostly focused on economic analysis due to the "asset pentagon" and "capitals" being the only topics of discussion.

The integration of changes in natural capital, or the environment, with social and economic elements, however, led to a considerable development in understanding of the potential for asset combination, substitution, and switching. This method promoted a more all-encompassing understanding of assets. For example, Bebbington (2019) saw assets as means of instrumental action (generating a livelihood), hermeneutic action (giving life significance), and emancipator action (opposing the systems through which one earns a living) (Scoones, 2019).

People use a range of capital assets to further their livelihood objectives, according to the Sustainable Livelihood (SL) framework (FAO, 2012). FAO (2008) states that assets are the cornerstone of an individual's resources and are commonly viewed as a pentagon. Financial capital includes things like savings, gold/jewellery, regular income, access to credit, and insurance; human capital includes things like labor force, health and nutritional status, skills, and

knowledge; natural capital includes things like access to land, water, wildlife, flora, and forests; social capital refers to the social trust, norms, and networks that people can use to address common challenges, mediated through kin networks and group membership; and physical capital includes things like homes, cars, equipment, and livestock.

Scholars argue that another prominent asset known as political capital, which shows ability to influence policy and the processes of government (FAO, 2008; Horsley et al., 2015). Natarajan et al. (2023) contend that the Sustainable Livelihoods (SL) Approach treated politics as a backdrop-ubiquitous yet simultaneously elusive. This concern intensified over time, particularly as development practice shifted its focus towards policies rather than politics, prioritizing "good governance" over inclusion, equity, and social justice. Collinson (2015) emphasises that a political economy approach ought to encompass a comprehensive historical and geographical perspective. It should elucidate the reasons behind the changing power dynamics and vulnerabilities of various groups over time, as well as elucidate how the actions and circumstances of one group in society impact others. Consequently, the perspective advocated is dynamic, comprehensive, longitudinal, and explanatory.

While various organizations have formulated their definitions, many adhere to the idea that livelihood involves the means of gaining a living, including livelihood capabilities, tangible assets, and intangible assets (Chambers, 2022). This concept is supplemented by a sustainability dimension, asserting that a livelihood is sustainable when it can cope with and recover from stresses and

shocks, and maintain or enhance its capabilities and assets, while not transcending both disciplinary boundaries and outdated paradigms (Robinson & Fuller, 2016). The emphasis on participatory methods endorsed by the SL approach may also contribute to improved policy and investment decisions in resource economies. These decisions could relate to private-sector Corporate Social Responsibility (CSR) initiatives at the community level or broader budget allocations for the public sector at various levels of government, encompassing district and regional levels (Natarajan, Newsham, Rigg & Suhardiman, 2022).

The Sustainable Livelihood (SL) Approach can be viewed as a set of principles that guide development interventions, whether initiated by the community or other entities. The core principle is the emphasis on evidence-based interventions, contrasting with top-down approaches that lack sufficient understanding of the community. It also serves as an analytical framework, aiding in comprehending the existing conditions and potential actions. The focus is on recognizing the available capitals, assessing their vulnerabilities, and considering institutional involvement. Moreover, it functions as an overarching development objective, where "development" entails enhancing the sustainability of livelihoods. This improvement may involve reducing the vulnerability of capitals, amplifying the contributions of certain capitals, or refining the institutional context (Horsley et a., 2015; Morse et al., 2009).

In the mining context, the term "sustainable livelihoods" has predominantly been utilized as a development objective, often interchangeably with "alternative livelihoods" (Labonne & Gilman, 2015). The aim is to diversify

rural communities, many of which face impoverishment and heavy dependence on informal artisanal mining for sustenance (Hilson & Banchirigah, 2019). However, this narrow application fails to fully capture the local realities where individuals leverage a variety of capital assets to advance their livelihood goals (Horsley et al., 2015).

Hilson and Banchirigah (2019) conducted empirical studies in three of Ghana's mining regions, revealing that most initiatives promoting "alternative livelihoods" have encountered significant resistance from the intended beneficiary groups. In this paper the approach is considered as the overall development objective which promotes sustainable livelihood in mining communities in Ghana.

Determinants of income and livelihood diversification strategies

Diversifying income and livelihoods hold immense significance in the realm of rural development, especially in regions grappling with constrained resources, environmental uncertainties, and economic vulnerabilities. The diversification of livelihoods stands as a pivotal strategy for mitigating poverty, addressing food insecurity, and enhancing the overall well-being of rural communities (Abera, Yirgu, and Uncha, 2021). It is imperative to comprehend the determinants steering individuals or households towards diversifying their income streams to formulate effective development interventions.

Abera et al. (2021) delved into the determinants of livelihood diversification strategies within the context of resettler households in the Chewaka district of Ethiopia. Authors employed a comprehensive research

approach, encompassing both qualitative and quantitative data. The study involved 384 households selected from seven sample kebeles in Chewaka district, utilizing a multistage sampling procedure. The findings illuminate that various livelihood strategies are prevalent in the study area, with agriculture being the predominant choice for 43.2% of households. Additionally, combinations of agriculture with non-farm (25.5%), agriculture with off-farm (19.3%), and a blend of agriculture with non-farm and off-farm activities (12%) were identified as significant strategies. The contribution of agriculture to total household income was found to be substantial, accounting for 72.5%, followed by non-farm activities (20%) and off-farm activities (7.5%).

The study employed a multinomial logit model, revealing that several determinants significantly influence livelihood diversification strategies. Key determinants include landholding size, educational attainment, livestock holdings, gender, age, market proximity, access to credit, annual income, training accessibility, and household size. Furthermore, Abera et al. (2021) identified various constraints to livelihood diversification in the area. Poor infrastructural development, limited working capital, absence of technical support, insufficient skill training, and a lack of awareness emerged as significant impediments to the diversification of livelihoods. These findings underscore the multifaceted nature of the factors shaping livelihood diversification decisions among resettle households. The results are consistent with the research conducted by Gebru, Ichoku, and Phil-Eze (2018), where they examine the factors influencing

livelihood diversification strategies among rural households in the Eastern Tigray Region of Ethiopia with same method.

Determine the factors influencing diversification within each specific livelihood strategy and their impact on poverty. Salam and Bauer (2022) utilizing a purposive sampling technique, a total of 153 households from three districts in Bangladesh were selected. Multinomial logistic regression and the multidimensional poverty index were employed for the analysis. The findings indicate that the age and farming experience of the household head, along with the total land cultivated by a household, significantly and negatively influence the likelihood of diversification into non-farm sector activities. They find is contrary to results from studies in Ethiopia (see Abera et al. (2021; Gebru et al., 2018). This difference can be attributed to differences in geographical area.

Alemu (2023) conducted a study to assess livelihood diversification strategies and their effects on the welfare of rural households. The research utilized cross-sectional data, comprising both quantitative and qualitative components. Employing a multistage sampling technique, 398 samples were selected from the south Gondar zone. Descriptive statistics, Tobit models, and multiple linear regression models were applied for data analysis. The descriptive statistics revealed that income derived from crop and livestock production constituted the most significant contributors (97.74%) to livelihood diversification in the study area. The Simpsons Index of Diversity, with a value of 0.4, indicated a relatively lower level of livelihood diversification in the study area. The Tobit model regression results demonstrated that factors such as education, family size,

irrigation, soil conservation, extension services, livestock, and infrastructure facilities significantly influenced the intensity of livelihood diversification. Furthermore, the multiple regression analysis indicated that livelihood diversification had a positive impact on the welfare of rural households.

Aynalem, Mossie, and Adem (2019) sought to examine and comprehend the various nonfarm diversification strategies adopted by households in Deber Elias Woreda. The researchers employed a multi-stage sampling procedure to select 120 households. The analysis involved descriptive statistics, a binary logit model, and qualitative data interpretation. The income portfolio assessment indicated that agriculture stands out as the primary livelihood activity in the study area, contributing 86.9% of the total income, while nonfarm activities contribute 5.7%, leaving the remaining 2.3% share. Notably, only 40.8% of the sampled respondents engage in nonfarm diversification activities. The results of the binary logit model regarding the determinants of nonfarm activity diversification highlighted the statistical significance of variables such as the sex and educational status of the household head, credit access, landholdings, and household size.

In the Ghanaian context, a review study conducted by Salifu (2019) uncovered that there is a positive correlation between income diversification activities and economic welfare indicators, including income, wealth, consumption, and nutrition. Nevertheless, recent empirical literature provides evidence suggesting that income diversification may also lead to increased income inequality and contribute to the marginalization of specific groups of people.

Boakye Danquah et al. (2017) investigated the impact of mining on rural livelihoods while employing a combination of quantitative and qualitative methods for data analysis. The strategies adopted and the involvement of stakeholders and regulatory institutions were examined. The multinomial logit results indicated that various factors such as gender, age, family size, leadership status of the household head, labor cost, annual household income, number of years of education, and extension training influenced the choices made by farmers regarding their livelihoods in mining communities. These findings support Agyeman et al. (2014), who finds age, years of education, households led by females, per capita household income, frequency of extension visits, owned productive assets, and the type of road were identified as significant factors influencing the income diversification of agricultural households in the Western Region.

Mahama and Maharjan (2017) employ national survey data to analyze livelihoods and the factors influencing livelihood diversification in Ghana, incorporating spatial factors into the asset framework. The research reveals that livelihoods and diversification are influenced by socio-economic factors, the characteristics of the primary livelihood activity, and spatial factors. The study underscores the importance of considering the spatial dimension when examining households' livelihoods. However, many scholars have not extensively pursued this spatial perspective. Existing studies tend to concentrate heavily on rural areas, while some exclusively examine urban livelihoods without conducting analyses that offer a comprehensive perspective on livelihoods.

Spadini (2021) assesses pre-project income diversification using various metrics including the Simpson's Index of Diversification (SID), the Margalef Index (MI), and the Share of Non-Farming Income (SNFI). Results indicate that, among the households affected by the project, pre-project income diversification acts as a protective factor against livelihood loss. However, the diversification into non-farming activities doesn't demonstrate a clear correlation with increased monthly revenues. Instead, a broader definition of diversification, encompassing expansion into agriculture-related value-adding activities, appears to be positively associated with higher monthly revenues, along with the initiation of new fishing activities.

Asare, Koomson, and Agyenim (2021) investigated the diversification of non-farm livelihoods among farmers in the Sunyani West District. The study employed a cross-sectional survey design, collecting data from 251 farmers for analysis. Data collection involved the use of an interview schedule and a focus group discussion (FGD) guide. The analytical approach encompassed descriptive statistics, binary logistic regression, independent sample t-test, Chi-square test, and one-way analysis of variance. The research underscored the heterogeneity of the nonfarm sector, encompassing various activities, with trading emerging as the predominant one. Despite agriculture being the primary livelihood strategy for farmers, engagement in non-farm activities is influenced more by push factors than pull factors. The study identified age, association membership, farm income, and market access as significant factors influencing non-farm livelihood diversification.

In a comprehensive analysis, Tedele (2021) conducts a systematic review to delve into how the rural economy responds to existing land constraints. The study specifically investigates the driving factors behind income diversification outlooks, considering both accumulative and survival strategies across spatial and temporal dimensions. The research emphasizes the significance of various factors such as skills, capital (both financial and physical), and multiple constraints. Small land sizes, high unemployment rates, social tension, migration patterns, and the crowding out effect on the nearest towns are identified as key components influencing these strategies. The study's findings underscore the impact of rural market failures, particularly in land and finance sectors. These market failures compel subpopulations with lower financial means to opt for strategies that yield lower returns. Conversely, wealthier populations are observed engaging in higher return strategies, benefitting from lower marginal and entry costs of participation. However, Abera et al. (2021) contended that the state of livelihood diversification in resettlement areas of Ethiopia has been relatively understudied, with limited knowledge available regarding the determinants influencing the livelihood strategies adopted by resettled households.

Income diversification and sustainable livelihood

In Ghana, diversifying income has emerged as a crucial strategy for poverty reduction and the advancement of sustainable livelihoods. The rural populace in the country has expanded their sources of income by participating in non-agricultural pursuits such as trading, artisanal mining, and small-scale manufacturing. Various factors, including diminishing farm productivity,

restricted access to credit, and the necessity to supplement farm earnings, have propelled this diversification (Atuoye, Antabe, Sano, Luginaah, and Bayne, 2019; Asare et al., 2021; Mahama and Maharjan, 2017). An advantageous outcome of income diversification is its capacity to diminish the susceptibility of rural households to economic shocks. In Ghana, it has been observed that diversifying income streams is an effective strategy for lessening vulnerability to economic shocks like droughts and floods (Agyeman, Asuming-Brempong, & Onumah, 2014). This effectiveness arises from the fact that households, through diversification, become less dependent on a solitary income source, enhancing their ability to withstand economic disturbances.

Additionally, income diversification contributes to the promotion of sustainable livelihoods. Sustainable livelihoods, characterized by resilience to economic, social, and environmental shocks, and the ability to provide a decent standard of living, can be fostered through income diversification. By offering households a variety of income sources that are less susceptible to economic shocks, income diversification helps diminish the risk of households descending into poverty and supports long-term economic growth (Asare et al., 2021). Nonetheless, income diversification is not devoid of challenges. Striking a balance among multiple income sources proves to be difficult for households engaged in diversification, potentially leading to stress and burnout (Agyeman et al., 2014). Another obstacle is the limited access to credit for non-agricultural activities. Many rural households in Ghana encounter challenges in obtaining

credit, hindering the initiation and sustainability of non-farm activities (Atuoye et al., 2019).

Atuoye et al., (2019) investigated the relationship between income diversification and household food insecurity in the economically deprived Upper West Region of Ghana. Utilizing multivariate ordered logistic regression, the study revealed that household heads who indicated high levels of income diversification were more prone to report severe food insecurity ($OR = 1.09$, $p \leq 0.001$). Additionally, households with lower socioeconomic status compared to the wealthiest ones, and those led by widows in contrast to those led by married individuals, were more inclined to report severe food insecurity.

Agyeman et al. (2014) examined the factors influencing income diversification among agricultural households in the Western Region of Ghana. They employed a censored Tobit regression model to identify the determinants of the extent of income diversification, measured by the Simpsons Index of Diversity (SID). The findings reveal that 65% of households participate in non-farm income activities. The calculated Share of Non-farm Income (SNFI), which constitutes 29.05% of the overall household income, and the SID, measuring 0.338, were determined to be relatively low.

Anaman and Adjei (2021) conducted a study to identify the factors impacting income diversification and the correlation between income diversification and the economic well-being of rural households in the Volta Region of Ghana. The data for this research were derived from 894 randomly selected households, obtained through the most recent round of the Ghana Living

Standards Survey conducted by the Ghana Statistical Service from October 2016 to October 2017. The findings revealed that the overall diversification of household income, as measured by the Simpson Index, was positively influenced by the age of the household head, remittances received by the household, and the size of the household.

Employing an alternative measure of diversification, the number of income-based activities (NIBA), the authors observed a cubic relationship between the age of the household head and NIBA, resembling an S-shaped curve. Specifically, income diversification declined during the early years, from 17 to 31 years, increased from 31 years to 74 years, and then declined again during the advanced age and retirement period of the household head. Additionally, the study identified several positive drivers of NIBA, including moderate levels of formal educational attainment, remittances, household size, and access to electricity.

Social capital endowment, alternative livelihood, and income diversification

Social capital represents a vital asset for rural communities in developing nations, encompassing networks, norms, and trust that foster cooperation and coordination among individuals and groups. This resource plays a crucial role in facilitating alternative livelihoods and income diversification in rural settings. Alternative livelihoods refer to income-generating activities outside of agriculture the term "alternative livelihood project (ALP)" is commonly employed to describe initiatives designed to decrease the occurrence of environmentally harmful activities by replacing them with less impactful livelihood endeavors that offer

comparable benefits. Although extensively applied in conservation efforts, the effectiveness of ALPs came under scrutiny in 2012 when an International Union for Conservation of Nature resolution called for a thorough evaluation of these projects due to concerns about their unproven efficacy (Wright et al., 2016).

Income diversification involves earning income from various sources. Both these strategies are fundamental in the context of poverty reduction and the promotion of sustainable livelihoods in developing countries (Habib, Ariyawardana & Aziz, 2023). In a research project undertaken by Vimefall and Levin (2023) in Kenya, the study examines the complete spectrum of income-generating activities at the household level. Moreover, it takes into consideration various types of female-headed households, each encountering distinct constraints. The results indicate that not only do female-headed households diversify and amalgamate their incomes in distinct ways compared to male-headed households, but there are also variations among different categories of female-headed households.

In Ghana, social capital has been recognized as a pivotal resource for advancing alternative livelihoods and income diversification (Hu, Yao, & Xiong, 2023). The rural population in the country has diversified their livelihoods by participating in non-farm activities such as trading, artisanal mining, and small-scale manufacturing (Abenakyo, Sanginga, Njuki, Kaaria & Delve, 2008). This diversification is attributed to various factors, including diminishing farm productivity, restricted access to credit, and the necessity to supplement farm incomes (Djordjević-Milošević & Milovanović, 2020).

One advantage associated with social capital is its ability to facilitate the promotion of alternative livelihoods. Social capital plays a crucial role in enabling access to vital components such as information, resources, and markets, all of which are pivotal for the success of alternative livelihoods (Hu et al., 2023). In Ghana, social capital has proven to be an effective resource for encouraging diverse income-generating activities, such as beekeeping, poultry farming, and soap making (Abenakyo et al., 2008). This effectiveness stems from social capital's capacity to overcome the common barriers that often hinder rural households from participating in alternative livelihoods.

Furthermore, social capital contributes to the promotion of income diversification. By facilitating access to credit, a critical factor in initiating and sustaining non-farm activities, social capital becomes instrumental in supporting income diversification efforts (Djordjević-Milošević & Milovanović, 2020). In Ghana, social capital has demonstrated its effectiveness in promoting income diversification among rural households (Habib et al., 2023; Hu et al., 2023). This is attributed to social capital's role in overcoming the barriers to credit access that frequently impede rural households from engaging in income diversification. However, it is essential to acknowledge that social capital is not exempt from challenges.

Building and maintaining social capital can be a complex task, given that it relies on the development of trust and reciprocity, which often necessitates a considerable amount of time (Abenakyo et al., 2008). However, enhancing social capital is a potent method to enhance communities, demanding sustained and

efficient strategies for constructing and fortifying both social and human capital. Additionally, accessing social capital can be challenging for marginalized groups, including women and youth, who frequently encounter limited entry points to the networks and resources essential for building social capital. This underscores the importance of addressing these challenges to ensure that the benefits of social capital are equitably distributed across diverse segments of the population. Habib et al. (2023) contends that there has been limited exploration of the relationship between social and physical capital concerning livelihood diversification.

In the United States, this research utilizes social capital theory to assess the perceived economic and social impacts of programs supporting immigrant farmers, as reported by agricultural educators. The study employed a combination of methods, including a nationwide survey and case studies focusing on programs in Ohio and Virginia. The findings revealed that economic results were linked to the cultivation of social networks and agency, while social outcomes were influenced by trust and reciprocity (Hightower, Niewolny & Brennan, 2017).

Hu et al., (2023) utilize sustainable livelihood theory and social adaptation theory to establish an analytical framework for life satisfaction. Their findings indicate that, firstly, the mean value of livelihood capital among the sampled herding households is generally below the medium level, while the mean values for social adaptation are above the medium level, and life satisfaction among herders is also above the medium level. Secondly, financial and natural capital play more significant roles in determining the level of livelihood capital. Lastly, both livelihood capital and social adaptation exhibit a substantial positive impact

on pastoralists' life satisfaction, suggesting that higher levels of livelihood capital and social adaptation lead to enhanced livelihood capacity, improved social relations, and increased life satisfaction

Abenakyo et al., (2008) conducted an assessment of social capital levels and dimensions, exploring how social capital influences various other livelihood capitals. In a cross-sectional survey involving a randomly selected sample of 208 households in Masindi and Hoima Districts, Uganda, the study aimed to evaluate existing livelihood conditions and strategies for enhancing rural livelihoods. Social capital played a pivotal role in empowering women, fostering their participation in decision-making processes, facilitating asset base creation, and promoting the adoption of natural resource management technologies. Notably, there was a significant correlation between the level of social capital and engagement in collective farming. Households with high social capital exhibited heightened community trust, reciprocity, and women's confidence. However, noted that there was no significant impact of social capital on household income.

In an extensive two-part examination of literature focusing on livelihood capital and strategies for diversification, as conducted by Habib et al., (2023), it is indicated that human, natural, and financial capitals emerge as the principal assets influencing livelihood diversification strategies. Notably, the exploration of the roles played by social and physical capital in livelihood diversification remains limited. The adoption of diversification strategies is significantly influenced by factors such as education, farming experience, family size, landholding size, access to formal credit, access to markets, and membership in village

organizations, according to the evidence presented in the study. In their review, Wright et al., (2016) suggested, among other recommendations, employing a sustainable livelihoods approach to comprehend the role and function of environmentally harmful behaviors within livelihood strategies.

Gaps in Literature

Although the issue of illegal mining has become a major concern, attracting the attention of policymakers, environmentalists, and researchers, much of the existing research has primarily focused on its environmental and health impacts (Yamarak & Parton, 2021). Studies have examined issues such as land degradation, water pollution, and occupational health hazards in mining communities (Mensah et al., 2022; Adu-Gyamfi, 2023). However, limited empirical evidence exists on the economic resilience of residents, particularly regarding alternative livelihood options and sustainable livelihood strategies.

It was obvious that there is no study on the moderating function of social capital on the influence of income diversity on sustainable livelihood in the country. Also, very few studies, globally, uses structural equation model for their analysis and interpretations. Studies on income diversity and alternative livelihood focused on residents in the community without clear cut on workers in the mining companies. This paper concentrates on management and staff of government agencies, NGOs and mining companies in the selected mining communities in Ghana. This will help fill the gap on the perspective of workers in the debate of income diversity and sustainable livelihood in Ghana

Conceptual Framework

The purpose of the study is to assess the moderating effect of social capital on the relationship between income diversification and livelihood sustainability in mining communities in Ghana. Concluding from the theoretical and empirical review, the author constructs the framework below.

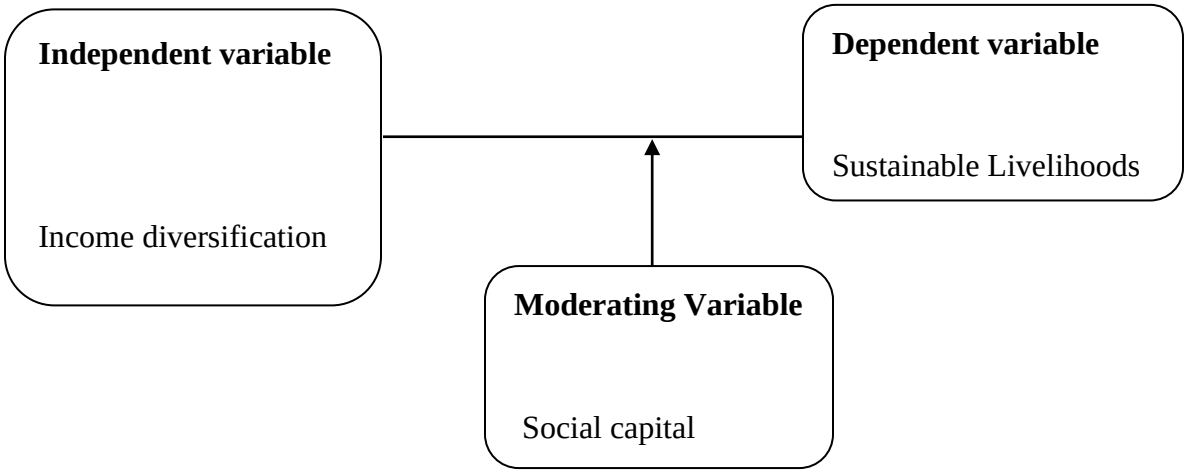

Figure 1: Conceptual framework

Source: Author's own construct (2024)

The conceptual framework of this study is built on the interrelationship between income diversification, social capital, and sustainable livelihoods within Ghanaian mining communities. These three variables are interconnected, influencing one another in a cyclical manner. In mining communities, reliance on

a single income source—mainly mining—makes households vulnerable to economic shocks such as price fluctuations, resource depletion, and government crackdowns on illegal mining. Engaging in alternative income-generating activities enhances economic resilience, contributing to sustainable livelihoods by ensuring continuous income flow and reducing dependency on mining (Owusu et al., 2020). Social capital does not only facilitate income diversification but also directly influences sustainable livelihoods. High levels of trust and cooperation within communities enhance collective action, allowing members to share resources and knowledge that contribute to long-term economic and environmental sustainability (Yeboah, 2020).

Chapter Summary

This section of the paper has review framework and theories, and empirical work on the moderation role of social capital on the influence of income diversity on sustainable livelihood in mining communities in Ghana. The study employed sustainable livelihood framework, income diversity theory and social capital theory. The section began with a review on key concepts such as income diversity, sustainable livelihood and social capital. Empirical review shown consistent results in factors determining sustainable livelihood.

CHAPTER THREE
RESEARCH METHODS

Introduction

This chapter addresses the structured methods employed to elucidate the moderating role of social capital in the relationship between income diversity and sustainable livelihood in selected communities in Ghana. Specifically, the chapter outlines the research design and the rationale, study design, approach, data gathering processes, the origins and assessment of variables, substantiated with empirical reasoning. It also highlights the research framework and the analytical method. Ultimately, this chapter discusses the estimation techniques and diagnostic tests.

Research philosophy

The concept of a research paradigm, as initially defined by Kuhn (1962), refers to a shared conceptual framework among a group of researchers. This framework offers a convenient model for analysing problems and discovering solutions within a study. In essence, it can be defined as a research environment characterized by shared views, morals, and assumptions among a group of scholars concerning the nature and execution of a study (Kuhn, 1962). The research paradigm reflects the philosophical foundations of a scientific inquiry and the methodological approach considered most apposite for the research's objectives, context, and scope (Hallebone & Priest, 2017).

Positivism and interpretivism represent the two primary globally recognized approaches within the research paradigm. This study follows the positivist

research paradigm. Positivism emphasises objective analysis of observable facts, aiming to identify causal relationships through empirical data and statistical methods (Aliyu et al., 2014). The primary objective of this study is to provide an in-depth understanding of the relationship between income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities. This will be achieved by rigorously analyzing data to assess how income diversification enhances economic resilience, examining the role of social capital in facilitating livelihood sustainability, and identifying statistically significant relationships that contribute to long-term economic stability and well-being in these communities.

Research Approach

The study employed a quantitative approach, incorporating correlation analysis and using surveys to gather primary data. Surveys, as described by Onen (2016), are directed methodologies used to investigate a population by selecting samples to analyze and uncover occurrences. Correlation analysis will be used to assess the presence and strength of the relationship between income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities. Additionally, a case study approach will be adopted, providing an in-depth, descriptive, and holistic analysis of selected mining communities to gain deeper insights into the dynamics of livelihood sustainability. This approach enables a comprehensive exploration of the unique socio-economic dynamics and livelihood strategies within Ghanaian mining communities, providing insights that can inform policies and initiatives aimed at promoting sustainable livelihoods and income diversification in similar contexts. The survey method is preferred for its

cost-effectiveness, efficient data collection, and ability to provide insights into the population from a representative sample (Onen, 2016).

Research design

According to Zikmund, Babin, Carr, and Griffin (2013, p.66), a research design functions as a detailed plan delineating the methods and protocols for collecting and analyzing necessary information. It offers a systematic framework or roadmap for carrying out the study. Research design encompasses exploratory, descriptive, or explanatory approaches (Saunders et al., 2012). An optimal design should demonstrate adaptability, flexibility, cost-effectiveness, and strive to minimize errors and biases while improving the precision of collected data (Cooper & Schindler, 2014). Saunders et al. (2012) categorize empirical studies seeking to create cause-and-effect relationships between variables as explanatory research. This design is centered on exploring a situation to clarify the connections between variables.

The explanatory research design was employed in this study because it goes beyond exploratory and descriptive analysis and emphasises the relationship among variables in predicting the outcome of particular social phenomena under investigation. The explanatory design uses deductive reasoning base on grounded theories to predict correlational outcomes (Ampah, Ambrose, Omagwa, & Frimpong, 2017). Again, explanatory study design sets out to explain and account and continue to identify actual reasons for the occurrence of a phenomenon.

Population and sampling of mining communities

The research encompassed all employees within government agencies, non-governmental organizations (NGOs), and mining companies in Ghana. The target demographic included both male and female personnel across different hierarchical levels, middle, and lower-level managers, as well as non-managerial staff operating within the Obuasi Municipality in the Ashanti Region and the Tarkwa-Nsuaem Municipality in the South-Western region of Ghana. Specifically, management and staff of AngloGold Ashanti, Obuasi, Goldfields Ghana Limited, Tarkwa, and workers of Obuasi Municipal Assembly and Tarkwa-Nsuaem Municipal Assembly were used for the study.

The study employed a stratified two-stage random sampling methodology. Initially, mining communities across Ghana were identified and randomly chosen in the first stage. Subsequently, the researcher utilized stratified sampling to select two specific communities from the initially chosen ones. The selection of managers from mining companies and within these communities was facilitated using purposive sampling, while staff participants in government agencies, NGOs and mining companies were chosen conveniently from the same organizations within the communities. A total population of 1200 managers and staff were used for the study. Using a minimum sample size determining table constructed by Adam (2020), 292 respondents were used for the study. As per Mugenda and Mugenda (2003), a sample ranging from 10% to 30% is considered adequate, provided it is well-selected, especially when the elements in the sample surpass 30.

Data collection techniques

The study employs a quantitative approach, to gather data from mining communities and relevant stakeholders, including government agencies, NGOs, and mining companies. In the study, the researcher made three separate visits to the study area, comprising mining worksites, offices of NGOs, and municipal assemblies. The first visit lasted three days and served as an introductory phase. The second visit spanned four days, and the third and final visit extended over five days. The research employed a combination of qualitative and quantitative data collection approaches, aiming to explore the intricate phenomenon of income diversity and alternative livelihood in Ghana's mining communities.

To address the complexity of the research problem, the study utilized the quantitative approach for the data collection. The instruments designed for data collection included a survey questionnaire. The survey instrument used a Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree") and comprised five items measuring demographic features; 10 items measuring the income diversification component; and nine items for sustainable livelihood, social capital, and income diversity strategies.

Variables and Measures

The definitions and operationalization of the variables and measures for the proposed study are:

Independent Variables:

Socioeconomic factors: These are variables related to households' socioeconomic status, including education level (highest level of education attained), income level (total annual income from all sources), and occupation (main source of income).

Demographic factors: These are variables related to households' demographic characteristics, including age, gender, and household size. Operationalization: Age (mean age of household head), gender (proportion of female-headed households), household size (number of household members).

Institutional factors: These are variables related to the institutional environment in mining communities, including access to credit (proportion of households with access to formal or informal credit), access to markets (proportion of households with access to local or regional markets), and access to extension services (proportion of households with access to agricultural or other extension services).

Dependent Variables:

Income diversification: This refers to the degree to which households have diversified their income sources, such as number of income sources (count of different sources of income reported by households) and income portfolio diversification index (weighted index based on income shares of different sources).

Livelihood sustainability: This refers to the ability of households to maintain their livelihoods over time. The measures include the livelihood

asset index (weighted index based on the availability of physical, financial, human, and social assets), and the livelihood resilience index (weighted index based on the ability to cope with shocks and stresses).

Moderating Variable:

Social capital endowment: This refers to the level of social capital resources available to households. The measure for this is the social capital index (weighted index based on social network size, norms, and trust).

The data for the above variables will be generated from survey questionnaires, using Likert scale. The questionnaires will be administered to gather data from residents in mining communities and relevant stakeholders, including government agencies, NGOs, and mining companies.

Data Analysis

Structural equation modelling (SEM) was employed to analyse the data collected from the survey questionnaire in this thesis. SEM is a statistical technique that allows researchers to test complex theoretical models that include multiple dependent and independent variables, and to examine the relationships among them. In this study, SEM was used to examine the relationships between alternative livelihood and income diversification and the moderating role of social capital endowment. The model can include exogenous variables such as household demographics and socioeconomic characteristics, and endogenous variables such as livelihood strategies, income sources, and social capital endowment.

The first step in conducting SEM is to specify a theoretical model based on the research objectives and hypotheses. The model should be based on a clear conceptual framework that defines the relationships between the variables of interest. The model can then be tested using SEM software, such as AMOS or Mplus. The analysis would involve estimating the parameters of the model, including regression coefficients and path coefficients, and assessing the goodness-of-fit of the model to the data using fit indices such as the Chi-square statistic, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI). The SEM analysis was employed to provide insights into the causal relationships among the variables and identify the most important determinants of income and livelihood diversification strategies in mining communities in Ghana.

Ethical Considerations

Pattern and Newhart (2017) identified key ethical considerations essential for any research endeavor. These ethical concerns encompassed participant consent, voluntary engagement, the right to privacy, and the confidentiality of information. Consequently, meticulous attention was devoted to addressing these ethical considerations in the design of the questionnaire. To secure participant consent, efforts were made to ensure that respondents comprehended the study's academic purpose and the importance of providing sincere responses. It was emphasized that the study's outcomes could potentially influence government policies in favor of their communities. Additionally, respondents were assured that participating in the exercise posed no potential harm. In terms of voluntary

participation, every respondent was given the freedom to engage in the data collection process voluntarily. Measures were taken to address concerns related to the right to privacy by allowing respondents to answer questionnaires independently, and clear instructions were provided for addressing any unclear questions.

The issue of anonymity was addressed by limiting the amount of detailed personal information requested on the questionnaire, such as names, contact numbers, and personal addresses. Respondents were guaranteed that their identities would not be disclosed to the public or utilized for purposes other than the study. Confidentiality of information was a top priority, and respondents were reassured that all provided information would be kept confidential. They were also guaranteed that none of the information provided would be used against them, and they had the freedom to opt out or withdraw from the research at any time. Importantly, no material rewards were offered to induce participation.

Chapter Summary

This section of the study examines the processes undertaken to analyze the research problem. It covers the research methodology, study design, study area, sampling techniques, data collection methods, and analytical tools used to investigate the relationship between income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The study sought to investigate the income diversification, social capital, and sustainable livelihoods in Ghanaian mining communities. The study was based on a quantitative research design and employed the Partial Least Squares Structural Equation Model (PLS-SEM version 3.0) for data analysis. This chapter presents the results of the study and further discusses it. The results of the study were presented based on specific research objectives.

Descriptive Statistics

Descriptive statistics of the respondents to the study's questionnaires are estimated using IBM-SPSS version 25. Using descriptive statistics, the researcher can spot significant trends, patterns, and distributions within the respondent responses. Descriptive statistics is also used to analyse the determinants of income diversification strategy, challenges, and opportunities for income diversification in mining communities in Ghana. Moreover, the study uses the Partial Least Squares Structural Equation Model (PLS-SEM version 3.0.) for the analysis of objectives three, four, five, and six. This chapter presents the results of the study and further discusses it. When using descriptive statistics, the data must be organised and summarised. Descriptive statistics, as opposed to inferential statistics, seek to characterise the data rather than generalise it to the entire population. Unlike inferential statistics, descriptive statistics are not based on

probability theory. The average is the data's central tendency, or the point at which the data are evenly spread. One figure can approximate the value of the complete data collection. A measuring range of 1 to 5 was used to ascertain the dispersion of the means. A mean value of 1.0 - 2.49 indicates poor observations, 2.50 - 3.49 indicates moderate observations and 3.50 - 5.00 indicates very high observations (Moshood et al., 2020).

Response Rate

The response rate is a crucial metric that indicates the level of engagement and participation among the target respondents. The formula for the response rate is the number of completed responses divided by the total number of potential respondents and multiplied by 100 to express the results as a percentage. The study obtained an 88.24% response rate which represents 300 out of a total of 340 respondents as a sample for the study, which signifies a high level of engagement among the target respondents. This suggests that the questionnaire effectively captured the participants' attention and interest.

Demographic information

This section presented an analysis of data on the gender, age, and educational level of respondents in mining communities, as summarised in Table 1 below. The respondents were 300 members living in the mining communities of Ghana. Table 1 presents the demographic characteristics of the study's respondents. It provides the breakdown of key demographic traits - gender, age range, and education level - among the 300 survey respondents. Analysing the gender split shows that 179 respondents representing 59.67% are male, while 121

respondents representing 40.33% are female. This demonstrates that there is a moderately higher proportion of males compared to females in the sample. In addition, examining the age ranges reveals that the most of respondents (61.67%) are between 18-28 years old. The next age category of 29-38 years accounts for 28.0% of the sample. Together, these two younger age groups make up almost 89.67% of total respondents, indicating the sample is heavily concentrated amongst young adults in their late teens to thirties. Only 7.83% are aged 39-48 years and 2.50% are above 48 years, showing very limited representation of middle-aged and elderly adults. Finally, educational attainment patterns showcase that an overwhelming majority of 90.0% of respondents had no formal education. By contrast, those with little to no tertiary education comprised less than 5% of the sample. This highlights that the sample is overwhelmingly comprised of highly formally uneducated individuals.

Table 1: Demographic information

Demographic	Frequency	Percent
Gender		
Female	121	40.33
Male	179	59.67
Total	300	100
Age Range		
18-28 years	185	61.67
29-38 years	84	28.00
39-48 years	23	7.83
Above 48 years	8	2.50
Total	300	100
Qualification		
No formal education	270	90
Primary education	8	2.67
Secondary education	15	5
Tertiary education	7	2.33
Total	300	100

Source: Field Survey (2024).

Determinants of income diversification strategies in mining communities in Ghana

The first objective of this study is to examine the determinants of income diversification strategies in mining communities in Ghana. Descriptive statistics are employed to assess the various factors influencing income diversification in these communities. Thus, the determinants constructed in this study comprised eight key elements, namely, micro or small-scale businesses, Renewable energy projects (e.g., solar panel installation), value addition and processing of agricultural products, and Remittances from family members working elsewhere. handicrafts and artisanal activities, Livestock rearing and animal husbandry, ecotourism and community-based tourism, agriculture, and crop production, and off-farm employment or casual labor. The evaluation of these variables followed the methodology outlined by Dess et al. (2016) and Horsley et al. (2015). According to these authors, the cut-off points for assessing the minimum and maximum values on the scale are defined as the midpoint minus 0.1. Considering a scale of 1 to 5 with a midpoint of 3, the cut-off point becomes 2.9 (3.0-0.1). Consequently, a mean value ranging from 1 to 2.9 signifies a low level, while 3 to 5 indicates a high level. The determination of the variables' levels is conducted individually and subsequently at the composite level using the grand mean. The normality distribution probability is done using skewness and kurtosis- to ensure data is normally distributed or not.

Descriptive Statistics

This section presents an analysis of data on determinants of income diversification strategies in mining communities in Ghana as summarised in Table 3 below. Table 3 presents the income diversification strategies employed by individuals in mining communities in Ghana, along with their respective descriptive statistics such as sample size (N), minimum, maximum, mean, and standard deviation. From the Table, the respondents indicate that many individuals in mining communities engage in setting up their small businesses to diversify their income streams with an average mean score of 4.3767 giving the lowest among the ranks.

The involvement in renewable energy projects, such as solar panel installation, is recorded an average mean score 4.4300 giving the second lowest rank. This suggests a significant interest in the adoption of renewable energy initiatives, likely driven by both economic and environmental factors. Respondents show a high level of engagement in adding value addition and agricultural products, with an average mean score of 4.4333. This indicates a recognition of the potential for increased income through processing and adding value to agricultural goods. The average score for receiving remittances from family members working elsewhere is 4.4500, indicating that many individuals in mining communities rely on financial support from relatives working outside the community to supplement their income. Engagement in handicrafts and artisanal activities is also significant, with an average score of 4.4533. This suggests that traditional skills and craftsmanship play a role in income generation for

community members. With an average score of 4.4800, this strategy indicates a considerable involvement in livestock rearing and animal husbandry among respondents, reflecting the importance of agriculture-related activities in income diversification.

The average score for involvement in ecotourism and community-based tourism is 4.4800, indicating a growing interest in leveraging natural resources and cultural heritage to generate income through tourism activities. Agriculture and crop production have a relatively high average score of 4.5033, indicating that traditional farming activities remain a significant source of income diversification in mining communities. The highest average mean score among all strategies is off-farm employment or casual labor with a score of 4.5333. This suggests that many individuals seek employment opportunities outside of agriculture and traditional livelihoods to diversify their income.

The findings suggest that individuals in mining communities in Ghana employ a variety of income diversification strategies, including entrepreneurship, agricultural activities, renewable energy projects, off-farm employment, remittances from family members working elsewhere, ecotourism and community-based tourism, livestock rearing and animal husbandry, micro or small-scale businesses, to mitigate the risks associated with reliance on a single income source from mining activities. This finding is in line with the study of Scoones (2019) and Natarajan et al. (2023).

Table 2: Determinants of income and livelihood diversification strategies in mining communities in Ghana

Income Diversification Strategies	N	Min	Maxi	Mean	Std. Deviation	Rank
Micro or small-scale businesses	300	2.00	5.00	4.3767	0.62404	8
Renewable energy projects (e.g., solar panel installation)	300	3.00	5.00	4.4300	0.59969	7
Value addition and processing of agricultural products	300	2.00	5.00	4.4333	0.62197	6
Remittances from family members working elsewhere	300	3.00	5.00	4.4500	0.54328	5
Handicrafts and artisanal activities	300	2.00	5.00	4.4533	0.56173	4
Livestock rearing and animal husbandry	300	2.00	5.00	4.4800	0.58085	3
Ecotourism and community-based tourism	300	3.00	5.00	4.4800	0.56922	3
Agriculture and crop production	300	3.00	5.00	4.5033	0.53317	2
Off-farm employment or casual labor	300	3.00	5.00	4.5333	0.52581	1
Valid N (listwise)	300					

Source: Field Survey (2024)

Effect of Income Diversification on Sustainable Livelihoods in Mining Communities in Ghana

The objective of this study was to assess the effect of income diversification on sustainable livelihoods in mining communities in Ghana, utilising Structural Equation Modeling (SEM). Standard criteria for results evaluation, including reflective measurement, structural model, and goodness of fit (Ramayah et al., 2016), were employed. Confirmatory Factor Analyses (CFA) were conducted using the Partial Least Squares (PLS) approach to align variables on both sides of the regression equation. The method estimates regression parameters to maximize the variance of the endogenous variable, combining factor analysis and path analysis into a rigorous statistical tool (Hair et al., 2016). PLS is particularly suitable for making measurements, predictions, and testing complex models. The study specifically employed the SEM PLS approach for the data analysis.

Before integrating a construct into the path model, the reflective measurement model estimation procedure was executed to assess construct validity and reliability. The reliability and validity tests encompassed internal consistency, indicator, convergent, and discriminant validity. Furthermore, consistent PLS yields superior power and coefficient of determination (R2) in full reflective models, as compared to traditional PLS (Hair et al., 2017). The findings align with existing literature on income and livelihood diversification in Ghanaian mining communities. For instance, Mohammed et al. (2021) identified a correlation between farm and non-farm diversification and increased resilience to

climate change among smallholder farming households. Similarly, Danquah et al. (2017) reported the adoption of various strategies, such as entrepreneurship and off-farm employment, in response to the impacts of mining on rural livelihoods.

However, some contradictions emerge in comparison to previous studies. Hilson et al. (2013) argued that artisanal and small-scale mining (ASM) in northern Ghana was not a diversification strategy but rather a survival strategy due to the lack of alternative livelihood opportunities. Additionally, Ofori et al. (2023) found that mining-induced displacement negatively affected various capital aspects of affected communities, challenging the notion that mining always creates opportunities for income and livelihood diversification. These studies highlight the impact of mining activities on rural communities, emphasizing the need for context-specific considerations.

Assessment of Test Measurement Model (Outer Model)

The outer or measurement model defines the relationships between blocks of indicators and their respective latent variables (Noor, 2015). This model is crucial for assessing the validity and reliability of the entire structural model (Ghozali, 2021). The Partial Least Squares Structural Equation Modeling (PLS-SEM) method calculates latent variable scores as linear combinations of observed variables, serving as proxies for latent variables. PLS-SEM is particularly suitable for estimating complex models, including higher-order construct modeling. Evaluation of the measurement model is the initial step before delving into the structural model, ensuring that hypothesized linkages among structural models are accurately interpreted and presented (Hair et al., 2018). In this process, the PLS-

SEM algorithm optimizes measurement model parameters before estimating path coefficients in the structural model.

Proposed methodologies guiding the evaluation of measurement model quality for reflective measurement models include assessing factor loadings, indicator reliability, internal consistency reliability, and convergent and discriminant validity. Factor loadings (FL), Cronbach's alpha (CA), composite reliability (CR), and average variance extracted (AVE) are key indicators in this evaluation. Thresholds for these values, established at 0.5, 0.6, and 0.5, demonstrate the validity and convergence of the assessment items (Hair et al., 2016; Sarstedt et al., 2017).

Factor loadings

Factor loadings show how well items represent the conceptual domain of a construct. Since Factor loadings above 0.6 are recommended (Becker et al., 2018), as part of the measurement model evaluation, items with low factor loadings (<0.60) were removed. Table 4 displays factor loadings.

Table 3: Factor loadings

Variables	Income Diversification_	Social Capital	Social Capital Endowment	Sustainable Livelihoods
ID10	0.769			
ID2	0.793			
ID3	0.733			
ID4	0.749			
ID5	0.670			
ID6	0.775			
ID7	0.815			
ID8	0.820			
ID9	0.841			
SC3		0.884		
SC4		0.866		
SC5		0.859		
SC6		0.715		
SC7		0.704		
SCE1			0.751	
SCE2			0.767	
SCE3			0.667	
SCE4			0.772	
SCE5			0.794	
SCE6			0.799	
SCE7			0.839	
SCE8			0.779	
SCE9			0.759	
SL1				0.863
SL2				0.894
SL3				0.855
SL4				0.783

Source: Field Survey (2024)

The results showed a strong loading for most of the variables which suggests a robust relationship between the observed variables and the latent constructs for ID10, ID2, ID3, ID4, ID5, ID6, ID7, ID8, ID9, SC3, SC4, SC5, SC6, SC7, SCE1, SCE2, SCE3, SCE4, SCE5, SCE6, SCE7, SCE8, SCE9 and SL1, SL2, SL3, SL4 and which had loadings of 0.769, 0.793, 0.733, 0.749, 0.670,

0.775, 0.815, 0.820,0.841, 0.884, 0.866, 0.859, 0.715, 0.704, 0.751, 0.767. 0.667, 0.772, 0.794, 0.799, 0.839, 0.779, 0.759, and 0.863, 0.894, 0.855, 0.783 respectively indicating a moderate and reasonable association. For example, income diversifications have 10 items, of which after the consistent PLS algorithm was applied, only one indicator ID1 was deleted. Social capital items loaded were seven with only SC 1 and SC2 deleted.

Construct Reliability and Validity, And Average Variance Extracted

Table 4 presents results to assess the reliability, convergent validity, and average variance extracted from the model.

Table 4: Construct Reliability and Validity and Average Variance Extracted

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Income Diversification	0.917	0.925	0.931	0.601
Social Capital	0.868	0.901	0.904	0.655
Social Capital Endowment	0.915	0.928	0.929	0.594
Sustainable Livelihoods	0.871	0.879	0.912	0.722

Source: Field Survey (2024)

The study employs two diagnostic methods (composite reliability and Cronbach's alpha) to check for internal consistency reliability. The reliability of indicators is examined from the factor loadings, where items with loadings above 0.7 were retained. Internal consistency as a reliability measure estimates how well

items on a test that one proposes to measure the same construct yield similar results. It focuses on the consistency of results delivered by a test of various items measuring the different constructs to deliver a consistent result.

Cronbach's alpha (α) tests the averages and correlation between every possible combination of split halves as well as permitting multi-level response. This test often produces a score between zero and one. The general rule is to accept .75 as an indicator of acceptable reliability. The Cronbach alpha of 0.917 for "Income Diversification" denotes a high level of internal consistency same as Sustainable Livelihoods with Cronbach alpha of 0.871. Additionally, the Cronbach alpha of 0.868 and 0.915 estimated for "Social Capital" and "Social Capital Endowment" indicates an excellent internal consistency among the included items, suggesting stronger reliability for these constructs. For each construct, the alpha values show how consistently the items assess the same underlying notion, making them an important dependability metric.

In addition to the Cronbach alpha, Composite reliability which is regarded as a more accurate measure of reliability in a PLS-SEM environment is also reported as an additional check on construct dependability (Hair *et al*, 2018). It is an indicator of the shared variation among the observed variables used as an indicator of a latent construct (Fornell and Larcker, 1981). The decision rule in the application of this test is that there should be a composite reliability score (C.R.) > 0.708. In the case of an exploratory study, a C.R. of 0.60–0.70 is acceptable. As a general rule, high values of Cronbach's alpha and composite

reliability imply high levels of reliability. Values between 0.60 and 0.70 are acceptable, whereas values above 0.70 are best (Sarstedt et al., 2021).

Average Variance Extracted (AVE) is a major way to assess the reliability of the study, according to Hair et al., (2017). The average variance extracted (AVE) provides support for convergent validity, with all AVE values meeting or exceeding the 0.5 guidelines (Hair et al., 2017; Fornell & Larcker, 1981). Average Variance Extracted (AVE) of 0.50 above shows acceptable reliability (Hair et al., 2016). For all the variables, the AVE is above 0.50 indicating a high level of reliability in the instruments. Convergent validity is evidenced by high factor loadings, all above the 0.5 benchmarks (Hair et al. 2017). The lowest AVE was 0.594 for income diversification, indicating the construct still explains a substantial amount of variance in its items on average.

Discriminant Validity Fornell-Larcker Criterion

The validity of discriminants is indicated by the results showing that the indicators of different constructions are theoretically not highly correlated with each other (Brown & Moore, 2012). Table 5 presents the results of the discriminant validity.

Table 5: Discriminant Validity (Fornell-Larcker Criterion)

Variables	Access Resources	Income Diversification_	Social Capital	Sustainable Livelihoods
Access Resources	**0.814**			
Income Diversification_	0.402	**0.775**		
Social Capital	-0.168	-0.355	**0.809**	

Sustainable Livelihoods	0.603	0.774	-0.356	**0.850**

Source: Field Survey (2024)

A discriminant validity measure known as the Fornell-Larcker criterion was developed to assess the degree of dissimilarity between one idea and another (Hair et al., 2017). Following this, the known construct-to-construct correlations were compared to each particular construct's AVE square root value (Fornell & Larcker, 1981). The results in Table 4.8 indicate that the square AVE values are consistently greater than the correlations associated with each scenario. Table 4. 8 presents the Fornell-Larcker criterion which compares the square root of the AVE values to the inter-construct correlations to assess discriminant validity (Hair et al., 2017). Specifically, the square root of each construct's AVE should exceed the highest correlation with any other construct.

All constructs meet the Fornell-Larcker criterion requirements, providing evidence that each reflects a conceptually unique underlying construct. This supports the discriminant validity of the measurement model's constructs, affirming they are sufficiently distinct (Hair et al., 2017). Meeting this critical threshold means the analysis can appropriately evaluate the structural model relationships among these variables in the next phase.

Discriminant validity Heterotrait-Monotrait Ratio (HTMT)

The HTMT criterion uses the item indicators' mean value for cross-correlations across the constructs. Table 6 shows Discriminant validity.

Table 6: Discriminant validity Heterotrait-Monotrait Ratio (HTMT)

Variables	ID	SC	SCE	SL
ID				
SC	0.378			
SCE	0.314	1.018		
SL	0.868	0.393	0.372	

Source: Field Survey (2024)

Given that the Hetero Trait-Mono trait (HTMT) was created to solve the Fornell and Larcker ratio criterion's insensitivity, it can be used to evaluate discriminant validity (Hair et al., 2017). Henseler et al. (2015) show that when the indicator loadings on a construct change relatively little, the Fornell-Larcker Criterion fails horribly. Henseler et al. (2015) suggested using the heterotrait-monotrait (HTMT) correlation ratio as an alternative (Voorhees et al., 2016). HTMT values involve comparing them to a threshold, typically 0.85. If the HTMT value for a pair of constructs exceeds 0.85, it indicates a lack of discriminant validity between those constructs.

The HTMT estimate is compared to a predetermined threshold (in this case, one (1) regarding the need). If the HTMT value exceeds this threshold (1), discriminant validity is absent; if it is lower than 1, the genuine correlation between the two constructs differs, indicating discriminant validity. Additionally, some academics suggested a 0.850 threshold (Windsong, 2018), while others suggested a value of 0.90(Geoffrey, 2019). As shown in Table 4.10, the values are less than or equal to 1, showing good discriminant validity.

Collinearity

This research looks at multicollinearity, using the VIF values recommended by Salleh et al., (2021) and Hair et al., (2017). Pathological collinearity and procedure bias are evident in models with a VIF greater than 3.3 (Kock, 2018). Table 7 shows collinearity using VIF for assessment.

Table 7: Collinearity

Variables	VIF
ID10	1.925
ID2	3.121
ID3	2.388
ID4	2.409
ID5	1.791
ID6	2.160
ID7	2.879
ID8	2.995
ID9	3.126
SC3	2.859
SC4	2.354
SC5	2.298
SC6	1.631
SC7	1.535
SCE1	2.010
SCE2	2.105
SCE3	1.701
SCE4	2.219
SCE5	2.919
SCE6	2.862
SCE7	3.371
SCE8	2.118
SCE9	2.260
SL1	2.447
SL2	2.637
SL3	2.331
SL4	1.781

Source: Field Survey, (2024)

Table 7 represents the multicollinearity. Results from the Variance Inflation Factor (VIF) analysis provide helpful information on the possibility of multicollinearity among the predictor variables within the investigated construct. Tomaschek et al. (2018) argue that identifying and reducing collinearity variables is critical before running regression. The Variance Inflation Factor (VIF) is a commonly used statistic for identifying multicollinearity. When the VIF surpasses ten, it implies multicollinearity. Table 8 shows the VIF values for every variable in the model. According to Al-ahdal et al. (2020), all VIF values are less than 10, indicating that the model is not multicollinear. This suggests that the model's variables do not exhibit high correlations and that the regression coefficients are probably reliable and consistent.

Goodness-of-Fit Indices

Table 8: Goodness-of-Fit Indices

Fit Index	Estimated model	p-Values	Result
SRMR	0.078	0.000	Significant
D_ULS	3.814	0.000	Significant

Source: Field survey, (2024).

The standardized root mean square (SRMR) technique for model fit is used in this current study (Henseler et al., 2014). Dijkstra and Henseler (2015) state that values of D_ULS indicate high model fit if they are more than 0.05. In this study, the model fits as the values are more than 0.05 and less than 0.08, as

shown in Table 4.11. SRMR values of 0.08 or below 0.08 indicate a satisfactory model fit (Kock,2017). Table 8 displays the study of the model fit indices. The results demonstrate that the estimated model had a reasonable model fit in terms of the endogenous variables according to all model fit indices used to evaluate the fitness of the estimated model.

Table 9: Co-efficient determination

Quality Criteria Livelihoods	Sustainable
R-Square	0.736
R-Square Adjusted	0.732

Source: Field Survey, (2024)

Table 9 presents the assessing the structural model, R-squared values indicate the model's predictive strength and usefulness (Hair et al., 2017). The R-squared represents the percentage of variance explained in the endogenous construct - in this case, social livelihoods. The R-squared value of 0.736 suggests the exogenous constructs account for a substantial 73.6% of the variation observed in the sustainable livelihoods measure. This provides evidence of good explanatory power for predicting sustainable livelihoods through the model. Additionally, the adjusted R-squared accounts for model complexity, correcting for the influence of additional constructs on the measure. At 0.732, the high adjusted R-squared confirms model usefulness is maintained even after this adjustment. According to Hair et al. (2017), R-squared values of 0.75, 0.50, or 0.25 can respectively be described as substantial, moderate, or weak in the

organisational sciences context. Hence with an R-squared exceeding 0.50, these results indicate the comprehensive model has moderately strong predictive accuracy.

Structural Model Test (Inner Model)

Structural model testing (Inner Model) aims to predict the relationship between latent variables (Ghozali, 2021). A structural model is used to evaluate the hypothesis links and support the hypothesis. To assess how predictors and outcomes are related, the study put various hypotheses out, and the results are shown in Tables 10, 11, and 12 depicting both direct, moderating, and mediating structural results.

Direct structural hypothesis testing results

Direct hypothesis testing results are shown in Table 10. Hypothesis 1: Income diversification has a positive and significant effect on sustainable livelihoods. The hypothesis investigates whether income diversification positively and significantly influences sustainable livelihoods. The result shows that Income Diversification positively and statistically significantly influences sustainable livelihoods. H_1: ($\beta = 0.636$, $t = 14.489$, $p < .001$), hence, hypothesis 1 was supported. The positive and statistically significant relationship ($\beta = 0.636$, $t = 14.489$, $p < 0.001$) suggests that as individuals diversify their sources of income, their sustainable livelihoods improve. Promoting income diversification strategies may be an effective way to enhance sustainable livelihoods among the population.

Hypothesis 2: Access to Resources has a significant and positive effect on Sustainable Livelihood. The hypothesis (H_2) investigates whether access to resources positively and significantly influences sustainable livelihood. The result shows that access to resources positively and statistically significantly influences Sustainable Livelihood. H_2 : (β = 0.332, t = 6.985, p <.000), hence, hypothesis 4 was supported. The positive and statistically significant relationship (β = 0.332, t = 6.985, p < 0.000) indicates that access to resources positively influences sustainable livelihoods. Policies or interventions aimed at improving access to resources may enhance overall sustainable livelihoods in the community.

Hypothesis 3: Social Capital has a positive and significant effect on Sustainable Livelihoods. The hypothesis (H_3 :) investigates whether Social Capital positively and significantly influences Sustainable Livelihoods. The result shows that Social Capital positively and statistically insignificantly influences Sustainable Livelihoods. H_3 : (β = 0.077, t = 0.974, p >.001), hence, hypothesis 5 was not supported. The positive but statistically insignificant relationship (β = 0.077, t = 0.974, p > 0.001) suggests that the impact of social capital on sustainable livelihoods was not supported. While social capital may be important, its direct influence on sustainable livelihoods might be limited in this context.

Hypothesis 4: Social Capital endowment has a positive and significant effect on Sustainable Livelihoods. The hypothesis (H_4 :) investigates whether

Social Capital endowment has a positive and significant influence on Sustainable Livelihoods. The result shows that Social Capital endowment negatively and statistically significantly influences Sustainable Livelihoods. H_4 : (β = -0.167, t = 2.172, p <.001), hence, hypothesis 4 was not supported. The negative and statistically significant relationship (β = -0.167, t = 2.172, p < 0.001) suggests that higher social capital endowment is associated with lower sustainable livelihoods. This unexpected result requires further investigation, as it contradicts the positive impact expected from the social capital endowment.

Table 10: Direct effect

Hypothesis	Variables	Structural paths relationship	Beta	T values	P values	Decision
H4	Access to Resources	**AR -> SL**	0.332	6.985	**0.000**	**supported**
H2	Income Diversification	**ID -> AR**	0.402	8.008	**0.000**	**supported**
H3	Income Diversification	**ID -> SC**	-0.355	7.025	**0.000**	**supported**
H1	Income Diversification	**ID -> SL**	0.636	14.489	**0.000**	**supported**
H5	Social Capital	**SC -> SL**	0.077	0.974	**0.330**	**not supported**
H6	Social Capital endowment	**SCE -> SL**	-0.167	2.172	**0.030**	**supported**

Source: Field Survey, (2024).

This diagram illustrates the direct relationships between the variables, showcasing how income diversification, access to resources, and social capital contribute to sustainable livelihoods. The direction and strength of the arrows represent the nature and significance of these relationships.

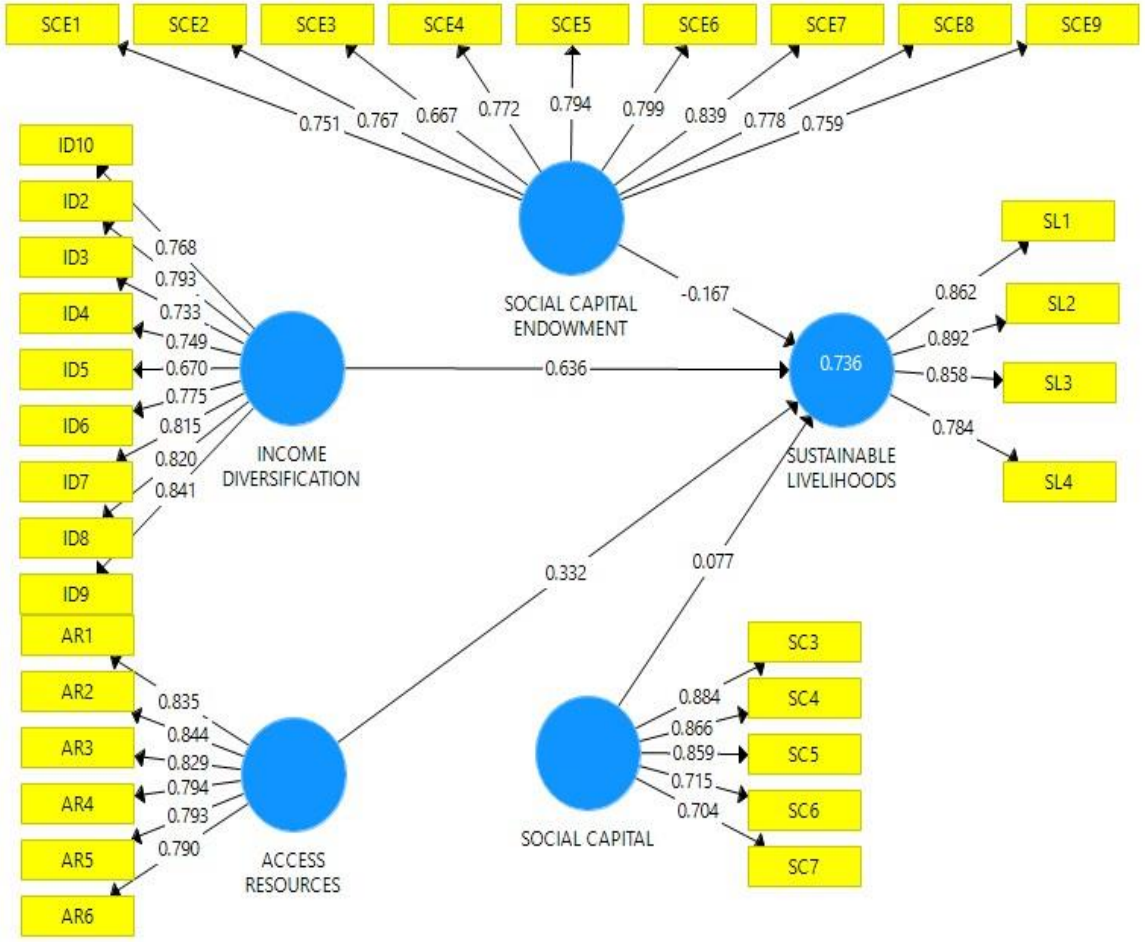

Figure 2: Measurement Model Diagram-Direct effect

Source: Authors' own construct (2024)

This diagram includes the moderating effects, showing how certain variables (social capital endowment) may influence or moderate the relationships between others.

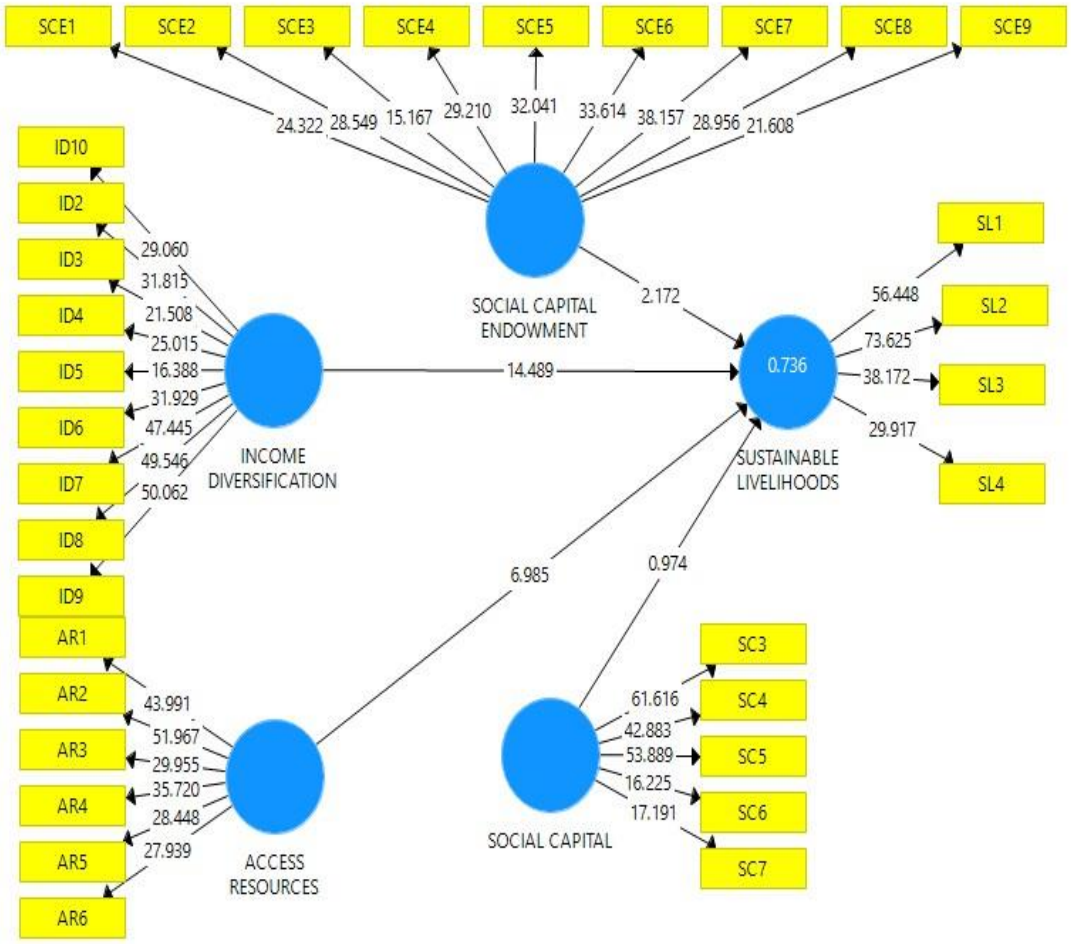

Figure 3: Structural model Diagram

Source: Field Survey (2024)

Moderating Effect of Social Capital Endowment

The study also investigates how social capital endowment will moderate income diversifications on sustainable livelihoods in the mining communities in Ghana. The result is shown in Table 11. The result reveals that Social Capital Endowment does not significantly moderate income. Diversification and Sustainable Livelihood. H_5: (β = 0.089, t = 0.757, p < 001). Hence, H_5 was not supported. This suggests that, in the context of this study, the

level of social capital endowment does not alter the impact of income diversification on sustainable livelihoods. Other factors or conditions might play a more significant role in moderating this relationship.

Table 11: The moderating effect of Social Capital Endowment

Hypothesis	Variable	Structural paths relationship	Beta	T values	P Values	Decision
H5	**Social Capital Endowment**	**ID* SCE -> SL**	0.089	0.757	**0.449**	**Rejected**

Source: Field Survey (2024)

This diagram illustrates the relationships between the variables involved in the moderating process. It includes indicators and latent variables representing social capital endowment, income diversification, and sustainable livelihoods. Paths and arrows show the direct relationships between these variables, as well as the indicators of the latent variables.

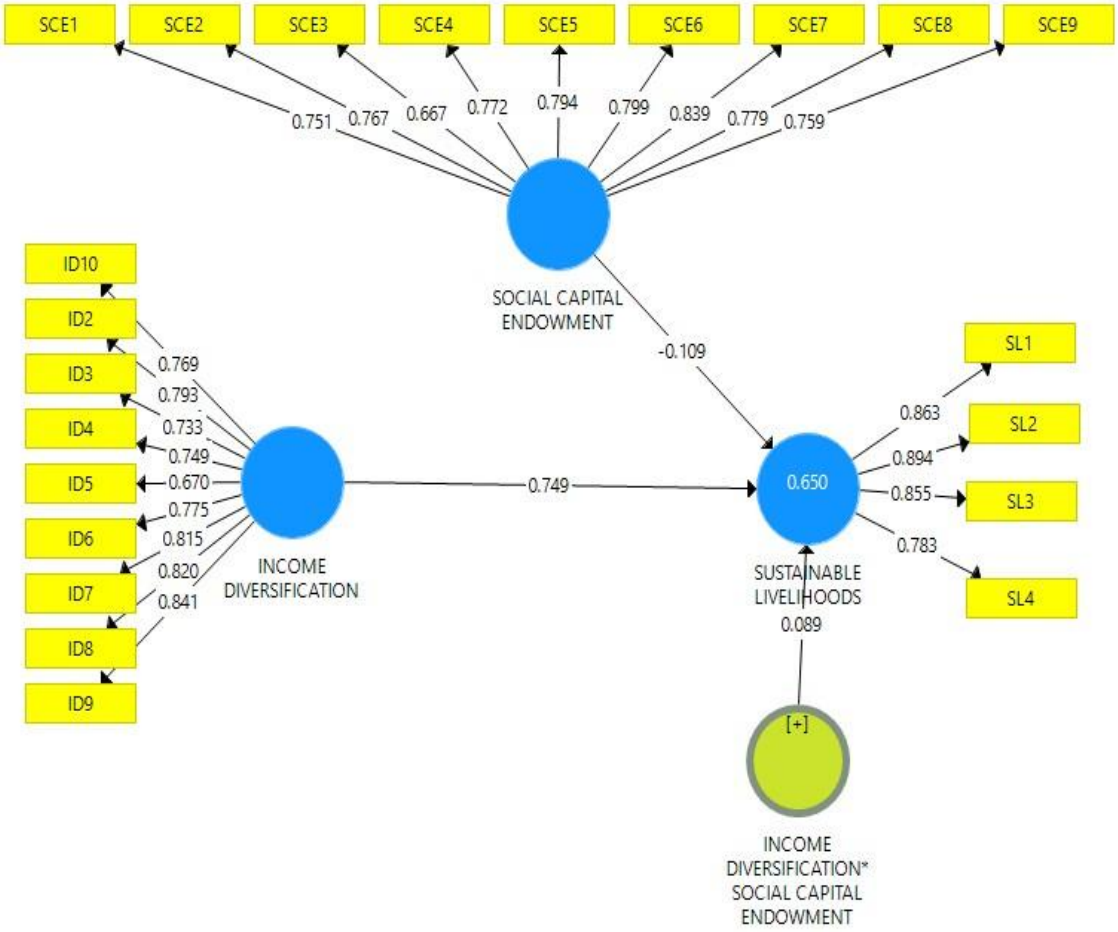

Figure 4: Measurement model diagram for moderating

Source: Authors' own construct (2024)

This diagram illustrates the moderating pathways between social capital endowment, income diversification, and sustainable livelihoods. It shows how social capital endowment influences the strength or direction of the relationship between income diversification and sustainable livelihoods. The diagram includes paths with coefficients representing the direct, moderating, and interaction effects.

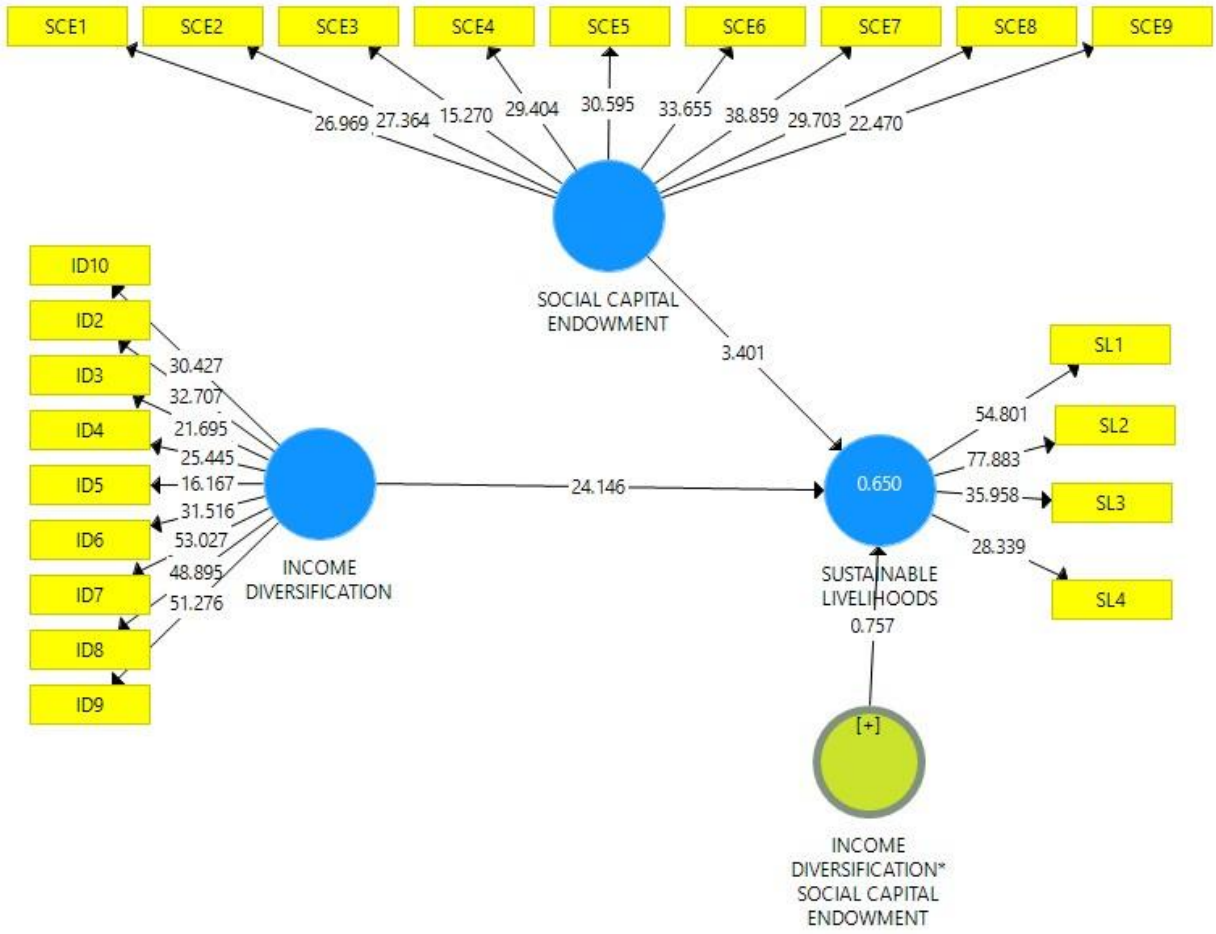

Figure 5: Structural model diagram -Moderating effect

Source: Authors' own construct (2024)

Chapter Summary

The research findings underscore the strategies adopted by individuals in Ghanaian mining communities to diversify their income sources, recognizing the risks associated with sole dependence on mining-related activities. The employed diversification strategies encompass entrepreneurship, agricultural endeavors,

renewable energy projects, off-farm employment, remittances, ecotourism, livestock rearing, and micro or small-scale businesses. However, the study identifies several challenges impeding income diversification in these communities. These challenges include a lack of technical skills and training, restricted options for diversification, the influence of government programs, and policy dynamics that both support and hinder diversification efforts. Additionally, barriers such as limited access to modern technologies, climate variability, environmental changes, inadequate market access, and restricted financial services pose obstacles to viable income diversification initiatives.

The research substantiates the positive and statistically significant influence of income diversification on sustainable livelihoods in Ghanaian mining communities. Specifically, income diversification positively affects access to resources and social capital, further contributing to sustainable livelihoods. The study notes that social capital alone has an insignificant impact on sustainable livelihoods, and social capital endowment exhibits a negative and statistically significant influence. However, social capital endowment is revealed to have no significant moderating effect on the relationship between income diversification and sustainable livelihoods.

CHAPTER FIVE
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This section provides a comprehensive review of the conducted research study. It summarizes the study's objectives, the underlying theories, the utilized methods, and the data processing and analysis techniques employed. Additionally, the chapter outlines key findings aligned with study objectives, draws conclusions based on results, and offers recommendations derived from these conclusions. Furthermore, suggestions for future research are proposed, considering both theories and methodologies**.**

Summary of key findings

The study reveals that individuals in Ghanaian mining communities adopt various income diversification strategies to mitigate the risks associated with over-reliance on mining-related activities. These strategies include entrepreneurship, agricultural ventures, renewable energy projects, off-farm employment, remittances, ecotourism, livestock rearing, and micro or small-scale businesses. However, several challenges hinder effective income diversification. These challenges include a lack of technical skills and training, limited diversification options, and the impact of government policies, which can either facilitate or restrict diversification efforts. Additionally, external factors such as climate variability, environmental changes, inadequate market access, and restricted financial services further constrain individuals from pursuing viable alternative livelihoods. To address these barriers, the study recommends targeted

interventions, including improving access to markets and financial services, enhancing skills training programs, and fostering government support for alternative economic activities.

Additionally, the findings indicate that income diversification plays a significant role in promoting sustainable livelihoods in mining communities. Statistical analysis confirms a positive and significant relationship between income diversification and sustainable livelihoods, demonstrating that households with multiple income sources experience greater economic resilience and stability. Furthermore, income diversification enhances access to critical resources, such as financial capital and modern technologies, which support long-term economic sustainability. Additionally, the study highlights that income diversification fosters social capital, as individuals engaged in diverse economic activities benefit from stronger community networks, cooperation, and support systems. These findings emphasize the importance of implementing policies that encourage income diversification, as well as strengthening social capital to improve the overall well-being of individuals and households in Ghanaian mining communities.

The study explores the mediating effects of access to resources and social capital on the relationship between income diversification and sustainable livelihoods. This investigation is essential as access to resources and social capital are integral components influencing rural households' ability to diversify their income sources, thereby impacting the sustainability of their livelihoods. This suggests that part of the positive impact of income diversification on

sustainable livelihoods is transmitted through enhanced access to resources which is in line with these studies (Habib et al., 2023; Kimkong et al., 2023). Guo et al., (2019) indicated that, financial capital insurance was indirectly and positively affected by livelihood strategy. This implies that the positive effect of income diversification on sustainable livelihoods is partially explained by the influence of social capital. Strengthening social capital through community engagement or networking may complement income diversification efforts, leading to more sustainable livelihoods.

Furthermore, strengthening social capital through community engagement and networking should be prioritized. Local authorities, NGOs, and private sector stakeholders should facilitate the formation of cooperative societies, business associations, and self-help groups that encourage collective investment, knowledge-sharing, and resource pooling. Social networks can provide critical support in accessing markets, securing financial assistance, and sharing best practices for income diversification. Additionally, policymakers should promote initiatives that foster trust, collaboration, and mutual assistance within mining communities to enhance resilience and improve the sustainability of diversified livelihoods.

To ensure long-term benefits, integrating social capital development into local governance and policy frameworks is essential. Community development programs should include leadership training, mentorship initiatives, and participatory decision-making structures that empower local populations to take charge of their economic well-being. Moreover, strengthening public-private

partnerships (PPPs) in resource allocation and community-driven development projects will help create a more inclusive economic environment where diversified income activities can thrive.

Conclusions

The determinants of income and livelihood diversification strategies in Ghana's mining communities reflect a proactive approach by individuals in mitigating the risks associated with overreliance on mining activities. Entrepreneurship, agricultural pursuits, renewable energy projects, ecotourism, livestock rearing, and micro or small-scale businesses and off-farm employment are all employed as strategies to diversify income streams, indicating a multifaceted approach to livelihood sustainability.

The study on income diversification and sustainable livelihoods in mining communities in Ghana reveals a complex landscape of challenges and opportunities. These challenges include a lack of technical skills and training, restricted options for diversification, the influence of government programs, and policy dynamics that both support and hinder diversification efforts. Additionally, barriers such as limited access to modern technologies, climate variability, environmental changes, inadequate market access, and restricted financial services pose obstacles to viable income diversification initiatives. In light of the identified constraints, the study recommends targeted interventions. Improving market access, providing financial support, and offering training and technical assistance emerge as crucial steps to empower community members and promote diversified income sources.

The study explores the mediating effects of access to resources and social capital on the relationship between income diversification and sustainable livelihoods and findings indicated that access to resources and social capital mediate income diversification and sustainable livelihoods. This investigation is essential as access to resources and social capital are integral components influencing rural households' ability to diversify their income sources, thereby impacting the sustainability of their livelihoods. This aligns with existing literature highlighting the connections between access to resources, social capital, income diversification, and overall livelihood outcome. The moderating effect of social capital endowment adds depth to the analysis, indicating that the existing social capital endowment within a community negatively influences the relationship between income diversification and sustainable livelihoods.

Recommendations of the Study

To enhance income and livelihood diversification strategies in Ghanaian mining communities, it is essential to implement targeted skills development and vocational training programs. Government agencies, non-governmental organizations (NGOs), and private sector stakeholders should equip individuals with the necessary expertise to engage in alternative income-generating activities such as agribusiness, renewable energy projects, and ecotourism. Additionally, expanding market access and financial services is crucial. Policies should focus on strengthening market linkages for diversified economic activities, while financial institutions should introduce flexible credit facilities and microfinance initiatives to support small businesses, agricultural ventures, and other non-

mining economic activities. Furthermore, strengthening government support and policy interventions can play a key role in overcoming barriers to income diversification. Authorities should develop policies that encourage alternative livelihoods by removing bureaucratic constraints and increasing funding opportunities for non-mining businesses. Government incentives such as tax breaks, subsidies, and grants can facilitate the growth of sustainable economic ventures. Another critical intervention is the promotion of technology and innovation. Encouraging the adoption of modern technologies in agriculture, small-scale manufacturing, and renewable energy projects can enhance productivity and sustainability. Governments and development agencies should introduce technology transfer programs to mining communities to ensure that residents have access to improved tools and techniques that enhance their income-generating capacity.

To strengthen the relationship between income diversification and sustainable livelihoods, enhancing social capital through community-based initiatives is necessary. Strengthening community networks through cooperatives, associations, and self-help groups can improve knowledge-sharing and collective resource mobilization, ultimately enhancing access to economic opportunities. Moreover, addressing climate variability and environmental challenges is essential in ensuring sustainable livelihoods. Sustainable livelihood programs should incorporate climate adaptation strategies, such as resilient agricultural practices and environmental conservation projects, to mitigate the adverse effects of climate change on income diversification. Institutional support for sustainable

livelihood development should also be prioritized. Establishing livelihood support centers within mining communities will provide continuous guidance and resources for individuals seeking to diversify their income sources. These centers can offer advisory services, financial literacy training, and access to government or private sector support programs. Lastly, encouraging public-private partnerships (PPPs) can significantly contribute to sustainable livelihood initiatives. Collaboration between the government, private sector, and development organizations can help mobilize resources to support alternative livelihood initiatives, infrastructure development, and capacity-building programs tailored to the needs of mining communities.

Additionally,

Suggestions for future studies

The findings of this study are specific to mining communities in Ghana and may not be fully generalizable to other contexts. Future research could explore similar dynamics in different geographical locations to enhance the external validity of the findings.

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