# Mercury Supply at Artisanal and Small-Scale Gold Mines in Ghana: Actors, Distribution and Networks

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**A Thesis Submitted To The Faculty of Graduate Studies in Partial Fulfilment Of The Requirements For The Degree Of Masters Of Arts**

**Graduate Program in Geography**

**York University**

**Toronto, Ontario**

**August 2025**

**ABSTRACT**

Through a regional case study of Ghana, this thesis explores the role mercury plays in artisanal and small-scale mining (ASM) and broader agrarian livelihoods, in rural sub-Saharan Africa. In doing so, it seeks to introduce a fresh perspective to the debate on mercury in the region's ASM sector, which has focused predominantly on the environmental and health-related impacts linked to its widespread usage. With ASM responsible for close to 40 percent of global anthropogenic emissions of mercury, donors and international NGOs have pushed to minimize – and where possible, eliminate altogether – its use. Findings reveal that mercury distribution and supply networks are firmly entrenched, populated by actors who are also embedded in the circuits linked to gold production at ASM sites. It is hoped that findings such as those reported here will help to stimulate a critical reflection on mercury management in the region's ASM sector.

**ACKNOWLEDGEMENTS**

Without the assistance, direction, and kindness of countless people, this thesis would not have been possible. The residents of the artisanal and small-scale mining communities Asamang and Akwatia in Ghana's Eastern Region were the foundation of this research. Their willingness to share their knowledge and perspectives on the intricate dynamics of mercury use and distribution, and their work more broadly is gratefully acknowledged. The author would like to thank also the representatives of the mining association and community leaders who introduced the author to miners and facilitated access to sites. A special thank you to "Atta", who helped with the fieldwork carried out for this thesis, and Mr Ekow Bartels for his comments, encouragement and assistance producing maps.

The author is grateful to her academic supervisors, Professor Anna Zalik and Professor Vanessa Lamb at York University. Their advice, critiques, and support were instrumental in transforming ideas into a research project worthy of a Masters thesis. Special thanks is extended to the organizations and funding bodies that supported the research undertaken for this thesis. A final thanks goes to Professor Gavin Hilson of the University Surrey for his patience and ongoing support during this journey.

This thesis is dedicated to the millions of artisanal miners in sub-Saharan Africa, whose livelihoods rely on striking a careful balance between environmental responsibility and economic necessity. It is hoped that this work will spark a more nuanced discussion about their realities.

**TABLE OF CONTENTS**

**LIST OF TABLES**

**LIST OF FIGURES**

## LIST OF PLATES AND BOXES

## ACRONYMS

| | |
|---|---|
| ASM | Artisanal and Small-Scale Mining |
| CIDA | Canadian International Development Agency |
| COVID-19 | Coronavirus Disease 2019 |
| DFID | UK Department for International Development |
| DRC | Democratic Republic of Congo |
| EGPS | Extractives Global Program Support |
| EJD | Centre for Environment Justice and Development |
| EPA | Environmental Protection Agency |
| EU | European Union |
| GEF | Global Environmental Facility |
| GHC | Ghana Cedis |
| GIZ | Gesellschaft für Internationale Zusammenarbeit |
| GMP | Global Mercury Project |
| GPN | Global Production Network |
| GTZ | Deutsche Gesellschaft für Technische Zusammenarbeit |
| IDA | International Development Association |
| ILO | International Labour Organization |
| IOMC | Inter-Organization Programme for the Sound Management of Chemicals |
| MIA | Minamata Initial Assessment |
| MMIP | Multilateral Mining Integrated Project |
| NAP | National Action Plan |
| NGO | Non-Governmental Organization |
| NRDC | Natural Resource Defence Council |
| OECD | Organisation for Economic Co-operation and Development |
| PMMC | Precious Minerals and Marketing Corporation/Company |
| PNDCL | Provisional National Defence Council Law |
| PROGREEN | Global Program on Sustainability |
| SEC | Securities and Exchange Commission |
| SSMP | Small-Scale Mining Project |

| | |
|---|---|
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Program |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNIDO | United Nations Industrial Development Organization |
| UNITAR | United Nations Institute for Training and Research |
| uPOPs | Unintentionally Produced Persistent Organic Pollutants |
| USAID | United States Agency for International Development |
| VAT | Value Added Tax |
| WHO | World Health Organization |

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

In popular culture and scholarship, the mercury used in artisanal and small-scale mining (ASM) is frequently dubbed a "silent killer" (Zafar et al., 2024).[1] In the literature and policy, ASM is the name used to describe low-tech, labour-intensive mineral processing and extraction (O'Driscoll, 2017; Verbrugge and Thiers, 2021; Hilson and hu, 2022). Used to extract gold from ore in a process referred to as "amalgamation", mercury has, for centuries, been a staple additive to mining across the world. But through burning the amalgam and washing the ore, mercury has also been repeatedly discarded into the environment (in vaporized and liquid form), after which it settles and methylates, presenting a series of health risks for humans (Esdaile and Chalker, 2018). Today, ASM accounts for close to 40 percent of anthropogenic mercury emissions (Aldous et al., 2024), roughly 50 percent, 18 percent and 16 percent of which occur in Asia, Latin America and sub-Saharan Africa, respectively (UN Environment, 2018).

Donors such as the World Bank, various departments of the United Nations and a number of bilateral agencies such as GIZ, CIDA, DFID and USAID have, over the years, funded technical assistance and complementary educational support to improve awareness in local communities of the environmental and health-related impacts of mercury use in ASM and to promote in minimizing emissions at sites. Developments around mitigating mercury pollution at ASM sites reached a crescendo on 10 October 2013, when the United Nations formerly adopted the *Minamata Convention on Mercury*,[2] an international treaty aimed at protecting the environment and human health from anthropogenic emissions of mercury. The seeds were planted in 2003, when the Global Mercury Assessment was presented to the 22nd United Nations Environment Program (UNEP) Governing Council, which concluded that anthropogenic emissions of mercury caused significant impact to the environment and there was a need to develop a legally-binding instrument to address the problem. It sparked a decade of international negotiations which would culminate in the launch of the *Minamata Convention on Mercury* (in 2013). After receiving the required number of UN member signatures, the *Minamata Convention* entered into force, in 2017 (UN Environment, 2013, 2019; Eriksen and Perrez, 2014).

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[1] "Mercury poisoning: The silent killer of Kenya's forgotten women miners", https://nation.africa/kenya/health/mercury-poisoning-the-silent-killer-of-kenya-s-forgotten-women-miners-5057514#google_vignette; "Mercury: A silent killer in Zimbabwe", www.fairplanet.org/story/mercury-a-silent-killer-in-zimbabwe/ (Accessed 4 June 2025).

[2] "History of the Negotiations Process", https://minamataconvention.org/en/about/history#:~:text=The%20work%20to%20prepare%20the,Stockholm (Accessed 12 May 2025).

### 1.2 Problem Statement and Need for Further Research

A main focus of the Minamata Convention is ASM, on the grounds that "the largest source of mercury emissions is artisanal and small-scale gold mining" (UN Environment, 2019, p. 5). Many of the countries that were among the first to ratify the *Minamata Convention* have some of the largest ASM sectors in the world and where consequently media coverage of mercury pollution at sites has been very extensive. While it seems logical from an environmental standpoint that these countries were among the first adopters, at the same time, the haste with which ratification decisions were made was nevertheless surprising, given the significant economic and social impacts the *Minamata Convention* would entail for those dependent on ASM for their livelihoods. In direct employment alone, ASM provides jobs to hundreds of millions of people worldwide (Table 1.1).

Perhaps nowhere is this problem more obvious than in sub-Saharan Africa, where countries with the region's most diverse and complex ASM sectors have proceeded to ratify the Convention, a list that includes Tanzania (ratified 5 October 2020), Zimbabwe (ratified 19 August 2021), Sierra Leone (ratified 1 November 2016), Mali (ratified 27 May 2016) and – the focus of this thesis – Ghana (ratified 23 March 2017).[3] In practice *Minamata* has prompted state level actions, not only interventions aimed at reducing mercury emissions, but also measures targeting eradication of its use altogether These actions and the media buzz *Minamata* has generated regarding mercury use, however, have overshadowed, almost entirely, research findings accumulated over the past two decades that firmly establish how the ASM sector is today, one of the most important rural nonfarm activities in sub-Saharan Africa (Maconachie and Binns, 2007; Banchirigah, 2008; Hilson, 2016). Over these decades, scholars have also established that throughout the region, the sector has inseparable connections with agriculture and is predominantly "poverty-driven", carried out mostly by people who have few alternative income-earning opportunities (Barry, 1996; Ofosu, 2020). While rarely acknowledged, these ASM activities are almost entirely dependent on mercury, access to which facilitates the production of gold; its subsequent sale enables the millions of people who work in the sector across sub-Saharan Africa to support their farms, pay their children's school fees and invest in other business ventures (Hilson, 2016). It seems inexplicable that policymakers in sub-Saharan Africa have pushed for the eradication of mercury use in ASM when, at present, there are no viable alternatives from both cost and efficiency perspectives, nor markets mature enough to support the implementation of potential substitutes.

[3] "Parties and Signatories", https://minamataconvention.org/en/parties (Accessed 3 June 2025).

This thesis seeks to spotlight how access to mercury ultimately drives ASM in sub-Saharan Africa. It has the explicit goal of building discussion about the use of mercury and its management into the broader debate in the region on the livelihoods "dimension" of the sector. It does so by asking questions that capture how access to mercury provides a lifeline for millions of people linked to ASM in sub-Saharan Africa, irrespective of its environmental and health-related consequences. The hope is that this thesis will facilitate a more nuanced discussion on mercury use in ASM in the region moving forward, in which environmental protection does not necessarily receive diminished attention but where economic and social concerns are given equal weight in decision-making. This equal weight is warranted irrespective of what level of media attention environmental health concerns may attract. Access to mercury makes ASM possible for, and ultimately drives the livelihoods of, a sizable segment of the African population, as indicated. A more balanced discussion on mercury, therefore, is a key to shifting the current unrealistic narrative of *eradication of its use* to a more plausible *minimization of emissions*.

There is indeed evidence to support claims of mercury use in ASM being a "silent killer" in sub-Saharan Africa. But in a similar vein, mercury is also a "silent contributor" to rural economic development in the region by facilitating timely and consistent production of gold for the millions of people who depend on its sale for their livelihoods.

### 1.3 The Case of Ghana

This thesis uses the case of Ghana to examine more closely how mercury sustains ASM and ultimately, supports livelihoods, in rural sub-Saharan Africa. The intention here is not to endorse the use of mercury in ASM and to dismiss its environmental impacts, Rather, the thesis aims to consider how mercury is supplied and distributed – and *not* how and why it can be eradicated – at sites, and to cast some important light on the economics and livelihoods-related impacts its ready-availability has locally. There are several reasons why Ghana is an ideal case study for investigating these issues, the first being that it is the first country in the region to legalize ASM (Davidson, 1993). For this reason, Ghana is often used as a reference point – for better or for worse – in policymaking and donor circles on how to regulate and support ASM and best practices for formalizing its activities (UN, 1996a, 1996b). The second reason is that Ghana is *all-in* on addressing mercury pollution in ASM, officializing its position on this matter on 23 March 2017, when it ratified the *Minamata Convention*, becoming the 40$^{th}$ party to do so. In 2018, it commissioned its Minamata Initial Assessment (MIA), a baseline of mercury emissions and releases from ASM which signatories are required to produce as an initial undertaking

following ratification (see United Nations Development Program, 2018). This informed the design of the country's National Action Program (NAP), the second step that must be taken following ratification, the aim of which, broadly, is to 1) assist the Government of Ghana and ASM partners, to formulate strategies to reduce mercury emissions; and 2) raise awareness of the risks posed by the sector to human and ecosystem health. The five principal outputs of the NAP development process were as follows (EPA and UNIDO, 2020):

- To disseminate information and to establish a project coordination mechanism;
- To conduct a comprehensive analysis of Ghana's ASM sector to support the development and implementation of a road map to reduce emissions and releases of mercury;
- To carry out an institutional and capacity needs assessment, with a view toward designing and implementing a public health strategy on ASM;
- To conduct a rapid health situational assessment, draft a public health strategy, and conduct a series of awareness-raising workshops; and
- To draft and finalize an NAP, and present its contents to stakeholders for debate.

A series of institutions have helped bring Ghana's NAP to fruition, and indeed kickstart the processes that have followed. The first is the Ghana Environmental Protection Agency (EPA), the main national executing agency and authority (the focal point) for the project tasked with overseeing management and coordination of the NAP. The World Health Organization (WHO) was the executing agency for the health component of the NAP (under Article 16), carried out in collaboration with the Ghana Health Service and Ministry of Health. The Global Environmental Facility (GEF) implementing agency was UNIDO, which is charged with providing technical support, as well as coordinating and monitoring the project. It reviewed and approved work plans, responsibilities, timelines and budgets. The Washington DC-based Natural Resource Defence Council (NRDC) a non-profit organization that is the co-lead of Global Mercury Partnership and responsible for assisting with conducting a comprehensive analysis of Ghana's ASM sector, helped coordinate the baseline (EPA and UNIDO, 2020). The ratification process for the *Minamata Convention* and the experience of Ghana specifically are revisited and elaborated in greater depth in Chapter 2.

A third and final reason why Ghana is an ideal setting for building a case for inclusion of analysis of mercury supply and distribution in the debate on the livelihoods dimension of ASM in sub-Saharan Africa is that successive governments have received a significant amount of support over the decades to address the environmental impacts of its usage in the sector. At the time of writing this thesis, there were three major ASM mercury management projects (or major ASM projects with significant mercury management components) ongoing in Ghana. They were as follows: 1) the *Africa Environmental Health and Pollution Management Program* (P167788), 2020

– 2025, funded by the World Bank; 2) *Ghana Landscape Restoration and Small-Scale Mining Project*, 2022 – 2027, also funded by the World Bank; 3) and the Ghana planetGOLD Project, 2022 – 2027. At a minimum, this shows the commitment internally and externally to addressing mercury pollution at ASM sites in Ghana.

### 1.4 Thesis Scope and Objectives

This thesis sheds important light on the dynamics of mercury distribution networks in ASM, focusing on the case of Ghana. It set out to provide a fresh empirical understanding of the supply-side dynamics of mercury use in ASM, a topic that is frequently disregarded in policy frameworks and the literature. Although a lot of work has been done to decrease mercury use through awareness campaigns and the promotion of mercury-free alternatives, the limited success of this suggests that more serious structural problems need to be addressed if releases (of mercury) from the sector are to be minimized.

It is against this background that this thesis asks the following overarching research question: *How does the issue of mercury supply and distribution feature in the debate on the livelihoods dimension of ASM in sub-Saharan Africa, with special focus on Ghana?* The study also poses the following sub questions:

1) How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa?
2) What key actors are linked to the supply of mercury in ASM, and what roles do these actors play in distributing supplies to site?
3) What additional roles (actual and potential) do actors play in the wider ASM sector?

Fieldwork for this case study was conducted in the Eastern Region of Ghana, the location of one of the country's highest concentrations of ASM activity. This fieldwork was made possible by the author's earlier research on international projects in the region through which crucial relationships with local actors were established. These networks were drawn upon to facilitate this research.

### 1.5 Thesis Structure

Five chapters follow this introduction. Chapter 2 sets the stage for this thesis by pulling together literature on ASM's livelihood dimension and work on mercury's environmental impacts. It highlights the absence of the former from the latter, in the process underscoring the need for research such as that discussed herein. Chapter 3 focuses on the Ghana case specifically. It builds on the ideas introduced in this chapter, reviewing key works that examine the environmental impacts of mercury use at Ghanaian ASM sites, and the policy responses to this problem, including progress made since the country ratified the *Minamata Convention*. Chapter

4 outlines the methodology adopted in this research, after which findings are shared in Chapter 5. In Chapter 6, recommendations for further research are presented and policy recommendations are made.

**Table 1.1:** Estimates of ASM populations by country[4]

| Country | Estimated ASM population | Major commodities mined |
|---|---|---|
| **Sub-Saharan Africa** | | |
| Ghana | 1,1000,000 | Gold, Diamonds |
| Democratic Republic of Congo (DRC) | 2,000,000 | Copper, Cobalt, Diamonds, Gold, Coltan |
| Burkina Faso | 200,000 | Gold, Zinc, Manganese, Lead, Silver, and Phosphates |
| Tanzania | 1,000,000 | Gold, Diamonds, and Gemstones |
| Mali | 400,000 | Gold |
| Kenya | 140,000 | Gold, Gemstone, and Quarrying of stones |
| Nigeria | 400,000 | Gold, Coltan, Lead, Zinc, and Tin |
| Niger | 450,000 | Gold, Tin, and Gemstones |
| Burundi | 340,0000 | Tantalum, Tin, Tungsten, and old |
| Ethiopia | 1,260,000 | Gold |
| Central African Republic | 200,000 | Diamonds and Gold |
| Liberia | 100,000 | Iron Ore, Diamonds, and Gold |
| Madagascar | 500,000 | Coloured gemstones, and Gold |
| Mozambique | 100,000 | Gold |
| Rwanda | 73,000 | Tantalum, Tin, and Tungsten |
| Sudan | 1,000,000 | Gold |
| Uganda | 305,700 | Gold, Tin, and Tungsten |
| Zimbabwe | 1,000,000 | Gold |
| **Latin America** | | |
| Peru | 70,000 | Gold, Silver, and Copper |
| Colombia | 300,000 | Gold, Diamonds, Emeralds, Coal, Tin, Tantalum, and Construction Materials |
| Brazil | 861,000 | Gold, Diamonds, and Development Minerals |
| Ecuador | 29,097 | Gold |
| Venezuela | N/A | Gold |
| Bolivia | 175,000 | Gold, and Tin |
| Guyana | 28,000 | Gold, Diamonds, and Bauxite |
| **Asia** | | |
| China | N/A | Gold, Tin, Tungsten, Rare earth elements |
| Indonesia | 3,600,000 | Gold |
| Philippines | 500,000 | |
| Myanmar | 420,000 | Jade, Rubies, Tin and |

[4] Data extracted from the DELVE website (see www.delvedatabase.org/).

| | | |
|---|---|---|
| | | Gold |
| Pakistan | significant producer | Gold |
| Vietnam | major producer | Gold, coal, bauxite, copper, tin |
| Mongolia | 70,000 | Gold, Fluorite, Coal, Limestone, Gemstones, Wolfram, and |
| Papua New Guinea | 108,000 | Gold |
| **Middle East, South Asia and North Africa** | | |
| Afghanistan | 50,000 | Gold |
| India | 15,000,000 | Gemstones and Gold |
| Nepal | 120,000 | Development minerals |
| Sri Lanka | 165,000 | Coloured gemstones |
| Morocco | 7500 | Phosphate, Barite, Lead, Zinc, and Gold |

## CHAPTER 2

## Conceptual Framework and Literature Review: The ASM "Ecosystem", Mercury Supply Chain and Rural Livelihoods in Sub-Saharan Africa

### 2.1 Introduction

This chapter reviews the literature with the goal of *locating* scholarly and policy discussions on mercury pollution at ASM sites in sub-Saharan Africa in broader debates on the sector's livelihoods "dimension" in the region. Surprisingly little attention has been paid – even in the wake of the *Minamata Convention on Mercury* – to studying the livelihoods dimension of mercury supply and distribution at sites in sub-Saharan Africa. Even less interest has been shown in understanding synergies and overlaps in the region between the mercury supply chain and the actors who populate it on the one hand, and that of gold production linked to ASM on the other hand.

The position of this thesis is that the multitude of informal and formal economic actors linked to small-scale gold mine production in some *capacity also* have ties to mercury supply and distribution. In other words, these two supply chains – i.e. that of small-scale gold production on the one hand, and mercury on the other – are intertwined. There is anecdotal evidence to support claims of this spillover, despite it not being stated explicitly: the gold shops staffed by people who sell (mercury) over the counter; the various financiers who do the same; and the licenced sellers who double up as registered gold buyers (Spiegel and Veiga, 2010; Cordy et al., 2013; Esdaile and Chalker, 2018). Why is understanding this link so significant? The short answer is that doing so provides a greater appreciation of the livelihoods dimension of ASM. Specifically, it is argued that mercury supply and distribution is a much-overlooked aspect of the livelihoods dimension of ASM in sub-Saharan Africa, which a detailed analysis of the dynamics of any productive gold site in the region would illuminate.

The chapter begins, in Section 2.2, by contextualizing analysis on mercury pollution in the ASM sector, with the goal of broadening understanding of why it has become such a preoccupation of governments, the media and the general public in recent decades. Section 2.3 proceeds to survey the literature on the livelihoods dimension of ASM in sub-Saharan Africa, drawing upon what is believed to be its most significant strands. In Section 2.4, the key planks of the theoretical/conceptual framework adopted in this thesis are introduced, each of which helps to locate the discussion on mercury use and its supply in the wider literature on livelihoods in ASM, with special emphasis on sub-Saharan Africa. Section 2.5 provides concluding remarks, and

serves as a lead-in to the next chapter, which zeros in on the dynamics of ASM in Ghana specifically by surveying key works published on this subject over the past three decades.

### 2.2 Contextualizing the "Mercury Pollution Problem" in the ASM Sector

Over the past three decades, methylmercury pollution associated with ASM activities – dubbed from this point forward the "mercury pollution problem" – has received considerable attention from scholars and policymakers. It is a discussion that has focused heavily on amalgamation, which has been the most popular technique for extracting gold from ore on an artisanal and small scale for over 500 years. The amalgamation process itself, which has been well-documented in the literature for decades (Telmer and Veiga, 2009; UNEP, 2013; Spiegel & Veiga, 2010), entails mixing elemental mercury with gold-containing ore to form a mercury gold amalgam. The amalgam is subsequently heated to vaporize the mercury, resulting in the retention of purified gold.

This leads to what is the very obvious yet ignored issue: why "phasing out" mercury use is by no means straightforward. Calls for doing so have centred heavily on the mercury emissions released from the amalgamation process into the environment, which over time, methylates and contaminates local air, water, and soil, thereby posing serious health hazards to miners and surrounding communities (Esdaile and Chalker, 2018; Gerson et al., 2022). A detailed analysis of these impacts is beyond the scope of this thesis but broadly, exposure to methylmercury, even in trace amounts, can impair the development of children in utero and early on in life; can have toxic effects on the nervous, digestive and immune systems; can cause neurological damage; and may affect the lungs, kidneys skin and eyes (WHO, 2021). At the same time, however, and what is often routinely ignored is the simplicity of the amalgamation process – specifically how it is highly-accessible to miners with limited funds and technical expertise – and mercury's low cost, great availability, and efficiency in gold recovery, even from low-grade ores. This is why amalgamation remains so popular in ASM in all corners of the globe. "Alternatives", including gravity concentration, cyanidation, and borax-based methods, are either more costly or require greater expertise than what is generally on-hand to implement effectively (Hinton et al., 2003; Hilson & van der Vorst, 2002).

Though practiced for centuries, mercury amalgamation first came to the attention of the media, global public and governments worldwide in the late-1980s and 1990s during the heyday of the *garimpeiro* gold rushes in the Brazilian Amazon (Hilson et al., 2020). With a history of gold mining spanning five centuries, Brazil has long been the focus of studies on methylmercury contamination linked to artisanal and small-scale activities (e.g. Nriagu et al., 1992; Malm et al.,

1995; Veiga and Hinton, 2002; Miserendino et al., 2017). Between 1550 and 1880, ASM gold mining activities in Brazil were responsible for the release of 200,000 metric tonnes of mercury into the natural environment; an additional 2000 metric tonnes were released during the *garimpeiro* gold rush (Malm, 1998). A case could be made that from this point onward, the ASM sector would start to be perceived differently by donors and policymakers across the globe. An analysis of scholarship and works linked to donor-funded projects on ASM (see e.g. Noetstaller, 1987; Davidson, 1993; World Bank, 1997, 2002) reveals that the main focus up to this point was on mechanization and the equipment needs of those operating in the sector. This "technical, productivity-linked approach in the 1980s" was replaced by "a broader socio-economic approach that involved environmental concerns in the early-1990s" (Jennings, 2003). The implication here is that scholars, policymakers, NGO officials and donors began viewing the sector, and analyzing its impacts, more dynamically.

While not a sweeping generalization by any means, this claim (i.e., that a broader socio-economic approach that involved environmental concerns) does warrant some further explanation. The impression conveyed by Jennings (2003) was that researchers and policymakers had started to take more of an integrated and holistic approach to diagnosing the challenges facing ASM and its impacts. The validity of this claim, however, is open to debate. In Brazil and the wider Amazon, while coverage of the socioeconomic dynamics of ASM, including the organizational structures of sites, financial flows between its actors and health concerns in local satellite communities (see e.g. Hoogbergen and Kruijt, 2004; Hoefle, 2009; de Theije and Heemskerk, 2009), has been extensive, understandably, it has been overshadowed by the much deeper and older body of work on mercury pollution from operations in the basin. Even powerful anthropological works such as *Anatomy of the Amazon Gold Rush* (Cleary, 1990) and *At the End of the Rainbow? Gold, Land, and People in the Brazilian Amazon* (MacMillan, 1995), produced during the peak period of the gold rush in Brazil, failed to shift focus away from the "mercury pollution problem" in the country and, broadly, change perception of ASM in the country.

In sub-Saharan Africa, research on ASM appears to have followed a very different path. Much like research in Brazil and the wider Amazon Basin, scholarship on ASM in sub-Saharan Africa has also been dichotomous, which has had a profound impact on policies designed for, and donor-funded technical assistance implemented in, the sector in all parts of the region. On the one hand, there is a body of technical research that spotlights the environmental impact of, and health and safety concerns at, ASM operations (e.g. Ikingura et al., 1997; Van Straaten, 2000a, 2000b; Green et al., 2019; Bose-O'Reilly et al., 2020; Mulenga et al., 2024). It focuses heavily on mercury contamination at sites, which has attracted a sizable following over the years.

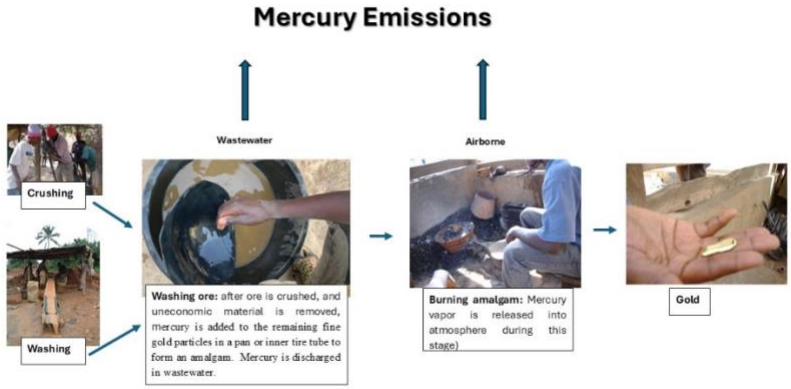
Replicating research carried out in Brazil and other ASM "hotspots" such as the Philippines and Indonesia (e.g. Appleton et al., 1999; Drasch et al., 2001; Ayhuan et al., 2003; Limbong et al., 2003; dos Santos et al., 2004), environmental scientists working across sub-Saharan Africa have, over the course of the past three decades, continued to produce analysis that reveals the water, air, soil and vegetative matter around sites containing elevated concentrations of (methyl)mercury. They draw attention to the amalgamation process in the region, which by comparison to Brazil, is extremely rudimentary, and highlight sources of contamination in the production process followed (depicted in Figure 2.1).

This work is, what Hilson (2006) claimed nearly two decades ago, "effects-based research", a reference to analysis that is *replicated* and offers very little new information aside from further reinforcing the scale of the environmental impacts the use of mercury in ASM has had in the region. Yet, despite barely acknowledging the social and economic aspects of ASM in sub-Saharan Africa, it is this body of literature, with its powerful messages and condemnations of the environmental impacts of the sector, that have captured the interests of policymakers and NGOs. A small body of work (e.g. Spiegel and Veiga, 2005; Jønsson et al., 2009; Drace et al., 2012) exists that provides a glimpse of potential technical and educational strategies for addressing the mercury problem in sub-Saharan Africa which highlights some of the social and economic aspects of the sector. But on its own, it is unlikely capable of fostering "a broader socio-economic approach that involved environmental concerns" in policy on ways which Jennings (2003) describes. These pieces barely go beyond superficial treatment of the social and economic aspects of the sector, and typically do so through brief situational analyses.

"Effects-based research" has accumulated in sub-Saharan Africa over the past two decades, doing little more than confirming, using samples of human tissue, blood and hair, as well as water, soils and plant matter, that in areas of the region where ASM is widespread and amalgamation features there are elevated concentrations of methylmercury (see e.g., Yevuga et al., 2021 Gyamfi et al., 2021; Jovne et al., 2023; Mariki et al., 2024). This work, has come increasingly into the global spotlight since the launch of the *Minamata Convention on Mercury (MCM)*, which, as explained in Chapter 1, is an international agreement designed to address global mercury pollution (Evers et al., 2016). The *Minamata Convention* specifically seeks to "protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds and it sets out a range of measures to meet that objective", a list that includes "measures to control the supply and trade of mercury, including setting limitations on specific sources of mercury such as primary mining, and to control mercury-added products and manufacturing processes in which mercury or mercury compounds are used, as well as artisanal and small scale gold mining" (UNEP, 2024, p.2). Countries that have

ratified the *Minamata Convention*, which came into force on 16 August 2017, are first required to produce a baseline assessment of mercury emissions or MIA.

**Figure 2.1**: Depiction of the mercury amalgamation process common at ASM sites in sub-Saharan Africa and sources of mercury emissions




*Source*: Author's construct

These baselines have confirmed what had long been suspected: that ASM is the world's largest anthropogenic source of mercury emissions (Spiegel et al., 2015). Estimates vary but nevertheless underscore the severity of what is now being portrayed as a global health epidemic. Veiga et al. (2006) were among the first to put forward estimates of releases, reporting, nearly two decades ago, that annual emissions of mercury from ASM are the range of 800-1000 tonnes. China (200–250 tonnes), Indonesia (100–150 tonnes), and Bolivia, Brazil, Colombia, Peru, Philippines, Venezuela and Zimbabwe (10-30 tonnes) top the list. The authors further explained that most of the mercury used that accounted for these projections entered these countries legally, typically via imports from the European Union (the European Union has, of course, since banned exports of mercury).[5] Esdaile and Chalker (2018) more recently reported that mercury releases from tailings and vapour exceed 1000 tonnes annually, originating from activities undertaken from 10-19 ASM operators across the world. The broad consensus today is that ASM accounts for the release of 38 percent of anthropogenic emissions of mercury (Schwartz et al., 2023).

[5] In 2011, the European Union passed Regulation No 1102/2008 which prohibits member states from exporting metallic mercury, certain mercury compounds and mixtures . It subsequently passed a new law, Regulation on Mercury 2017/852, on 1 January 2018, which culminated in both an EU export ban on mercury and import ban (on mercury and mercury mixtures). See "The Mercury Regulation (EU) 2017/852", https://era-comm.eu/eu_air_quality_law_and_the_right_to_clean_air/part_2/part_2_4.html#:~:text=As%20of%202011%2C%20the%20EU,the%20EU%20is%20also%20banned. (Accessed 4 May 2025).

Whether intentional or not, the *Minamata Convention on Mercury* has, once again, brought into sharp focus the environmental side of ASM in an overbearing manner. It has sparked a global media frenzy over, public fixation on, and government condemnation of, mercury usage in ASM on a scale not seen since the peak of *garimpeiro* activities (in the Amazon) in the 1980s and 1990s. Moving forward, this does not bode particularly well for sub-Saharan Africa – the focus of this thesis – because here, on the balance of the evidence, ASM is, as will be explained in greater detail in Section 2.3, predominantly poverty-driven and interconnected to rural livelihoods more so than other parts of the globe. In other words, while it may be in the interests of host governments to phase out mercury use at sites and ASM more generally because of global pressure and concerns over downstream contamination, its indispensable economic importance in the region makes this impossible.

According to the latest figures, virtually all of sub-Saharan Africa is now operating in step with the *Minamata Convention on Mercury*. At the time of writing, in Africa, 33 countries had ratified the convention, nine had "accession" status and an additional two countries had "acceptance" status.[6] Ghana, the focus of this thesis, was the 40th Future Party to the *Minamata Convention*, signing and ratifying it on 24 September 2014 and 23 March 2017, respectively. As is the case with all countries, an Executing Agency, Implementing Agency and National Focal Point have been assigned to assist Ghana with its requirements, post-ratification (Table 2.1). This begins with completion of an MIA, an enabling activity supported by the GEF that aims to paint a portrait of national mercury pollution through an elaborate presentation of existing and fresh emissions and contamination data.[7] To assist ratifying countries, the UNDP has developed a guidance document, *Minamata Initial Assessment Report Suggested Structure and Contents* (IOMC, 2020), which offers insights on how to conduct inventories of, and construct emissions profiles for, mercury. Following completion of an MIA, countries are required to produce a NAP, a document which serves as the national blueprint for reducing and where possible, eliminating, the use of mercury in ASM, with the goal of minimizing human and environmental exposure to

[6] See "Party Profiles", https://minamataconvention.org/en/parties/profiles?field_geographical_region_value=Africa (Accessed 4 May 2025). Following their signatures, countries can become a formal part of the Minamata Convention through 1) ratification, or the official government consent to be a bound by it; 2) acceptance, which has the same legal effect but used in situations where the party has not signed the treat; and 3) accession, where the state agrees to a state accepts the offer or the opportunity to become a party to the treaty on the grounds of it having been negotiated and signed by other states. See UN Environment, 2024.

[7] "Minamata Convention Initial Assessments (MIAs)", https://minamataconvention.org/en/parties/minamata-initial-assessments#:~:text=The%20development%20of%20Minamata%20Convention,more%20initial%20assessments%20become%20available. (Accessed 13 May 2025).

it.[8] Each must be produced in line with guidelines outlined in Annex C of the *Minamata Convention on Mercury: Text and Annexes* (UN Environment, 2024).

**Table 2.1:** Institutional setup to respond to the Minamata Convention on Mercury[9]

| Institution | Description | Institution in Ghana |
|---|---|---|
| Executing Agency | The executing agency for the Minamata Convention on Mercury varies by country and project. They can include national environmental agencies order equivalent, regional organisations and even UN agencies such as UNITAR, UNIDO and of course UNEP. | UNIDO |
| Implementing Agency | Responsible for supporting the implementation of the Minamata Convention on Mercury. The United Nations Environment Programme (UNEP) is the main implementing agency, providing capacity building and technical assistance to ratifying countries. | Ghana EPA |
| National Focal Point | Is the designated official point of contact in each country that has ratified the Minamata Convention on Mercury. The National Focal point for all matters related to the convention within the ratifying country. | Deputy Director, EPA |

It is the buzz that the *Minamata Convention on Mercury* has generated in donor circles, the particular tone of the messaging emerging from ratifying governments about ASM, along with the resulting growing public condemnation of the sector on environmental grounds that provided the impetus for this thesis. Despite preaching a message of "reducing and *where possible, eliminating*, the use of mercury in ASM", governments in sub-Saharan Africa are going to extreme lengths to phase out amalgamation altogether, seemingly at all costs (Hilson et al., 2018). Even if they are overstepping their limits, it is easy to see why: the *Minamata Convention on Mercury* is an *environmental* treaty, calling for the elimination mercury on *environmental grounds*, and which demands that ratifying countries first produce an MIA that details *environmental* impacts, and subsequently, an NAP that outlines an *environmental* program. At the same time, there is

[8] "Mercury in ASGM: Latest trends from Minamata National Actions Plans", www.unep.org/globalmercurypartnership/news/blogpost/mercury-asgm-latest-trends-minamata-national-actions-plans#:~:text=Development%20of%20National%20Action%20Plans%20(NAPs)%20for,in%20its%20territory%20is%20more%20than%20insignificant. (Accessed 3 May 2025).

[9] "Minamata Convention on Mercury", https://minamataconvention.org/en (Accessed 4 May 2025).

minimal reference made to the social and livelihoods dimension of ASM in the region; if anything, the dialogues the *Minamata Convention on Mercury* have generated, which focus almost exclusively on the environmental and health-related impacts of mercury, largely overshadow meaningful discussion on the economic importance of the sector. While sub-Saharan Africa accounts for only 16 percent of anthropogenic mercury emissions, a whopping 80 percent of this comes from ASM (UN Environment, 2019).

The next section of this chapter unpacks the livelihoods dimension of ASM in sub-Saharan Africa, the strands of which are being increasingly overshadowed by policy dialogues on the Minamata Convention on Mercury and actions taken to meet goals enshrined in NAPs.

**2.3 Surveying the Literature on the Livelihoods Dimension of ASM in Sub-Saharan Africa**

In addition, and in contrast, to the mercury contamination-centred literature described above, there is a dynamic and diverse body of literature that sheds important light on the social and economic impacts of ASM in sub-Saharan Africa. The work that falls into this category is thought-provoking and rich empirically, disconnected and disassociated from the technical work mentioned above, despite first surfacing at roughly the same time (late-1990s and early-2000s). It was during this time that the theme of "livelihoods" first emerged in the literature on ASM (see e.g. Davidson, 1993; Labonne 1994, 1996). Officials at the International Labour Organization (ILO) were the first to thoroughly unpack the livelihoods "dimension" of ASM, in the landmark report, *Social and Labour Issues in Small-Scale Mining* (ILO, 1999). The document revisited and proceeded to analyze in depth a series of key social issues in ASM touched on briefly during the 1990s in policy dialogues but which failed to spark much discussion in government and donors circles. Among the major issues discussed were gender inequality (in the sector), inappropriate regulations and policies, direct employment, and the auxiliary income-earning activities ASM generates.

In the case of sub-Saharan Africa, since publication of the ILO report, four interconnected strands of (interconnected) literature have emerged that have come to define and shape discussions on the livelihoods dimension of the region's ASM sector. The **first** is a fairly obvious one: direct employment. Various estimates have been put forward over the years (see ILO, 1999; World Bank, 2019). The figures compiled on the DELVE Database (https://www.delvedatabase.org/) suggest that there are at least 20 million people employed directly in ASM across sub-Saharan Africa (Hilson et al., 2017). Specific employment figures have emerged for some of the major ASM hotspots in the region: Ghana, one million (Mabe,

2023); Tanzania also one million (Mutagwaba et al., 2018); DR Congo, two million (DELVE, 2021); and Zimbabwe, at least 500,000 (Gwande, 2023).

A **second strand** sheds light on what ASM income is used for. An important component of this body of literature provides a glimpse of the interconnectedness between subsistence agriculture on the one hand, and ASM on the other hand. It was Maconachie and Binns (2007) who, based on fieldwork conducted in Sierra Leone, first underscored how in post-independence sub-Saharan Africa both activities dovetail and complement/subsidize one another across seasons. Scholars have since carried out research across the region which show how interdependent they are, in many cases undertaken simultaneously by families. This interconnection means that income and labour flow freely and unimpeded between the two activities, and that the economic importance of each varies, depending on the circumstances individuals face (Hilson, 2016). Simultaneous engagement in farming and ASM in sub-Saharan Africa also acts as a buffer against economic shocks and stresses, revealed most illuminatingly during the Ebola epidemic in the Mano River Region and most recently, the COVID-19 pandemic (Maconachie and Hilson, 2018; Hilson et al., 2021; Muthuri et al., 2021; Perks et al., 2021). Work which profiles the interconnectedness between ASM and farming has since been undertaken in a number of countries in sub-Saharan Africa, including (further work) in Sierra Leone (Maconachie, 2011; Cartier and Burge, 2011), Liberia (Hilson and Van Bockstael, 2012), Tanzania (Jonnson and Bryceson, 2009; Poignant, 2023), Malawi (Kamlongera, 2011) and – the focus of this thesis – Ghana (Hilson, 2010; Adranyi et al., 2023).

Another aspect of this body of literature articulates the drivers fuelling participation in ASM, and what motivates them to do so. On the former point, Hilson (2016) was among the first to highlight drivers of ASM participation in sub-Saharan Africa, building on points raised decades ago (see Barry, 1996). The basic typology he advanced presented, at the one extreme, "poverty-driven" activity and at the other extreme, "get-rich quick" activity. In further explaining what this means in the context of personal aspirations, Hilson et al. (2018) aligned these two narratives with comparable descriptions of entrepreneurial activity, drawing on theoretical work published in the Business and Management literature. "Poverty-driven" activity should be viewed as what business scholars refer to as "necessity-based entrepreneurship" – that is, work taken up out of desperation and the need to survive. "Get-rich quick" activity is rather akin to what is commonly described as "opportunity-based entrepreneurship", or work taken up because there is perceived investment gain in doing so. "Poverty-driven" activity can be misconstrued as "get-rich quick" activity in instances where people turn to ASM out of desperation initially but

eventually enjoy success through shrewd accumulation and investment of earnings (Hilson and Hu, 2022).

The **third** and **fourth** strands of the literature are those which will be relied upon herein to locate mercury supply chains in discussions on the impacts of ASM in sub-Saharan Africa. The third strand highlights one of the most important aspects of the livelihoods dimension of ASM in sub-Saharan Africa, which is regularly overlooked: the auxiliary income-earning activities it creates. A quick glance at any ASM site in sub-Saharan Africa would reveal this phenomenon – how for every person employed directly, there are individuals who feed, clothe, transport, entertain, sponsor and house him/her. Focusing on dependents alone, Girard et al. (2024) projected the multiplier effect in the region's ASM sector to be five. There is, however, case study evidence to suggest that the multiplier effect at ASM sites in sub-Saharan Africa extends beyond family members, and includes sizable vibrant and ancillary economic activities. Examples include women miners opening bars and restaurants at sites in Kenya (Buss et al., 2022); people who have used earnings to finance the construction of hotels in gold-rich areas of Burkina Faso (Werthman, 2009); and individuals using mine monies to invest in a radio station in a locality in Ghana (Hilson and Hu, 2022). The dynamics of what Traore et al. (2024) dub the "ASM ecosystem", however, are rarely taken into account in policymaking decisions regarding the sector.

The list of auxiliary income-earning activities which ASM kickstarts in the region includes several individuals and groups responsible for facilitating mercury's availability, steady supply and distribution at ASM sites. Fritz et al. (2016) use Stakeholder Theory to identify individuals potentially impacted by "mercury trade and supply" at ASM sites, and are among few scholars to investigate this issue with some urgency, framing their work against the backdrop of the passage of the *Minamata Convention* and its implications for the sector. The authors identified, following a survey distributed to government officials and researchers, 13 "local stakeholders" potentially impacted by mercury supply and trade: 1) certification bodies, 2) financiers, 3) large-scale gold miners, 4) landowners, 5) technology owners, 6) informal mercury and gold market stakeholder (e.g. brokers and buyers), 7) gold shops, 8) security guards, 9) local government officials, 10) (ASM) miners associations, 11) ASM communities, 12) (mercury sellers) and 13) the miners who use/recover the mercury itself.

Aside from Fritz et al. (2016), the only other attempt made to map the mercury supply chain for ASM is a joint study undertaken by the Centre for Environment Justice and Development, and the Africa Centre for Energy and Mineral Policy (EJD and ACEMP, 2020). It, too, was

commissioned largely in response to developments taking place under the *Minamata Convention*, in an attempt to "map formal and informal mercury import and export in East Africa, with a particular focus on identifying illicit trade routes, trade hubs, price and quantity patterns, and key players" (p. 4). Neither study, however, is much more than a stakeholder mapping exercise. Reinforcing points put forward by Traore et al. (2024) the implications of this oversight cannot be overstated because it is not just those extracting gold at sites who are impacted by sweeping policy decisions but rather the entire *ASM ecosystem*. Each ASM ecosystem features a multitude of actors, most of whom are *not* mining (i.e. extracting/transporting/processing ore) but nevertheless carry out a series of tasks critical to, and whose wellbeing is dependent on, its continued functioning and resource/monetary circulation through it. This includes the many thousands of people responsible in some way for facilitating the timely supply and distribution of mercury at ASM sites.

Fritz et al. (2016) and EJD and ACEMP (2020) also touch on a critical **fourth** strand of literature: the sector's persistent informality. This is of central import to this thesis. Broadly, and as numerous scholars have highlighted over the years (e.g. ILO, 1999; Hilson and Potter, 2005; Spiegel, 2015; Kumah, 2022), a combination of factors have pushed artisanal and small-scale gold mine operators into the informal economy in Ghana and various other countries in sub-Saharan Africa, including Liberia, Tanzania, Zimbabwe and Mozambique. These factors include: high fees for licenses/permits, bureaucratic application processes that must be navigated to lodge them, and shortages of land due to sizable percentages of it being awarded as concessions to (large-scale) mining and mineral exploration companies. Further examination of each of these is beyond the scope of this thesis but central to them is the *layering* of informality and formality in a typical ASM community.

Specifically Fritz et al. (2016) and EJD and ACEMP (2020) reveal the synergies between actors embedded in both the informal and formal economies, without which mercury would not reach, let alone be distributed at, sites. The mix of formal and informal sector actors is very much resonant with the ASM sector as a whole, irrespective of the legal status of the site. For example, a licensed gold buyer is often seen purchasing ore from an illegal miner, who purchases equipment from a shop in a local town whose owner pays VAT to the government. The dynamics are complicated further by various actors who assume *multiple* roles in the ASM ecosystem, as revealed in the literature around mineral buyers. Although projected as exploitative, many buyers double up as financiers at sites and supporters of family needs more generally (See e.g. Teschner, 2012; Perks, 2016).

The problem is, as indicated, that the technical research undertaken on the environmental and health-related impacts of amalgamation in ASM across sub-Saharan Africa, and work it has helped to jumpstart under the *Minamata Convention on Mercury*, has cast a sizable dark cloud over the sector. Consequently, it has become near-impossible to build a case for how the mercury supply chain acts as an integral component of the sector's livelihoods "dimension" in the region. The aim of this thesis, therefore, is to lay important groundwork for rewriting the narrative on mercury in ASM and in the process, and more broadly, the sector's livelihoods "dimension", by unearthing details of its supply chain and distribution network, and the actors who populate them. It does so through a case study of Ghana, the location of one of the largest and complex ASM economies in sub-Saharan Africa and where mercury pollution in the sector has long been identified as a persistent environmental problem, as confirmed by numerous scholars over the past two decades (see e.g. Babut et al., 2003; Mensah et al., 2016; Clifford, 2017).

Ghana is a prime target for exploring more closely perceptions and handling of the "mercury pollution problem" in ASM because, at the time of writing this thesis, the country housed no fewer than three active multimillion dollar donor-funded projects supporting the ASM sector. These are as follows: 1) the *Africa Environmental Health and Pollution Management Program* (P167788), 2020 – 2025, funded by the World Bank; 2) *Ghana Landscape Restoration and Small-Scale Mining Project*, 2022 – 2027, also funded by the World Bank; 3) and the Ghana planetGOLD Project, 2022 – 2027. It is the latter which deserves some spotlight at this point because in many ways – and whether this was intentional or not is open to debate – it is one of few interventions (research, policy or technical) made to date that has attempted to articulate a link between mercury use in the ASM sector and those dependent on it for their livelihoods. This has to do with the goals of the parent planetGOLD program itself, under which Ghana and several other countries were selected to have a national project.[10] A US$350 million project supported by the GEF with inputs from UN agencies, the planetGOLD program "works in partnership with governments, the private sector, and ASGM communities to significantly improve the production practices and work environment of artisanal and small-scale miners".[11] As currently witnessed in Ghana, national projects prioritize work in four areas: 1) finance, 2) support for formalization, 3) awareness raising, and 4) connecting mining communities with mercury-free technology and formal markets. Those hoping planetGOLD will generate attention to ASM livelihoods in the

[10] Ghana is actually a part of Phase II of the program. It joins 14 other countries, including nine others in sub-Saharan Africa: Bolivia, Honduras, Madagascar, Nigeria, Republic of the Congo, Suriname, Uganda, Côte d'Ivoire, Ecuador, Guinea, Mali, Nicaragua, Sierra Leone and Zambia. Phase I, now completed, featured nine countries: Indonesia, the Philippines, Mongolia, Burkina Faso, Kenya, Colombia, Peru and Guyana.

[11] See "About", www.planetgold.org/about (Accessed 23 May 2025).

debate on the mercury pollution problem, whether in Ghana or elsewhere, however, have set themselves up for disappointment. Although some fairly comprehensive reports about ASM populations have been produced in Phase I planetGOLD countries, they have not been produced to showcase aspects of operators' livelihoods *per se*. They have rather been produced with one environmental goal in mind: specifically, "supporting countries' commitments under the Minamata Convention on Mercury", and therefore "working to eliminate mercury from the supply chain of gold produced by artisanal and small-scale miners by" prioritizing work in the four abovementioned areas.[12] While work is yet to start under planetGOLD Ghana, with an agenda that remains largely unchanged in Phase II, the country seems destined to follow the same path as its Phase I counterparts. Ghana continues to fixate on pursuing technical solutions to the mercury pollution problem, coupled with the draconian approach taken by the government to extinguish unlicensed ASM activity (typically under the guise of "protecting our waterbodies"). This approach has been normalized in Ghana over the past few decades and does not bode well for the millions of people whose livelihoods are connected to the sector directly and indirectly. The latter list includes diggers, financiers, dependent family members and those engaged in auxiliary trades (equipment repair, transport, food supply, etc.).

For this reason, the research reported in this thesis is particularly timely. With the government of Ghana showing little inclination to date to locate livelihoods in discussions on the environmental impacts of ASM, there is a rare opportunity to make crucial connections at the inception phases of a project (planetGOLD Ghana) that seems destined to ignite media attention over incomplete stories and generate false hope about inappropriate solutions

### 2.4 Mercury Supply Chains, Networks and Informality in ASM: Piecing Together a Theoretical Framework

As indicated, this thesis does not attempt to map the supply chain and distributional networks for mercury used in the ASM sector to demonstrate how they impact rural livelihoods economically. Rather, this study sought to identify the actors in the mercury supply chain linked to ASM sites and shed light on the roles they play. While the handful of studies referred to in the previous section of this chapter do an excellent job of identifying actors who populate the networks facilitating the circulation of mercury supplies at ASM sites, none take stock of the employment opportunities they create. Nor do they offer much insight into the likely intersections between the supply chain for gold linked to ASM on the one hand, and that for mercury on the other hand, with relation to human capital and finance. This thesis will draw on

[12] *Ibid*.

findings from Ghana to physically locate the former in the latter while simultaneously laying the groundwork for inclusion of mercury use in ASM in broader debates on the sector's livelihoods dimension.

A significant relationship undergirding the livelihood dynamic in gold and mercury in ASM is that they are largely located in the informal sector. This leads to the **first** theoretical plank of this work which is **informality**. Without go too much into detail, there is rich body of literature on this subject. The line of work most frequently relied upon by scholars to theorize informality in ASM is the legalist school (Chen, 2012), headed by the Peruvian economist Hernando De Soto (De Soto, 1989, 2001). Reinforcing points raised in Section 2.3, the legalist literature on informality views the informal economy as separate world, in which the actors who populate it forge their own trust-based relationships, deals and partnerships that are not recognized outside of the sphere of work. The argument presented by De Soto and articulated in the context by Siegel and Veiga (2009) is that the many deeds, titles and agreements that are recognized in the informal economy be "activated" – so called "dead capital" – which would go a long way toward empowering unlicensed artisanal miners not recognized by law. This body of work has been used by ASM scholars to help conceptualize the "world" that the sector's operators and groups find themselves working and living in across sub-Saharan Africa: a space in which, even in instances where individuals possess the correct permits, people struggle to access formal support in the form of finance and technology. Scholars argue that it is the struggles in this "world" which lead to various actors emerging and taking on roles that ordinarily, others assume: as financiers, equipment suppliers and taxiing. Antonio (2023) was among the first to use the legalist approach to theorize how the world in which informal ASM groups are found fosters relationships between the actors found there and what these may mean. For the purposes of this thesis, however, De Soto (1989, 2001) is only relied upon to conceptualize boundaries and to legitimize how the roles of the actors found there are shaped by their circumstances.

The **second theoretical plank** is that of the of the Global Production Network (GPN) which I employ to theorize and "map" networks of actors. It is a framework that has gained popularity in the field of Economic Geography to trace industry networks, and thus helps locate actors in the mercury supply chain in sub-Saharan Africa. The thesis also uses GPN to more accurately assess the economic consequences of mercury's rapid phase out, which, as indicated, many governments in sub-Saharan Africa have interpreted to be the aim of the Minamata Convention on Mercury. While recognized here that the GPN was pioneered to map the dynamics of international industries and their reach across the globe, as McQuilken and Hilson (2018) explain, aspects of it are useful when it comes to mapping actors in informal sectors such as

ASM. As identified by Henderson et al (2002) central to this are questions of embeddedness (the idea that there are social/spatial arrangements in which economic units are entrenched), value (the idea that there are actors and various elements in a supply chain that enhance production and the value chain) and power (that different actors have different levels of influence and command over a supply chain). The unique attribute of the GPN is that it also recognizes *horizonal*, not only *vertical*, linkages, in a bid to theorize relationships between actors in a supply chain (McQuilken and Hilson, 2018).

Pioneering work on the GPN was predicated upon there being a central firm around which subsidiaries and other business entities gravitate (Henderson et al., 2002; Hughes et al., 2008). It has surprisingly attracted very little attention until recently as a tool for mapping informal industries, within which trust and relationships between people are critical to the success of production (Philips, 2011). This includes ASM, which, as explained throughout this chapter, is persistently informal throughout sub-Saharan Africa (Hilson and Maconachie, 2017, 2020). Only recently has GPN been applied to this sector to better understand connections and relationships among those within ASM's many supply chains (see Cuvelier, 2019; Geenen, 2018). This thesis applies the GPN framework to the networks linked to mercury supply and distribution in Ghana, demonstrating their inseparability from broader supply chains linked to gold production, distribution and marketing in the region's ASM communities.

This leads to the **third and final** plank in the conceptual approach adopted here to contextualize the mercury supply chain: the complementary rooted networks approach. The rooted networks framework seeks to situate production networks in broader "socio-ecological relations, while emphasizing the place-specific materiality of these relations" (Stoddard et al., 2018, p. 960). Pioneered by Rocheleau and Roth (2007), the "rooted network" approach assists with generating a granular level of detail at the regional and community levels, helping – in this instance – to paint an accurate picture of mercury supply chains linked to ASM sites and livelihoods in Ghana specifically.

Using the GPN and rooted networks frameworks as a guide, the thesis examines who populates the mercury supply chain in the Eastern Region of Ghana, their economic relationship with the mercury supply chain, and the contributions and interdependence between its nodes, gold production and the parallel ASM supply chain. There is an element of the recent GPN literature that factors in here as well: work which theorizes the presence of *multiple* GPNs. When extrapolated for the purposes of ASM, the ideas underpinning this body of work legitimize the presence of multiple, interrelated supply chains, each with its own unique attributes and actors,

yet with overall, often overlapping, links (Yeung and Coe, 2015; Coe et al., 2015; Todd et al., 2020; Hilson et al., 2024).

### 2.5 Concluding Remarks

This chapter outlined the conceptual framework adopted in this thesis and reviewed elements of the extant literature on mercury and ASM. The intention is to reveal its limitations in relation to the role mercury supply plays in broader ASM livelihoods. This is particularly relevant to sub-Saharan Africa where, as Section 2.2 explained, there has been extensive research carried out on the environmental impacts of mercury pollution but minimal appreciation of the social and economic implications an amalgamation "phase out" would have for so many artisanal miners. This context sets stage for the case study of Ghana, for which further details are laid out in Chapter 3.

# CHAPTER 3
# INTRODUCTION TO THE GHANA CASE

## 3.1 Introduction

This chapter sets the stage for the case study of ASM in Ghana explored in this thesis. As the first country in sub-Saharan Africa to legalize small-scale mining, Ghana has heavily featured – for better or for worse – in the literature produced on ASM over the past three-four decades. The initial focus of the literature on ASM concerned policies and regulations and ultimately facilitated the sector's legalization/formalization (see Davidson, 1993; UN, 1996a). The efforts made in Ghana to formalize ASM were so highly-regarded by donors, other governments and NGOs at the time, that it was seen as "a leader in the promotion of small-scale mining enterprises" (UN, 1996b).

The chapter begins in Section 3.2, with a brief review of the laws, regulations and institutional frameworks instituted in a bid to formalize ASM in Ghana. Understanding the context in which these moves were made and the significant policy changes that have followed in subsequent years underscore why ASM is persistently informal in Ghana. Section 3.3 delves into the mercury pollution problem as manifested in Ghana. Reinforcing the position presented in Section 2.2, most of the research that has been undertaken exploring mercury use at ASM sites in Ghana is "effects-based". Section 3.4 places this discussion in the context of the work on ASM livelihoods carried out in the country. It is guided by the same framework developed in Chapter 2 to examine the subject, building the case that in Ghana, ASM contributes positively to rural livelihoods by drawing on evidence in support of each of the four strands identified: 1) direct employment, 2) details of what income earned from the sector is used for, 3) evidence of auxiliary income-earning activities, and 4) persistent informality. Section 3.5 serves as a lead-in to Chapter 4, which outlines the methodology adopted in this research. Here, the theoretical framework developed in Section 2.4 is refined further through integration of material in the literature that aligns with each of its three planks, namely *informality*, the *GPN* and *rooted networks*. Section 3.6 provides concluding remarks.

## 3.2 Formalization of ASM in Ghana

Why was Ghana selected as a case study for examining technical work on the "mercury pollution problem" in sub-Saharan Africa within debates on the sector's livelihoods dimension? While the author's previous fieldwork in the Eastern Region of Ghana facilitated an understanding of the dynamic interactions between small-scale miners, this is insufficient on its own for rationalizing *why* the country was a logical choice to explore the dynamics of mercury supply chains and

distribution channels linked to the sector. There are several other reasons why Ghana is perhaps *the* most appropriate case study in sub-Saharan Africa for exploring the social dynamics of mercury supply and distribution in the ASM sector. They are as follows: 1) it having one of the more dynamic ASM economies in sub-Saharan Africa; 2) how policies implemented in the country have *informalized* the sector; and 3) operators being criminalized by the government. Each reason is examined in turn.

The **first reason** is that Ghana has one of the more dynamic ASM sectors in the region. It was the first country in sub-Saharan Africa to official legalize small-scale mining (in 1989), following passage of the *Small-Scale Gold Mining Law* (PNDCL 218), *Precious Minerals and Marketing Corporation Law* (PNDCL 219) and *Mercury Law* (PNDCL 217).[13] Since this time, the sector expanded rapidly, and at its peak levels of production in the mid-2010s, it accounted for 30 percent of declared gold production in the country (Table 3.1). This growth rate is attributed to the swift establishment of an institutional structure for formalizing and supporting ASM, the details of which are examined in some detail in the literature.

Typically referred to as Small-Scale Mining Project (SSMP), this process was established in the early-1990s with financing from the German technical development agency, GTZ (World Bank, 1995; Wiedmaier, 1997; Yakubu, 2002). Four pillars were initially established in its institutional setup, each with specific responsibilities. The **first** was the Precious Minerals and Marketing Corporation (PMMC), which in the 1990s employed 800 licensed buyers and subagents, who travelled to ASM sites buying gold and diamonds locally (Hunter, 2019). This was a very effective system in capturing gold and reducing smuggling as government paid agents a price for gold close to the market rate. The **second** is the Geological Survey Department (since 2016, the Ghana Geological Survey Department, following passing of the *Ghana Geological Survey Authority Act 2016* or Act 928), which was given the difficult assignment of doing all prospecting, geophysical and geochemical work linked to ASM. The unit was empowered to identify geographical locations capable of supporting licensed ASM activity and to demarcate them for this purpose (World Bank, 1995).

[13] See Aryee et al. (2003) for a comprehensive overview of these legislative developments.

**Table 3.1** Small-scale gold mine production in Ghana (official), 1990 – 2016

| YEAR | LARGE SCALE PRODUCERS - OZ | SMALL SCALE PRODUCERS – OZ | TOTAL GHANA PRODUCTION OZ | % OF SMALL SCALE TO TOTAL PRODUCTION |
|---|---|---|---|---|
| 1990 | 517,818 | 17,234 | 535,052 | 3.22 |
| 1991 | 825,114 | 15,601 | 840,715 | 1.86 |
| 1992 | 976,223 | 17,297 | 993,520 | 1.74 |
| 1993 | 1,222,344 | 35,145 | 1,257,489 | 2.79 |
| 1994 | 1,338,491 | 89,520 | 1,428,011 | 6.27 |
| 1995 | 1,581,506 | 127,025 | 1,708,531 | 7.43 |
| 1996 | 1,474,746 | 112,349 | 1,587,095 | 7.08 |
| 1997 | 1,677,911 | 107,097 | 1,785,008 | 6.00 |
| 1998 | 2,244,819 | 128,334 | 2,373,153 | 5.41 |
| 1999 | 2,358,423 | 130,833 | 2,489,256 | 5.26 |
| 2000 | 2,168,802 | 145,662 | 2,314,464 | 6.29 |
| 2001 | 2,184,313 | 185,596 | 2,369,909 | 7.83 |
| 2002 | 2,075,954 | 160,879 | 2,236,833 | 7.19 |
| 2003 | 2,085,070 | 221,063 | 2,306,133 | 9.59 |
| 2004 | 1,783,400 | 246,570 | 2,029,970 | 12.15 |
| 2005 | 1,913,534 | 225,411 | 2,138,945 | 10.54 |
| 2006 | 2,095,553 | 247,063 | 2,342,616 | 10.55 |
| 2007 | 2,239,678 | 388,594 | 2,628,272 | 14.79 |
| 2008 | 2,378,012 | 418,943 | 2,796,955 | 14.98 |
| 2009 | 2,564,095 | 555,737 | 3,119,832 | 17.81 |
| 2010 | 2,624,391 | 767,196 | 3,391,587 | 22.62 |
| 2011 | 2,642,331 | 1,006,623 | 3,648,954 | 27.59 |
| 2012 | 2,848,409 | 1,464,781 | 4,313,190 | 33.96 |
| 2013 | 2,808,405 | 1,441,497 | 4,249,902 | 33.92 |
| 2014 | 2,851,885 | 1,489,722 | 4,341,607 | 34.31 |
| 2015 | 2,592,563 | 1,025,671 | 3,618,234 | 28.35 |
| 2016* | 2,620,033 | 1,134,635 | 3,754,668 | 30.22 |

*Source*: Data obtained from the Minerals Commission

The **third SSMP** pillar is the Minerals Commission, set up as the main policymaking and regulatory body for ASM. It established a Small-Scale Mining Unit, a department staffed with professionals and technical experts. The main responsibility of the Commission was (and continues to be) to oversee the licensing procedure for the *Small-Scale Gold Mining License*. To facilitate this, monies from GTZ assisted the Minerals Commission to establish district centres in areas designated as having high ASM potential: Assin Fosu and Dunkwa (Central Region); Bolgatanga (Upper East Region); Tarkwa, Bibiani and Asankrangwa (Western Region); and Akim

Oda (Eastern Region).[14] As Iddirisu and Tsikata (1998) explain, each was initially resourced with a 4X4 vehicle, field equipment and motor bikes, to support prospective applicants in their journeys to licensing. The final decision on applications is made in the country capital of Accra. Each district centre was staffed with a district officer from the Minerals Commission and a mines warden from the now-closed Mines Department, the **fourth** pillar of the SSMP. The Mines Department was charged with upholding health and safety standards in the sector. It continues in this role as the Inspectorate Division of the Minerals Commission, made official following implementation of the *Mining Act 2006*. District officers and mines wardens guide individuals in securing their *Small-Scale Gold Mining Licenses*. These licenses entitle holders to extract and process gold within a designated plot of land, to purchase mercury from an authorized distributor, and to sell product to a licensed buyer. Any licensed small-scale miner is authorized to work a plot of land no larger than 25 acres for up to five years, with the possibility for renewal.

The **second reason that Ghana is a highly appropriate case** is the *informalization* of the ASM sector. This arises from amendments that have been made to the initial SSMP architecture and policy that effectively shifted most ASM in Ghana to the informal economy, activity that is popularly referred to as "*galamsey*".[15] Most pertinent to this thesis, these changes have created a regulatory environment that has given rise to a mercury supply and distribution network with interconnecting formal and informal components. What factors have fuelled the growth of informal ASM in Ghana, within which mercury supply and distribution networks are now embedded? There is of course the exorbitant fees that must be paid and the bureaucratic procedures that must been overcome in order to obtain a *Small-Scale Mining License*. The important takeaway here is that the fees have *mounted* over the years, despite criticism (Teschner, 2012; Kumah, 2022). This is because various new institutions have been added to the SSMP over the years each of which has applied its own fees to ASM, beginning with the EPA and the Water Resources Commission. Initially, it was only payment that needed to be paid to the Minerals Commission. Today, the basic license fee that must be paid to the Commission is GH¢750.00, along with a US$70 for the application form, US$150 processing fee, GH¢3400 permit fee, US$120 for annual mineral rights per concession, and a GH¢600GH for the gazetting of land documents.

[14] It seemed almost inevitable that more district centres would open as ASM activity exploded. In 2013, another centre was opened in Wa (Upper West Region) and Konongo (Ashanti Region). Today, there are 13 district centres, up from the initial seven: 1. Obuasi, 2. Tarkwa, 3. Bibiani, 4. Asankrangwa, 5. Akim Oda, 6. Assin Fosu, 7. Konongo, 8. Wa, 9. Bolgatanga, 10. Ho, 11. Cape Coast, 12. Hohoe and 13. Kenyasi.

[15] A label assigned to informal artisanal mining in Ghana, the meaning of which is "gather them and sell".

Significantly, however, neither the EPA nor the Water Resources Commission were a part of the thought process when the *Small-Scale Gold Mining License* and underpinning institutional structure were conceived. To the EPA, payment of the "Application for Environmental Permit to Undertake Small/Medium Scale Mining" must now be made.[16] From the Water Resources Commission, miners must secure a *Water Use Permit*, which commands a GH¢600 Processing Fee and GH¢5000 Permit Fee. What makes these many different payments so significant is that they are not only administered by separate government units but each falls under its own ministry: the Minerals Commission, the Ministry of Lands and Natural Resources; the EPA, the Ministry of Environment, Science, Technology and Innovation; and the Water Resources Commission, the Ministry of Sanitation and Water Resources. It is little surprise that with decision-making spanning three ministries that delays on decisions with *Small-Scale Mining Licenses* are so lengthy and ultimately encourage people to operate in the informal sector. Keep in mind, too, that both the EPA and Water Resources Commission were established *after* ASM was fully legalized, in 1994 and 1995, respectively. There is also the issue of each being empowered with the authority to administer these fees long after their establishment: the *Water Use Permit* becoming a requirement following implementation of the *Minerals and Mining (License) Act* (Act 2176) in 2012, and the "Application for Environmental Permit to Undertake Small/Medium Scale Mining" not materializing in 2001, following passage of the *Environmental Assessment Regulations* (LI 1652), 1999.

The point here is that neither the EPA nor the Water Resources Commission were a part of the thought process when the *Small-Scale Gold Mining License* and underpinning institutional structure were conceived. Ghana's ASM activities were, therefore, evolving without these institutions being present. These have presented formidable barriers to formalization, with their constantly shifting demands (Tschakert and Singha, 2007; Hilson and Hu, 2022). It magnifies what may be an even more significant problem: the fact that so much land is now in the hands of large-scale mineral exploration and mining companies. It is no secret that African governments have long shown preferential treatment to these parties when it has come to demarcating concessions. Referred to by Hilson (2019) as the large-scale mining "bias", these countries recognize that there are significant amounts of revenue in the forms of royalties, ground rents and permit fees to gain by awarding concessions to large-scale mineral exploration and mining companies for set periods. A point of frustration for aspiring small-scale (mining) licensees, however, is that so many areas capable of supporting ASM geologically but which are unviable for large-scale extraction, are included as part of these concessions, thus "squeezing"

[16] Between 2001 and 2011, a GH¢100.00 permit fee charged by the EPA but in 2012, it increased this amount to GH¢750.00, and in March 2016, to GH¢5,000.00 along with an added GH¢1,000.00 processing fee (Hilson and Potter, 2005; Arthur-Holmes et al., 2022; Adu-Baffour et al., 2021).

these people even further. At the time of writing, close to 30 percent of Ghana's lands were under concession to large-scale mining and mineral exploration companies.[17]

The **final reason** is the criminalization of small-scale mining in Ghana, which has manifested as powerful criticism from media outlets that have branded it as a menace, and government action targeting the eradication of activities (Hilson, 2017; Tuokuu et al., 2020). In 2017, the ruling government launched *Operation Vanguard*, a military-led intervention aimed at eradicating all ASM activities country-wide. It was launched, coincidentally, after an electoral platform just months' prior designed heavily around promises to formalize ASM. The military-led intervention lasted a full 18 months, after which, *Operation Halt* was launched, more or less a continuation of the previous intervention. These successive sweeps have left a trail of destruction but more importantly, in the context of this thesis, have pushed the country's ASM activities even further into the informal economy, which commentators have not referenced explicitly but have nevertheless broached implicitly (Edu-Afful, 2022; Alhassan and Asante, 2022; Ayelazuno and Aziabah, 2025). This, it is argued here, includes networks linked to supply and distribution of mercury, contamination from which was a main focus of both campaigns.

The next section of this chapter explores how Ghana got to this point: specifically how the discourse on the mercury pollution problem has evolved in the country over the years, including how it has been shaped by policy.

### 3.3 Contextualizing the Mercury Pollution Problem in Ghana

Work conducted on mercury pollution in Ghana has mirrored the general approach taken elsewhere in sub-Saharan Africa. It was mostly "effects-based" up until when Ghana ratified the *Minamata Convention on Mercury*, from which point onward little variation has been shown. Scholars began to investigate the extent of the mercury pollution problem in Ghana from the mid-to-late-1990s through to the 2000s. Work began streaming which revealed that several areas of the country with high concentrations of ASM activity also have elevated concentrations of (methyl)mercury. Samples of human hair, blood and urine, as well as plants, soils and water collected in localities such as Obuasi, Tarkwa and Dunkwa confirmed, at the earliest phase of ASM's legalization, that the sector was indeed responsible for significant methylmercury contamination (Amonoo-Neizer et al., 1996; Amegbey et al., 1997; Adimado and Baah, 2002; Bannerman et al., 2003; Serfor-Armah et al., 2004; Donkor et al., 2006; Kwaansa-Ansah et al., 2010; Tschakert, 2010; Tetteh et al., 2010).

[17] Calculation made based on data extracted from "Ghana Mining Repository", https://ghana.revenuedev.org/map (Accessed 4 June 2025).

In the early-2000s. Ghana began to examine mercury use and reducation training of artisanal miners, breaking from the earlier research focus on the 'effects" of the ASM sector. Up until this point, there had not been much work done on awareness raising or education around mercury use in ASM in Ghana, let along analysis aimed at "locating" elements of its supply and distribution in broader debates on the sector's livelihoods dimension in the country. Change was ushered in following the launch of the Global Mercury Project (GMP), a US$13 million project, financed by the UN, aimed at demonstrating "ways of overcoming barriers to the adoption of best practices and pollution prevention measures that limit the mercury contamination of international waters from artisanal and small-scale gold mining (ASM)".[18] The three year project featured six countries, namely Brazil, Lao PDR, Indonesia, Sudan, Tanzania and Zimbabwe but also, very importantly, jumpstarted complementary work in other countries with sizable ASM sectors. In the case of Ghana, a comprehensive mercury pollution study organized by the United Nations Industrial Development Organization (UNIDO) and financed by the Government of France, was carried out in the small-scale gold mining town of Dumasi in the Western Region.

In the early-1990s, GTZ did fund some work, tied to the approximately US$1.5 million it dispensed in support of the SSMP, to distribute equipment to ASM groups. Between 1991 and 1993, various pumps and pneumatic hammers were purchased and demonstrated to miners in localities such as Tarkwa, and on some occasions, made available to them to rent for a small fee. Mercury retorts – enclosed devices intended to prevent the release of mercury emissions – were also distributed at the time to miners, albeit with limited success (Yakubu, 2003; Hilson et al., 2022). The Dumasi project, however, seemed to provide a spark for more dynamic mercury-oriented research and intervention at ASM sites in Ghana. The US$440,000-US$450,000 project, which was launched in 1999, supported UNIDO and government officials to carry out mostly what would be considered "effects-based" environmental analysis throughout Dumasi. An assortment of samples of various environmental media and human tissue were collected, revealing that the people of Dumasi, whether miners, shopkeepers or financiers, were contaminated, along with the fish they were consuming, the water they were drinking, and the soils and plant matter surrounding their residences. Alongside this fairly comprehensive environmental and health-related work, however, awareness campaigns were also carried out, which seemed to provide inspiration to researchers seeking to move work beyond its "effects-based" focus (Babut et al., 2003).

[18] "About the GMP", https://archive.iwlearn.net/globalmercuryproject.org/about/about.htm (Accessed 4 April 2025).

The body of work that would emerge was policy-oriented and anchored in discussions important to geographers and other social scientists. On the technology side, a variety of devices were piloted in a bid to reduce mercury pollution at ASM sites. Hilson et al. (2007) reflect on efforts made to distribute transparent mercury retorts in the townships of Tarkwa (Western Region) and Bolgatanga (Upper East Region). While not particularly effective, these UN-funded projects were a major break from the *status quo* (again, "effects-based" work focused on ascertaining mercury contamination levels in gold-producing areas). Another notable intervention was made under the EU Mining Sector Support Programme, the financial agreement for which was signed in 2002. As Bawa (2010) explained, one of the projects funded under the program was the *Mercury Pollution Abatement Project*, which evaluated alternative technologies to amalgamation in Ghana's ASM sector, the contracts for which were awarded by the British Geological Survey to international consultants and the resident University of Mines and Technology in Tarkwa. One of the more viable and widely-tested alternatives that emerged from this work was a portable furnace called *sika bukyia*, used to smelt ores (Amankwah et al., 2010; Abbey et al., 2014).

More dynamic research on mercury usage at ASM sites in Ghana also began to emerge in the 2000s. Hilson and Pardie (2006) offered one of the first takes on how a dependency on mercury at ASM sites in sub-Saharan Africa had brought further hardship to subsistence ASM communities. The authors report, drawing on evidence gathered in Ghana, that those engaged in ASM activities depend on their gold buyers not only as middlemen in the gold trade but also as suppliers of mercury. These unhealthy relationships further impoverish struggling miners as the buyers they are bonded to are often able to purchase gold at prices much lower than the market rate. One of the more comprehensive community-based analyses of mercury awareness in Ghana's ASM communities was conducted by Tschakert and Singha (2007), who through participatory ranking and mapping, surveying miners' perceptions of mercury contamination, particularly its causes and consequences. Nyame (2010) also offers some compelling suggestions on how the government should respond to the mercury pollution problem in Ghana.

Unfortunately, through Ghana's ratification of the *Minamata Convention on Mercury*, work undertaken to empower local miners to build and regulate their own mercury supply has been derailed. All eyes are now squarely focused on – a preoccupation, more precisely – the sector's environmental impacts, which have attracted significant media attention over the past decade or so, which several scholars have documented in some detail in the literature (Biney, 2019; Spazzov and Agbozo, 2019; Kpienbaareh et al., 2021; Sojková, 2022; Ayelazuno et al., 2023). Any attempt made at this point to draw attention to ASM's livelihoods dimension in Ghana, let alone

specific aspects about the actors involved in facilitating the distribution and supply of mercury to sites in the country, seems futile. Influential actors such as traditional leaders and church leaders have weighed in on the growth of ASM, sharing mostly-ungrounded and inaccurate views about its impacts and those who carry out activities (see Appiah et al., 2019; Asori et al., 2023). Fixation is at present on the military-led crackdowns of ASM communities that have taken place since the election of President Nana Akufo-Addo in 2017, which have produced a continuous catalogue of images suggesting that ASM activities are damaging local waterways through releases of mercury. Media outlets reporting on these interventions have routinely described ASM as a "menace" and portrayed efforts to address its environmental impacts as "a war" between the state and operators (Mantey et al., 2017; Eduful et al., 2020; Ampaw et al., 2023). The media has influenced public opinion of ASM, to the point where all of the sector's activities, unlicensed *and* licensed, are being clumped together. These views appear to have "contaminated" local researchers' perceptions of ASM, as evidenced by the growing number of analyses being produced by Ghana-based scholars that portray the sector in a negative light using demonizing language but which, at the same time, are so biased that they barely acknowledge the sector's economic and social importance (Gilbert and Albert, 2016; Osusu-Nimo et al., 2018).

With such powerful voices driving the military-led sweeps of ASM communities in Ghana and an influential media feeding stories into the general populace, the sector's livelihoods dimension is being overshadowed completely. The *Mercury Initial Assessment for Ghana* (GEF, 2018) and evidence pointing to ASM accounting for the release of 100 tonnes annually (Brunnschweiler et al., 2024) have provided an impetus for the continuous scrutiny. Posting pictures of damages to waterways such as the River Pra and River Offin, therefore, has left a lasting impression on the general public. The next section of the chapter provides an overview of the livelihoods dimension of ASM in Ghana that it has overshadowed.

### 3.4 Ghana's ASM Sector: The Livelihoods Dimension

This these aims to counter the media frenzy and preoccupation in the literature with the environmental impacts of ASM and mercury use. It does so by providing a more grounded perspective on the effects of mercury use at sites through a case study of Asamang in the Eastern Region of Ghana. The case offers fresh insight on ASM's much-overlooked dependence on mercury and how it constitutes a separate supply chain in itself. The presumption made here is that this supply chain is connected to ASM, united and fused together through common actors. The concern raised is that Ghana's ratification of the *Minamata Convention on Mercury* has failed to properly account for the welfare of the hundreds of thousands of people in the

country whose livelihoods depend on the continued and uninterrupted supply and distribution of mercury to ASM sites.

While the literature on the livelihoods dimension of ASM in Ghana may have had little influence on policymaking for the sector, it is nevertheless rich and extensive. A fairly detailed picture of a typical Ghanaian ASM "ecosystem" can be constructed using the information it contains. Following the framework developed in Section 2.4, the widely-accepted **direct employment** figure for Ghana's ASM sector is one million people, a figure that first emerged in the 2010s (Banchirigah, 2008; Hilson, 2010); needless to say, this figure is likely to be outdated at this point (i.e. a major underestimate). But significantly, and building on points raised in Section 3.2, over 85 percent of this activity is **persistently informal** (Kumah, 2022), although because of ongoing military sweeps, so much land being in the hands of companies (as mentioned, 30 percent of the country's surface area) and the pedestrian pace at which the government awards *Small-Scale Mining Licenses* (there were only 491 active licenses at the time of writing),[19] this figure is likely to be much higher.

What *is* clearer is that the composition of the sector is very rich, attracting people from many different backgrounds but whose circumstances can be mapped fairly straightforwardly on to the "poverty-driven"-"get-rich quick' typology detailed in Section 2.3. A large share of individuals found in Ghana's ASM sector today have farming backgrounds. This was revealed many years ago, very ironically through farm-oriented "alternative livelihoods" programs aimed at discouraging people from pursuing work at illegal artisanal gold mining sites. It quickly emerged that not only were many of these agricultural activities nowhere close, financially, to what people could earn from engaging in *galamsey* work but that they were, for the most part, the work they were abandoning in favour of gold mining (Hilson and Banchirigah, 2009).

Most of the people with agricultural backgrounds who are working at ASM sites do so to generate money to support their family farms. The mine work they pursue positions them to purchase crucial inputs such as fertilizers, insecticides and pesticides, which are no longer subsidized by the state (or at least to the extent that they once were). Consistent with findings elsewhere in sub-Saharan Africa, the evidence from Ghana points to ASM and subsistence farming being inseparable for these people, carried out simultaneously across seasons (Hilson and Garforth, 2013; Osumanu, 2020; Baddianaah et al., 2021; Mabe et al., 2021). From this analysis, it becomes clear that ASM in this context is stabilizing agriculture through an injection of funds and in the process, improving local food security. These dynamics are visible in Ghana's Eastern

[19] See "Ghana Mining Repository", https://ghana.revenuedev.org/license (Accessed 4 June 2025).

Region – the case study focus of this thesis – which is an area of the country where livelihoods have long been linked to farming and ASM. In communities such as Noyem, Kibi, Ntonang, Kobriso and Oda, long farming communities, ASM has rapidly become indispensable economically for tens of thousands of people (see Yakovleva, 2007; Banchirigah, 2008; Hilson, 2010).

Many who have farm backgrounds and now engage in ASM in Ghana are women and youth, two groups who are identified as "vulnerable" by policymakers and donors such as the ILO and UNIDO. The "vulnerable" label, of course, feeds the narrative about ASM and *galamsey* activities specifically being hazardous and destructive, and therefore warranting a ban in the country. Most youths found working in Ghana's ASM sector – specifically those under the age of 25 – have done so because of a lack of employment. Their livelihoods have been further disrupted by *Operation Vanguard* and *Operation Halt*, as they have been pushed further into the informal sector which has included, at times, taking even greater risks to mine (Osei et al., 2021). In some localities, such as Bekwai Municipality in the Ashanti Region, however, it has been observed that ASM "enables some students to save money to pay their school fees, and it further provides employment to the majority of youth with low skills" (Asamoah and Osei-Kojo, 2016, p. 9).

In other communities in Ghana, such as Prestea (Western Region), the youth have accepted *galamsey* as an acceptable career path despite its public condemnation (Yakson and Gough, 2019). Here, Arthur-Holmes et al. (2022) went as far to explore the livelihoods of university graduates who have taken up employment in ASM communities. Specifically, in towns such as Prestea, university graduates are increasingly viewing ASM as an arena where they can apply their skills, in response to the shortage of alternative income-earning opportunities available locally and in the cities. Another more recent trend is young people migrating to ASM settlements from other areas of the country for months and sometimes years out of desperation, hoping to accumulate enough money, before returning, to purchase a motorbike or build a better-quality house (Gough and Birch-Thompsen, 2017).

Women face similar circumstances, engaging in ASM across Ghana to secure crucial finances to support their families. Yakovleva (2007) undertook one of the first comprehensive studies of women's participation in ASM in Ghana, drawing on research conducted in the Ntronang and Noyem localities in the Eastern Region. The author revealed, among other things, that many women carry out ASM work out of necessity, working mostly in the capacity of diggers and haulers to generate money which they use to cover household expenses and to pay children's school fees. Others have since reported similar findings (see e.g. Armah et al., 2016; Arthur-

Holmes and Busia, 2020). These cases reinforce findings reported by Yakovleva (2007): that women miners use mine earnings to contribute to the households they are a part of in a multitude of ways, form food preparation to support for children's education. Analysis of women's and youth livelihoods provides a glimpse of is **what mine monies are used for** in Ghana.

What this thesis is particularly concerned with, however, is coverage of **auxiliary income-earning activities** linked to Ghana's ASM activities. According to the literature, it is not uncommon to encounter university graduates and/or professionals working in ASM communities in Ghana. Nearly two decades ago, Hilson and Potter (2005) commented on the impact structural adjustment had on the country's ASM sector. They concluded that it created a sizable pool of unemployed persons, many of whom migrated to sites for the first time. As the sector has grown, seeing someone with a higher university degree in a non-mining subject (i.e. *not* mining engineering or geology) no longer surprises.

Many people found at sites are castoffs, often with skills (blasting, processing, machine operation, etc.) acquired through previous work at mining companies. In other instances, they are "generational miners" who have accumulated skills in the sector, over time, and have moved elsewhere to put them to the test. It is the arrival time of most of these individuals, along with many of the educated people (accountants, financiers, etc.), to sites that differentiate them from the other groups mentioned. These are the closest examples of Ghana's "get-rich quick" type of operator: people who will continue mining no matter what other sources of income-earning may exist.

These dynamics are most visible in the Western Region, which is the country's most established gold mining region. In localities such as Tarkwa and Prestea, gold mining has taken place for hundreds of years. In both localities, people made redundant over the years from the State Gold Mining Corporation have long taken up work in ASM. Community members who face major obstacles in securing *Small-Scale Mining Licenses* are also increasingly displaced from mining areas they have worked for generations following the demarcation of these lands as part of new concessions awarded to large mining companies. For example, in both the Tarkwa and Prestea cases, a mining company has been awarded a vast concession, which has prevented locals from securing licences to work (mostly vacant) areas. In Tarkwa, the entire town is under concession to the multinational Gold Fields, on which its Tarkwa mine can be found. The situation in Prestea is slightly more complex. Here, the Prestea Underground, which was the property of the State Gold Mining Corporation up until the 1990s and later acquired by the Junior company Bogoso

Gold Limited in the 1990s, and then Golden Star Resources (which acquired Bogoso Gold Limited in 1999), has never been freed up by the government for ASM, despite proving unviable to mine on a large scale. Ex-State Gold Mining Corporation workers, with their wealth of experience and skills, now control the town (and to some extent, Tarkwa), building careers in the local *galamsey* economy (Hilson and Yakovleva, 2007).

A large segment of the Ghana's population finds work in the many support industries that flourish alongside ASM. A typical ASM site in the country features transportation services that provide "in and out", shops selling work wear, numerous eateries, stalls where equipment can be purchased, financiers who are relied upon to pay workers and to acquire machines, and security for protection (Crawford and Botchwey, 2016; Adranyi et al., 2023). The breadth of these ancillary industries is captured in research (see e.g. Hilson and Garforth, 2013; Hilson and Hu, 2022) that documents activities such as carpentry, machine-repair and ore sack sellers. The livelihood trajectories of these populations are varied: some take up work as miners, initially because of poverty, and then pursue and achieve some level of success in an ancillary trade, whereas others actively establish themselves at sites to pursue work as service providers such as food sellers and equipment repairers (be specific) (Hilson and Hu, 2022). It is difficult to generalize about the different types of actors found at ASM sites in Ghana because each person who chooses to mine does so for different reasons and therefore; this makes devising concrete *categories* of operator/worker impossible. Although overly simplistic, the typology of "poverty-driven"-"get-rich quick" outlined in Section 2.3 does provide some mileage in this context because it maintains focus on why different types of people may pursue work in this sector.

This research seeks to insert mercury supply chains and distribution networks into this discussion on auxiliary income-earning activities. Extant research has largely overlooked the people and paths along which mercury flows to sites and those responsible for facilitating its dispersal throughout Ghana and wider sub-Saharan Africa. To help bridge this gap, the thesis broadens understanding of the social and economic impacts of mercury use in ASM, with particular focus on the lives that are inextricably tied to the distribution, sale and socio-spatial supply of mercury in the sector. As indicated, fieldwork for this case study will be conducted in the Eastern Region of Ghana. The methodology followed is detailed in Chapter 4.

### 3.5 Concluding Remarks

This chapter has helped to situate the work carried out for this thesis in the context of recent developments in Ghana's ASM sector, including gaps in the extant literature. It has explained the salience of Ghana as a key location for studying mercury supply and distribution as an auxiliary income-earning sector in ASM in sub-Saharan Africa, one that has been sidelined by

the promotion of the *Minamata Convention on Mercury*. Box 3.1 shares some of the key facts relevant to ASM in Ghana. The next chapter (Chapter 4) shares the methodology followed to carry out the research linked to this thesis. It then proceeds to sharing the findings from the research.

**Box 3.1:** Key facts about Ghana's ASM sector and its regulation

**Estimated ASM Population:** At least one million

**Key small-scale gold mining localities:** Tarkwa (Western Region), Konongo (Ashanti Region), Obuasi (Ashanti Region), Dunkwa (Central Region), Talensi (Upper East Region), Bole (Northern Region), Birim North (Eastern Region)

**Year small-scale mining was legalized:** 1989

**Key Legislation:** *Mercury Law* (PNDCL 217), *Small-Scale Gold Mining Law* (PNDCL 218) and *Precious Minerals and Marketing Corporation Law* (PNDCL 219), all implemented in 1989 but subsumed by the *Mining Act 2006*

**Key Regulatory Agencies Involved:** Minerals Commission, Environmental Protection Agency, Geological Survey Department, Precious Minerals and Marketing Company, and Ministry of Lands and Natural Resources

# CHAPTER 4

# METHODOLOGY

## 4.1 Introduction

This chapter outlines the methodology adopted to conduct this study. The research employed strictly qualitative research methods to identify and interrogate the actors who populate mercury supply chains and distribution networks in Ghana. The interviews the author carried out sought to uncover details of the relationships among various actors within the country's mercury supply chains and distribution networks, and in the process, capture information about usage practices and socio-economic dependencies on amalgamation techniques at the community level.

The research approach adopted aimed at soliciting the experiences and perspectives of various stakeholders linked to amalgamation and circulation of mercury supplies at the grassroots, including miners, porters, foremen and equipment suppliers. As discussed further in Section 4.2 below, qualitative methods are the preferred choice when the study in question is exploratory, which is the case here: investigations into the sensitive nature of the mercury trade and how it maps on to and potentially sustains an informal ASM sector more broadly. They offer the required flexibility to investigate complex phenomena, permitting interrogation of the cultural, economic and social contexts in which – in this case – mercury distribution networks are rooted and informal ASM persists.

Interviews were carried out by the author in the Asamang and Akwatia localities, Eastern Region of Ghana (Figure 4.1), between 30 November 2024 and 30 January 2025. An ASM hotspot, the Eastern Region has become the main focus of national military sweeps aimed at eradicating "illegal" (ASM) activity – which again, is popularly referred to as *galamsey* – while simultaneously being a main target of technical assistance for the sector dispensed by donors such as the World Bank (Davidson, 1993; Yakovleva, 2007; Hilson and Garforth, 2013; Eduful et al., 2020; Hilson and Hu, 2022). The intention here was to elicit opinions from miners and other local-level actors on mercury use, purchase and supply, with the goal of painting a picture of the dynamics of distribution channels at the site level. In total, 36 individuals in the adjoining townships of Asameng and Akwatia were interviewed by the author, by which point, (data) saturation was reached. These participants engaged in a range of activities, including mining, trading, gold selling, equipment supply and ore haulage. A deliberate attempt was made, however, to identify individuals who were potentially involved in multiple activities, as it was assumed that the supply chains for mercury and gold (sourced from ASM) overlap on the basis of the same actors being entrenched in, and being significantly responsible for, both. Interviewees were

encouraged by the author to share perspectives on a number of issues, including mercury dependency, supply chain dynamics, and regulatory challenges within ASM.

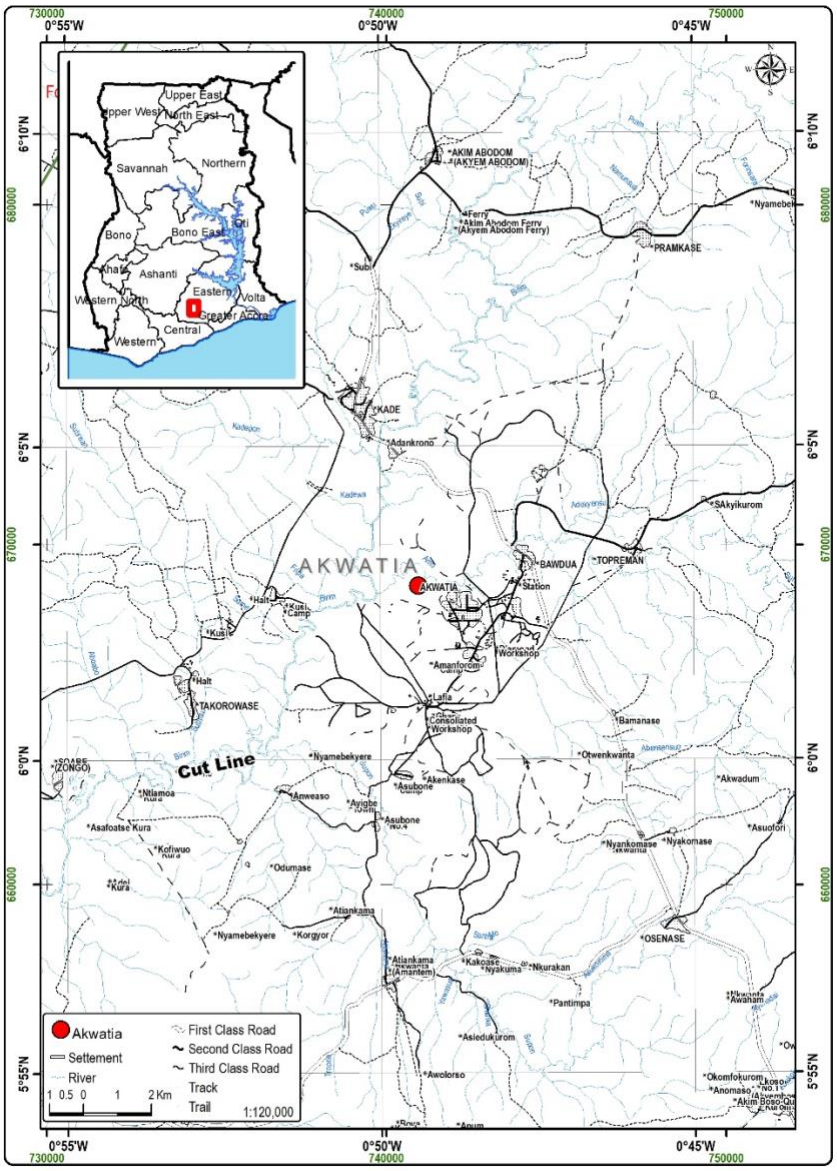
Section 4.2 provides a deeper analysis of qualitative research, setting the stage for the thesis. In Section 4.3, the foundations of case study methodology, a staple of qualitative research and the approach adopted here to showcase the distribution and supply of mercury at ASM sites in sub-Saharan Africa and Ghana specifically, are detailed. Section 4.4 outlines the research question and sub questions underpinning the research carried out for this thesis. Section 4.5 provides concluding remarks.

**4.2 Qualitative Research: A Deeper Dive**

Qualitative research methods feature when the inquiry centres on exploring and understanding phenomena. They seek to assemble dynamic holistic pictures, pieced together using the words of actors consulted in natural settings (Creswell, 1994). Qualitative research prioritizes discovering what is happening, asking questions and appraising issues from varied perspectives, and generating fresh insights. Qualitative researchers in the social sciences seek to build knowledge based on the ideas they formulate from discussions with stakeholders, their observations and field experiences (Parker and Kozel, 2005). In this thesis, the phenomenon under study is mercury supply and distribution and the natural settings in which this is examined are ASM sites (in Ghana).

As the task at hand with qualitative research is to examine a phenomenon (or phenomena), it naturally takes the form of an exploratory inquiry (Stebbins, 2001); therefore, there are often few suitable studies available to serve as immediate and close comparators for the research being undertaken. This is the case with the present thesis: while there are studies that offer a glimpse of how mercury is used in ASM in Ghana and wider sub-Saharan Africa, and the environmental consequences of its release into the natural environment, no scholar has attempted to unpack how a dependency on mercury itself drives the sector's operations and ultimately supports livelihoods. In other words, there is little appreciation of the need for analysis of access to, and distribution of, mercury at the country's ASM sites. This topic of mercury's position in local ASM socio-economic dynamics is one that should feature more prominently in scholarly and policy debates on the sector's livelihoods dimension in sub-Saharan Africa.

**Figure 4.1:** Location of study sites (Asamang and Akwatia, Eastern Region) visited in this research




*Source*: Map produced by author

Qualitative research methods are best understood as interpretive, naturalistic approaches to understanding the world. In short, the qualitative researcher examines phenomena within their natural contexts, striving to understand and interpret based on the meanings attributed to them by – in the case of this thesis – the stakeholders interviewed by the author (Denzin and Lincoln, 2011; Creswell, 2013). In the current research, this is significant because it allows for the researcher to investigate dynamics beyond the actions of the actors at ASM sites as they relate to the handling and distribution of mercury, the rationale behind their choices, and their perceptions of associated risks and benefits. Here, qualitative research allows for in-depth exploration of specific issues, with emphasis on detail, context and nuance (Patton, 2015), which is why it is ideal for examining the specificities of the mercury supply and distribution networks at ASM sites where socio-economic exchange may occur outside the formal economy

and specific trade and income data are unavailable. Qualitative research was thus essential for exploring the difficult nature of mercury dependency, underlying economic factors, technical considerations, social relationships, and risk and regulation.

Qualitative methods are also effective at building rapport with actors on sensitive issues, which in this instance was necessary: asking questions about a mercury trade and environmental destruction that is condemned by the government and the general public. The adaptable and interactive characteristics of qualitative data collection enable researchers to establish a connection with participants, fostering an environment conducive to honest sharing of experiences. This is significant considering that the mercury trade largely functions outside of formal regulatory frameworks, and participants may be reluctant to disclose their involvement in potentially informal activities (after Creswell, 1994).

A final point on qualitative research concerns the structure of this investigation. Qualitative research is the preferred approach when "how" or "why" questions are asked, which, as Section 4.4 will explain, applies to this thesis. A qualitative research study, because of its exploratory nature, "does not begin with a hypothesis or a presumed outcome as in the case of a quantitative study" (Agee, 2009, p. 433). It rather starts with "a question, or at least an intellectual curiosity if not a passion for a particular topic" (Janesick, 2000, p. 382). With respect to these questions, as Oranga and Matere (2023) explain, "qualitative research responds to the "hows" and "whys" instead of "how much" or "how many" (p. 3). The authors elaborate on what this entails:

> At its core, qualitative research asks open-ended questions whose answers are not easily quantifiable. Phenomena such as attitudes, experiences and behaviours can be hard to accurately capture quantitatively, whereas the qualitative paradigm lets participants themselves explain why, how, or what they were feeling, thinking and experiencing during the occurrence of an event of interest or at a certain time. [p. 3]

Apart from a central "why" or "how" question, however, qualitative research features "several sub questions starting with How or What" (Barroga et al., 2022, p. 6). These are intended to unearth valuable information about context.

The open-ended questions formulated to obtain this information, explain Barroga et al. (2022), seek to "elicit a description rather than to relate variables or compare groups", are "continually reviewed, reformulated, and changed during the qualitative study", and "are also used more

frequently in survey projects than hypotheses in experiments in quantitative research to compare variables and their relationships" (p. 8). The lack of a concretized hypothesis, however, does not mean that qualitative research studies are not executed without plans. In fact, and as Richards (2005) highlights, there is broad consensus that a qualitative study cannot begin without a plan on the grounds that doing so would be "unacceptable for both ethical and practical reasons" (p.14). While the research questions are discussed in further below, it is apt to note at this point that the thesis is guided by the following "how" question: *How does the issue of mercury supply and distribution feature in the debate on the livelihoods dimension of ASM in sub-Saharan Africa?* The plan is to use a case study of Ghana, the location of one of sub-Saharan Africa's largest and most dynamic ASM sectors, to explore how.

### 4.3 The Case Study

This research takes a form of case study, which as Yin (1994) explains, is adopted when the goal is to unearth details of a particular program or situation in great depth. It constitutes an empirical inquiry that is effectively an investigation of a contemporary phenomenon in depth and within its real-world context (Yin, 2018, p. 15). Case studies combine data collection methods such as interviews, questionnaires and archives, enriching the phenomena studied (Yin, 1994).

The case study design adopted is a detailed analysis of a particular regional example of mercury supply and distribution in Ghana's ASM sector. The case study approach helps to facilitate, in this instance, conceptualization of mercury usage as a defined system within Ghana's mining communities, while recognizing the wider global context of (mercury) supply and the international regulatory frameworks that govern its use, foremost the *Minamata Convention*. This methodological choice allows the research to focus on local dynamics while acknowledging the impact of national policies, international markets, and global environmental issues. More generally, mercury use in ASM represents a global concern but its manifestations in specific locations – in this instance, Ghana – are influenced by local factors such as traditional mining practices, economic conditions, regulatory capacity and social structures. The case study design, therefore, facilitates an in-depth examination of contextual factors, yielding insights that may be applicable to analogous situations in other countries. Interviews, on which approximately 90 percent of all qualitative research is based (Brenner, 1981), were the basic means of data collection employed by the author in this thesis. They allow those consulted to supply responses in their own way, thus allowing the researcher to evaluate and interpret communicative behaviour and processes (DiCicco-Bloom and Crabtree, 2006).

As a final point, exploratory case studies underpinned by qualitative research methods are appropriate for undertaking work in developing world contexts and in ASM communities in sub-Saharan Africa specifically. Chambers (1994) argued that research in developing countries require methods that are increasingly participatory, grounded, realistic, and aligned with local needs and priorities. Qualitative approaches, brought together under a case study, meet these criteria by emphasizing local voices and perspectives rather than relying on external frameworks or predetermined theoretical models. In ASM contexts, qualitative methodologies have several notable advantages, including an ability to respond to the informal characteristics of various (ASM) operations, and to generate information in contexts where there are no official records or statistics. Moreover, and to reiterate points raised earlier, they offer the flexibility essential to adjust to local conditions and cultural norms, which can vary from ASM community to ASM community, and help to facilitate the establishment of trust needed for researchers to explore sensitive subjects, foremost the illegal mercury trade and environmental destruction linked to amalgamation.

The case study approach illuminates these benefits through a framework for analyzing manifestations of global issues within local contexts. In the context of the present thesis, ASM communities frequently operate at the convergence of global commodity markets, international environmental regulations, and local survival strategies. The case study methodology allows for analysis of complex interactions while concentrating on unique experiences and challenges encountered by specific communities. It prioritizes understanding phenomena from the perspective of individuals who experience them directly, rather than imposing external categories or assumptions. This is especially important in the present thesis: indeed, the absence of voices from artisanal miners in policy discussions that impact their livelihoods is significant, a gap which this research in Ghana seeks to bridge.

### 4.4 Research Problem, Gaps and Research Questions

Despite increasing global focus on mercury use in ASM, there remains minimal understanding of miners' dependency on mercury and how it arrives and is distributed at sites. Moreover, there has been unsurprisingly little effort to even try and locate this work in the broader debate on ASM livelihoods in sub-Saharan Africa. As explained in Chapter 2, most research conducted to date on mercury use in ASM, whether in sub-Saharan Africa or elsewhere in the developing world, has been technical in nature and/or focused predominantly on the environmental and health risks associated with its use. At the same time, insufficient attention is paid to the practical factors that fuel miners' continued reliance on mercury and its implications for their livelihoods.

Access to mercury, it would appear, plays an important role in sustaining a vibrant ASM sector that provides direct employment to millions of people across sub-Saharan Africa.

There is a sizable discrepancy between what international policy frameworks designed to reduce mercury usage address on the one hand, and the actual experiences of artisanal miners who rely on it for their livelihoods on the other. As indicated, the existing literature frequently portrays mercury usage as a technical problem which necessitates the application of technological solutions to resolve, while insufficiently accounting for the economic, social, and institutional factors influencing and underpinning miners' decision-making processes around amalgamation. The persistence of this gap in policy and scholarship threatens to undermine the efficacy of interventions designed to decrease mercury usage and may lead to the formulation of policies that are inappropriate given the local context.

This study seeks to address the gap by illuminating details on the lives intricately connected to the distribution, sale, and supply of mercury within the sector. It is against this background that this thesis seeks to answer the following central research question: *How does the issue of mercury supply and distribution feature in the debate on the livelihoods dimension of ASM in sub-Saharan, with special focus on Ghana?* In doing so, it poses the following sub research questions:

1) How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in Ghana?
2) What key actors are linked to the supply of mercury in ASM, and what roles do these actors play in distributing supplies to site?
3) What additional roles (actual and potential) do actors play in the wider ASM sector?

To help answer these questions, fieldwork was carried by the author out in Ghana's Eastern Region. Access here was facilitated by the author's previous research in the area in collaboration with colleagues from the University of Surrey, supported with funding from the World Bank (findings from this research have not yet been published). Key contacts were made in mining communities, in the local government offices in Asamang and Akwatia, and among traditional leaders in the localities, which helped to make the research undertaken for this thesis possible. My fieldwork entailed administering a detailed qualitative survey aimed at accessing details about various aspects of mercury utilization in the region's ASM sector.

The qualitative survey consisted of five sections: 1) demographic information, 2) general mining activities, 3) mercury supply chains, 4) mercury consumption practices, and 5) business operations (Appendix I). This framework facilitated the collection of organized data while allowing for adaptation to unforeseen circumstances that arose during fieldwork. The closed-

ended questions yielded basic quantitative data on mercury usage, prices, and production levels, while the subsequent open-ended questions allowed participants to elaborate on their experiences, articulate their decision-making processes, and discuss regulatory challenges and alternative technologies from their own perspectives.

The research followed all ethical protocols, including voluntary informed consent and ensuring confidentiality such as assigning all participants pseudonyms (they were assigned numbers) and using a secured way of keeping the data recorded during each interview carried out by the author. Data collection was conducted by the author through face-to-face interviews using the structured survey instrument. The data collection period lasted three months (November 2024 – January 2025) and in total, 36 individuals were interviewed by the author (Table 5.1). The group included miners, buyers and porters, many of whom also act as intermediaries (sponsors), shop owners and suppliers, thus filling multiple roles in the supply chain. The bulk of individuals interviewed by the author were miners (21), 18 of whom were male aged 20 to 60 who were "pit owners" and wage labourers with maximum educations up to Secondary School. Of this group, 15 were working without a license while five claimed they were (although this was not verified and, given the situation in the Eastern Region, unlikely).[20] The three female miners were aged between 26 and 45 with mining experience of between two and 22 years. The group, which engaged in ore processing activities, including washing, panning, and amalgamation directly, provided insights into mercury handling, risks and knowledge about mercury, occupational health and safety, and daily mining routines. The same information was elicited from the seven buyers and eight porters interviewed by the author. It was felt that as individuals who covered more distance through their work (as opposed to being fixed at locations like miners), these two groups were in a better position to offer unique perspectives on how mercury arrives at sites, from whom, at what price, and how relationships among those in distribution networks have evolved over time. A local research assistant, whom the author has worked with previously on other projects and who is based in Akwatia, helped to organize the interviews.

Overall, participants shared detailed descriptions of their extraction processes, safety procedures, and waste management practices. This information was supplemented with observational data gathered during site visits. Questions about participants' knowledge of mercury-free technologies, their experiences with alternative methods, and their assessments of these alternatives' effectiveness, were also tabled. The discussions they generated offered

[20] There are a number of reasons why, foremost the government's reluctance to award *Small-Scale Mining Licenses* since the launch of *Operation Vanguard*. Moreover, much of the territory visited is under concession to mining and mineral exploration companies, including Ghana Consolidated Diamonds, Xtra-Gold Resources Corporation and Newmont Gold Mining.

important insights about the practical and economic barriers to adopting mercury-free extraction methods. Finally, the author asked detailed questions about income sources, financial relationships with suppliers, and the economic impacts of mercury usage on participants' livelihoods. The information gathered was important for understanding why mercury persists and is a necessary input locally, despite known risks.

Individuals observed to engage in multiple activities were targeted. In total, 10 of the miners interviewed by the author were reportedly also engaged in equipment supply and/or worked as technicians. The group (eight males, two females) possess rich technical expertise, services which they "sell" to "head" miners or pit owners. They have experience using crushers and sluices, and handling mercury. Four claimed to offer services as machine repair technicians (mobile) while six claimed to have shops where they service equipment. Six have technical and vocational training, eight had completed apprenticeships and a one had formal education. Within the group of 36 individuals interviewed by the author, five (four males, on female) were upfront about being recognized mercury dealers; they were either "head" miners or individuals who owned shops. In the analysis of the data presented on buyers, shop owners, "head" miners and equipment suppliers (Chapter 5), the corresponding "Miner", "Buyer" or "Porter" is used (Table 4.1).

Purposive sampling was used by the author to identify interviewees, specifically those who have worked multiple jobs in the ASM localities of Asamang and Akwatia. They were identified and contacted through community leaders and mining association representatives, and by referrals from participants. Selection criteria included direct involvement in mercury-related activities, undertaking multiple activities (as indicated), willingness to engage, and willingness to provide informed consent. Each of the 36 interviews lasted between 45 and 60 minutes and was conducted in *Twi* or English by the author, depending on the preferences of the particular participant. The data collected were subsequently coded according to theme. Coding, explain Linneberg and Korsgaard (2019), helps to transform raw qualitative data into a communicative and articulable "story". It entails examining a coherent portion of empirical material and "labeling it with a word or short phrase that summarizes its content" which, in the end, as the effect of reducing "large amounts of empirical material and makes the data readily accessible for analysis, while at the same time increasing the quality of the analysis and findings" (p. 259). In this thesis, the "labeling" used corresponded to themes interrograted by the research questions, such as "networks", "income flows" and "sponsorships". Anonymized data are reported in Chapter 5 of this thesis.

**Table 4.1:** Demographics of individuals interviewed, 30 November 2024 – 30 January 2025

| Interviewee | Age | Years in Sector | Education Level | Number of Dependents | Date of Interview |
|---|---|---|---|---|---|
| Miner #1 | 45 | 20 | O level | 12 | November 30,2024 |
| Miner #2 | 50 | 30 | Senior High school | 12 | November 30, 2024 |
| Miner #3 | 55 | 35 | Primary 5 | 12 | November 30, 2025 |
| Miner #4 | 40 | 8 | Junior high school | 11 | December 02, 2025 |
| Miner #5 | 52 | 36 | Form 4 | 4 | December 02, 2025 |
| Miner #6 | 60 | 40 | Junior high school | 10 | December 02, 2025 |
| Miner #7 | 38 | 7 | Form 4 | 2 | December 03, 2025 |
| Miner #8 | 46 | 24 | Middle school | 12 | December 03, 2025 |
| Miner #9 | 53 | 20 | No formal education | 7 | December 03, 2025 |
| Miner #10 | 37 | 12 | Junior high school | 4 | December 04, 2025 |
| Miner #11 | 48 | 32 | Middle school | 12 | December 04, 2025 |
| Miner #12 | 49 | 27 | Senior high school | 8 | December 04, 2025 |
| Miner #13 | 55 | 35 | Primary school | 14 | December 05, 2025 |
| Miner #14 | 45 | 20 | Secondary school | 12 | December 05, 2025 |
| Miner #15 | 47 | 30 | Senior high school | 12 | December 06, 2025 |
| Miner #16 | 44 | 29 | No formal education | 9 | December 06, 2025 |
| Miner #17 | 59 | 40 | Basic school | 20 | December 10, 2025 |
| Miner #18 | 30 | 5 | Junior high school | 4 | December 10, 2025 |
| Miner #19 | 40 | 13 | No formal education | 20 | December 16, 2025 |
| Miner #20 | 46 | 16 | Senior high school | 7 | December 16, 2025 |
| Miner #21 | 54 | 23 | Junior high school | 9 | December 16, 2025 |
| Porter #1 | 50 | 30 | Junior high school | 10 | December 19, 2025 |
| Porter #2 | 34 | 11 | Senior high school | 6 | December 20, 2025 |
| Porter #3 | 43 | 20 | Junior high school | 6 | January 06, 2025 |
| Porter #4 | 39 | 20 | Junior high school | 5 | January 06, 2025 |
| Porter #5 | 44 | 16 | Senior high school | 7 | January 08, 2025 |
| Porter #6 | 38 | 17 | Senior high school | 8 | January 08, 2025 |
| Porter #7 | 27 | 5 | Junior high school | 4 | January 15, 2025 |
| Porter #8 | 35 | 12 | No formal education | 5 | January 15, 2025 |
| Buyer #1 | 55 | 25 | Tertiary | 8 | January 17, 2025 |
| Buyer #2 | 47 | 15 | Senior high school | 3 | January 17, 2025 |
| Buyer #3 | 57 | 18 | Form 2 | 7 | January 20, 2025 |
| Buyer #4 | 50 | 17 | O level | 9 | January 20, 2025 |
| Buyer #5 | 49 | 30 | Senior high school | 12 | January 27, 2025 |
| Buyer #6 | 40 | 7 | Form 4 | 11 | January 27, 2025 |
| Buyer #7 | 49 | 18 | Tertiary | 15 | January 30, 2025 |

### 4.5 Conclusion

This chapter outlined the research methodology adopted in this thesis. It discussed at length the value of qualitative research methods and their appropriateness for interrogating the research question and sub research questions which this thesis seeks to answer. It then

pivoted to the fieldwork itself, describing the nature of the research and where it was carried out. The next chapter (Chapter 5) responds to each of these sub research questions in turn, drawing on data from interviews conducted by the author. Following this, conclusions and recommendations are shared in Chapter 6.

# CHAPTER 5

# ANALYSIS OF RESEARCH FINDINGS

## 5.1 Introduction

This chapter shares findings from the research in an attempt to address the three sub research questions of this thesis. These (sub)questions are as follows:

1) How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa?

2) What key actors are linked to the supply of mercury in ASM, and what roles do these actors play in distributing supplies to site?

3) What additional roles (actual and potential) do actors play in the wider ASM sector?

The thesis begins in Section 5.2 by providing a synthesis of the policy context for mercury use in ASM in Ghana. Over the years, a significant proportion of technical assistance dispensed to support ASM in Ghana has targeted the mercury pollution problem in a variety of ways. It is argued that despite changing rhetoric surrounding projects designed with the goal of facilitating reductions in releases of mercury emissions at sites, all are similar at their core: technical undertakings that remain largely-mute on livelihoods-related issues. Specifically, all fall short of recognizing how hundreds of thousands of Ghanaians and ultimately, millions of Africans, rely on access to mercury to service their day-to-day livelihood strategies.

This sets this stage for Section 5.3, which draws on findings to use the Ghana experience to locate mercury use and supply in the broader discussion on the livelihoods dimension of ASM in sub-Saharan Africa. Here, emphasis is placed on reinforcing points from the literature about the economic dependence of rural-based Africans on ASM. This section observes that that, in the absence of alternatives, access to mercury for use in amalgamation is critical to their wellbeing. Section 5.4 draws on findings from interviews conducted by the author to address sub research question 2 and sub research question 3. The analysis presented here deepens understanding of the roles played by various individuals at sites in supplying and distributing mercury. Section 5.5 provides concluding remarks.

## 5.2 Critiquing the Policy Context

### 5.2.1 An Overview

A critique of the policy context for ASM in Ghana contributes to addressing the first sub research question of this thesis (i.e., *How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa?*). With a lengthy history

of technical assistance to ASM, Ghana provides an excellent case to make the argument *a priori* that programs implemented to date in sub-Saharan Africa to tackle the region's mercury pollution problem have lacked a livelihoods component (see Section 5.3). These projects have been excessively technical, focused on environmental and health-related aspects overwhelmingly, and have not been adequately located in the sector's broader policy architecture. This, it is argued here, explains why so few mercury management projects launched to date for ASM have had a lasting impact in Ghana and wider sub-Saharan Africa.

This problem is symptomatic of a broader dynamic that officials at the ILO observed in the ASM policy space as early as the late-1990s:

> Many projects to assist small-scale mining have failed or have not led to lasting improvements because they have treated small-scale mining as a subset of large, formal mining. For the most part, emphasis has been on finding technical solutions to mining and processing problems, with scant heed being paid to the underlying economic, labour and social issues. Another factor in their relatively short-lived success has been the low priority given by governments to small-scale mining. So once a project has been left to stand on its own, it has often gently wound down due to a lack of continued government support or supervision. Fortunately, the relatively recent recognition that much small-scale mining is closely related to poverty has led to a reorientation of assistance programmes to ensure that the underlying aspects are included when assistance is provided, giving a greater chance of sustained improvements being achieved. [ILO, 1999, p. 72]

As discussed earlier in this thesis, this problem has been evident in Ghana for decades, beginning with the inaugural work carried out under the SSMP during the early-1990s (Section 3.2).

Central to the discussion this chapter, however, Ghana has experienced a pronounced change when it comes to its policy approach to mercury management in ASM since that period. Specifically, the government has shifted from a position in that era that centred on **control** and **prevention or mercury use**, to one which seeks to **eliminate/eradicate** it altogether. What is referred to here as the "eradication narrative" has manifested very visibly in the work carried out under the three mercury-related ASM projects launched in Ghana since the country ratified the *Minamata Convention on Mercury* (Table 5.1). These projects, listed briefly in Section 2.3, have been operationalized in a way which points to the Government of Ghana pushing to eliminate/eradicate. A main driver of *Operation Vanguard* (2017-2018) and *Operation Halt* (2019-present), the two government-coordinated military-led sweeps of unlicensed ASM communities

in Ghana (and mentioned briefly in Section 3.2), was public perception of miners' impacts on the environment. During the build-up to the launch of each, scholars and the local media centred attention on indiscriminate releases of mercury into waterbodies and the atmosphere (e.g. Cudjoe et al., 2023; Darko et al., 2023). What has become evident is how these sweeps and the public opinion associated with, and shaped by, them provided fuel for this "eradication narrative".

While the *Ghana Landscape Restoration and Small-Scale Mining Project*, though extremely large in terms of funds (i.e., US$70 million), does not have particularly focused objectives as far as environmental protection is concerned, and also lacks a tangible health and safety component, a breakdown of its components is instructive. The World Bank's tepid response to the Government of Ghana's outlandish request for US$200 million to support its conceived Multilateral Mining Integrated Project (MMIP), 2017, the *Ghana Landscape Restoration and Small-Scale Mining Project* has the look of a more multipronged support-related intervention with very significant environmental components. Below is a breakdown of its funding allocation, as follows (World Bank, 2021):

- Component 1. Institutional Strengthening for Participatory Landscape Management40 (US$14.21 million, including IDA US$10.66 million, GEF US$2.51 million, PROGREEN US$1.04 million).
- Component 2. Enhanced Governance in Support of Sustainable ASM (US$17.48 million, including US$16.88 million from IDA and US$0.60 million from EGPS.
- Component 3: Sustainable Crop and Forest Landscape Management (US$60.28 million; including IDA US$38.26 million, GEF US$9.14 million, PROGREEN US$12.88 million).
- Component 4: Project Monitoring and Knowledge Management (US$11.39 million, including US$9.20 million from IDA, US$1.11 million from GEF, and US$1.08 million from PROGREEN).
- Component 5. Contingent Emergency Response Component.

On mercury, the project envisages, under "Subcomponent 2.2. Training and technology transfer" (US$5.68 million, all IDA), to facilitate access to mercury-free processing, regulatory compliance, environmental management and mine rehabilitation and technology transfer, and health and safety. A primary goal under Component 2 is to construct Demonstration Centres aimed at facilitating continuous capacity building for ASM operators, mining engineers, and extension service agents, and which would prioritize the practical demonstration of sustainable and environmentally-friendly mining practices, including mercury-free gold extraction and the adoption of safe and appropriate local technologies. The architects of the project also aim to

"build complementarities and explore synergies with other projects, such as the Africa Environmental Health and Pollution Management Program" (p. 102), which as noted, is the second major donor-funded ASM project with mercury management components ongoing in Ghana.

**Table 5.1** Major ASM mercury pollution abatement programs ongoing in Ghana

| **Donor** | **Project Name** | **Total Project Cost (US$ millions)** | **Details** |
|---|---|---|---|
| World Bank | Ghana Landscape Restoration and Small-Scale Mining Project, October 2022 – December 2027 | 70 | This project emphasizes a range of areas central to promoting a more regularized ASM sector in Ghana. It features the following core elements:<br>a) land-use planning;<br>b) formalization of ASM;<br>c) restoration of degraded lands for agricultural productivity, and<br>(d) strengthening of sustainable management of forest landscapes for biodiversity conservation and ecosystem services.<br>The original project of US$150 was scaled back to US$70 million. The environmental impacts of ASM receive substantial treatment under each of these four strands. |
| World Bank, funding provided by the GEF | Africa Environmental Health and Pollution Management Program, July 2020 – July 2025 | 37.89, of which Ghana receives 8.7 | The project, funded by GEF mostly, comprises the following:<br>1) Component 1: Strengthen institutions and build capacity<br>2) Component 2: Policy dialogue and regulatory improvements;<br>3) Component 3: Fostering technological improvement<br>4) Component 4: Project coordination and management<br>Its focus is mercury pollution in ASM in sub-Saharan Africa and is multi-country in nature. |
| United Nations Development Program | planetGOLD Global Program, Phase 2, 2022-2027 | 6.35 | The objective of the project is to minimize mercury use in the Ghanaian ASM sector. It has the following four components:<br>1. Optimizing formalization through Jurisdictional Approaches; |

| | | | |
|---|---|---|---|
| | | | 2. Accelerating financial inclusion and responsible supply chains;<br>3. Enhancing uptake of mercury-free, resource efficient technologies; and<br>4. Fostering knowledge sharing and local capacity building support.<br>The four components of the planetGOLD Ghana project follows a template established by the GEF that has been rolled out so far in eight Phase I countries. Ghana is among 15 Phase II planetGOLD countries. |

*Source*: Information retrieved from www.worldbank.org

On mercury management in ASM specifically, the *Ghana Landscape Restoration and Small-Scale Mining Project* has taken a backseat to the *Africa Environmental Health and Pollution Management Program* (World Bank, 2020). Under this project, Ghana has been allocated US$8,715,596 as part of an effort to "reduce exposure to mercury and uPOPs pollution at pilot sites and strengthen the institutional capacity to manage and regulate mercury use in artisanal small-scale gold mining (ASGM) and e-waste in selected countries in Africa" (p. 11). Its specific components are as follows:

- Component 1: Institutional strengthening, capacity building and knowledge sharing (US$1.9 million).
- Component 2: Policy dialogue and regulatory enhancements (US$1.9 million).
- Component 3: Demonstrating the application of technological tools and economic approaches (US$ 4.5 million).
- Component 4: Project coordination and management (US$ 415,028).

This project's documentation articulates the position of the World Bank on mercury use in Ghana's ASM sector very clearly. With emphasis on words such as "regulation", "monitoring" and "auditing", a spotlighting of the sector's environmental damages and a focus on constructing demonstration sites, World Bank officials, in line with the GEF, appear to be laying the groundwork for a "command and control" approach to eliminate mercury from the country's ASM circuit. Crucially, apart from lukewarm acknowledgement of ASM's social and economic importance in Ghana, there is little reference made to the sector's livelihoods dimension.

The same can be said about the Ghana planetGOLD project, *Advancing Formalization and Mercury-fee Gold in Ghana*. It aims to reduce mercury use through fostering more integrated, multisectoral formalization strategies, while improving access to finance and alternative

technologies. Financed by a US$6,350,000 fund awarded by the Global Environmental Facility (GEF), *Advancing Formalization and Mercury-fee Gold in Ghana* has the following four components: **Component 1:** Optimizing Formalization through Jurisdictional Approaches (Jas), UNDP GEF lead; **Component 2:** Accelerating Financial Inclusion and Responsible Supply Chains, UNDP GEF Lead; **Component 3:** Enhancing the Uptake of Mercury-free Technologies, UNIDO GEF Lead; and **Component 4:** Fostering Knowledge Sharing and Local Capacity Building Support, UNDP GEF Lead.[21]

Of the three projects, the eradication narrative has manifested most visibly in the planetGOLD project, which is arguably the most technical and practical. It will draw heavily on expertise from the Department of Mining Engineering at the University of Mines and Technology in Tarkwa, prioritizing the more skilled and licensed small-scale miners who have the financial and logistical means to consider mercury-free production strategies. The most recent intervention is evidence of this: a 2025 two-day onsite training program for miners based in the Prestea Huni-Valley and Wassa Amenfi West municipalities of the Western Region. The focus was on training the 136 participants (118 men and 18 women) on a range of technical and environmental topics, including basic geology and mineralogy, responsible mining practices, health and safety, and mercury-free gold processing methods such as the gravitational *Gold Kacha*.

But it largely excluded the people who operate and use mercury at a subsistence level, a massive group that includes the individuals surveyed in the Eastern Region in support of this thesis.[22] These are *not* the holders of licenses for "notable small-scale mining operations, including Okutey Mine and Bazurey Mining Company in Prestea Huni-Valley, and Bugart Mining Company in Wassa Amenfi West" who are well-positioned to overhaul operations and have access to markets.[23] They are rather miners whose earnings are meagre and livelihoods are wholly dependent on ready-access to mercury and who are clearly in no position, without support, to entertain a move to alternatives without guidance.

The broader takeaway here is whether Ghana's ASM operators can adapt to the "eradication narrative" that is clearly at the heart of all three of these projects. A better appreciation of their circumstances, interpreted through analysis of data from interviews conducted by the author,

[21] See descriptions at "About the Programme", www.planetgold.org/about (Accessed 14 April 2025); and "planetGOLD Phase 2", www.planetgold.org/planetgold-phase-2 (Accessed 16 April 2025).
[22] Information obtained during a personal communication with a Minerals Commission official, 1 March 2025.
[23] Information extracted from "planetGOLD Ghana trains small-scale miners in Western Region", www.planetgold.org/planetgold-ghana-trains-small-scale-miners-western-region (Accessed 4 July 2025).

casts light on this and in doing so, helps *To better locate analysis of mercury use and supply in the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa*.

### 5.2.2 "Locating" Mercury in the ASM Livelihoods Debate in Sub-Saharan Africa

At the time of writing, in Ghana, there were only 483 individuals in possession of *Small-Scale Mining Licenses* engaged in the extraction of gold.[24] The owners of the Okutey Mine and Bazurey Mining Company in Prestea Huni-Valley, and Bugart Mining Company in Wassa Amenfi West, fall into this category. When it comes to embracing and facilitating change in ASM, this very small group of 483 people are the "low hanging fruit" for staff at the likes of planetGOLD and the World Bank because they are the most visible and most importantly, are in a position to do so: having a license means they can rethink their approaches to environmental management, including entertaining radical shifts in processing that are mercury-free (see Hilson et al., 2025). Most of the more than one million people engaged in the extraction of gold on an artisanal and small scale in Ghana, however, do not have this luxury because they are operating in the informal sector and therefore do their best to evade security personnel linked to nationwide military interventions such as *Operation Vanguard* and *Operation Halt*. The reasons for this are, as outlined in Section 3.2, fairly credible and have been examined in considerable depth by scholars over the years (see e.g. Hilson and Potter, 2005; Tschakert and Singha, 2007): a combination of a shortage of land that can be worked legally, exorbitant licencing fees and massive bureaucracies that must be navigated in order to register operations. Collectively, these barriers prove to be formidable, which discourages individuals from operating in the informal economy. This informality, therefore, is "created". In other words, it could be seen as the outcome of a policy stance that prioritizes large-scale mine development but which, at the same time, falls short of empowering their artisanal and small-scale counterparts (Hilson, 2013).

Creating general profiles for the mushrooming group now found working in Ghana's informal settings – the category into which the people interviewed by the author in this research fall – helps to address the first sub research question of this thesis (*How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa?*). These are people who are highly mobile and mostly rely on incomes earned at the end of every work day in order to sustain their livelihoods. From the data gathered from interviews conducted by the author, this is a cycle which access to mercury *sustains*, likely for reasons similar to those listed by scholars working in other ASM settings: because of its (i.e., mercury's) inexpensiveness and effectiveness, and the simplicity of amalgamation (Veiga et al., 2006). In Ghana, the general perception among the sector's workforce is, as one miner/transporter with

[24] See "Ghana Mining Repository", https://ghana.revenuedev.org/license (Accessed 13 July 2025).

24 years' experience summed up in an interview with the author, that "If you can't manage to get mercury, then you shouldn't get involved in mining".[25] Part of the reason for this is that it is seen locally by those engaged informally in ASM in Ghana as the *only* option to extract gold from ore (Plate 5.1), a collective view shared by different actors at sites when asked about alternatives:

> [Mercury is] the only element used to extract the gold and without you cannot extract gold.[26]
>
> It is impossible to mine without mercury. After obtaining the ore, you will need mercury to extract the gold.[27]
>
> Mercury is crucial for extracting gold. Without it, you cannot retrieve the gold, as it is in powdered form.[28]

Box 2Plate 5.1: Panning for gold using mercury in Asamang

Another less-obvious reason is that mercury use appears to be synchronized closely with earnings from ASM. For the people interviewed by the author, it was explained that the quantity of gold extracted at the end of a working day determined how much food could be purchased. A steady availability of mercury, therefore, is very much the lifeblood of their households, their intimate knowledge of amalgamation speed and recovery rates keys to their survival. The following extract from an interview conducted by the author with a porter with eight years' experience captures this succinctly:

[25] Interview, Miner #1.
[26] Interview, Miner #2.
[27] Interview, Miner #3.
[28] Interview, Gold Buyer #1.

> Mercury is important in mining because you can't extract the right amount of gold without it. If you try to extract gold without using mercury, you'll lose a significant amount.[29]

This synchronization is unsurprising, given the backgrounds of most people found working informally in Ghana's ASM sector. They fit the mould of the "poverty-driven" operator described briefly in Section 2.3. Extracts from selected interviews conducted by the author such as "Life was tough…things were really difficult, so I decided to turn to mining",[30] "Mining is the primary source of income in this community",[31] and "mining provides immediate relief"[32] are confirmation of this. One interviewee in particular, who claimed to be mining for 28 years, provided a very detailed explanation of the impact of the sector, financially, on those driven to ASM by poverty:

> I lack the formal education required for a traditional job. As a result, I entered the mining industry to earn money and support my children's higher education. This job has been highly beneficial, allowing me to care for 20 children who are not my biological children.[33]

Access to supplies of mercury ultimately makes the mining activities described above possible. The most experienced miner interviewed (40 years' experience) by the author underscored why mercury is so popular in Ghana, explaining that "Mercury is a cheap, easy, and simple way of extracting gold", and "without mercury, I'm not sure we will find it easy to extract our gold [because] there is no other cheap, simple, and easiest way of extracting gold except with mercury".[34]

Other individuals interviewees focused on what impact a removal of mercury from their operations would have. One gold buyer was very vocal in expressing his opinion on the matter, explaining in an interview with the author that "the average share of household income in every mining community is derived from non farm sources… [regulatory changes would] rob a lot of people livelihood".[35] Similarly, a miner with nearly 25 years' experience explained that he viewed this change as damaging. He claimed in an interview with the author that "Any negative impact on artisanal and small-scale mining (ASM) would directly affect my family and others who depend on this work for their survival".[36] Others reflected on the wider implications a sudden

[29] Interview, Porter #1.
[30] Interview, Miner #4.
[31] Interview, Miner #5.
[32] Interview, Miner #6.
[33] Interview, Miner #7.
[34] Interview, Miner #12.
[35] Interview, Gold Buyer #2.
[36] Interview, Miner #3.

removal of mercury from ASM, and ultimately a consequent de-synchronization with their earnings, would have on gold production and ultimately, for their livelihoods:

> Regulatory changes would cause economic hardship and likely drive an exodus…mining is vital to Ghana's economic development.[37]

> Regulatory changes could lead to economic hardship and increase on social vices.[38]

> If mining were to be banned by the government, it could have severe consequences for the local community. Without mining, many people would likely resort to theft as a means of survival.[39]

This dependency is further underscored by the general lack of awareness of alternatives. The least experienced miners consulted showed little knowledge of alternatives. Comments such as "Mining cannot continue without mercury, especially for processing powdered sand, and extending the blanket and carpet used to trap gold while pumping water onto the sand [is possible but] ineffective for powdered sand",[40] and "Very few people are able to extract gold without mercury, and that is done at sites with nuggets only",[41] a miner with eight years' experience and gold buyer with seven years' experience, respectively, were very much the norm (Plate 5.2). By comparison, some of the older miners exhibited some knowledge of substitutes but this was likely the result of having participated in a workshop of two on mercury in the past. This was the case with a miner with 36 years' experience, a miner/porter with 30 years' experience and a miner with 40 years' experience:

> A site or land with nuggets does not require mercury for extraction. Instead, we use magnets to extract the gold. We place the ore and the magnet in a rubber bag, tie it, and then the magnet removes the dirt, exposing the gold.[42]

> I've experimented with mercury-free extraction methods (heating sand on a plate over fire) [but found it] inefficient, time-consuming, and resulting in gold loss through evaporation.[43]

> I went for training in Tarkwa where they used another method to extract gold, and we learned it; however, it was not easy to practicalize it because it is expensive and time

[37] Interview, Miner #4.
[38] Interview, Miner #9.
[39] Interview, Miner #10.
[40] Interview, Gold Buyer #1.
[41] Interview, Miner #11.
[42] Interview, Miner #4.
[43] Interview, Porter #2.

> consuming. Using mercury to extract gold is the simplest and easiest way to get your gold within the shortest time.[44]

Importantly, these miners, despite clearly reluctant to abandon mercury as a gold-extraction agent, do recognize its dangers. Miners talk amongst themselves and share experiences, so it is unlikely that they are completely unaware of its health-related impacts. One experienced miner summed up what was likely common knowledge amongst the group interviewed by the author:

> We know mercury as a toxic substance, and when you inhale the vapor into your body, it will cause so many diseases. There is a man in my house whose child was born without hands and legs, and I believe these are the effects of the mercury. I'm sure the father didn't protect himself properly when he was using mercury to mine; that is why his child was born with no legs and hands.[45]

Revisiting the first sub research question of this thesis, therefore, the situation can be summed up as follows: mercury clearly *enables* those engaged in the sector – particularly those operating in the informal economy – to produce their gold, synchronizing this work around its availability. In short, and building on ideas shared in Chapter 2 on the livelihoods dimension of ASM in sub-Saharan Africa, access to supplies of mercury *sustains* operations populated by individuals who move into the sector because of poverty.

**Plate 5.2** Typical small-scale mining setups dependent on mercury supplies

Box 3**Plate 5.2** Typical small-scale mining setups dependent on mercury supplies

### 5.2.3 Articulating Dependency More Clearly

[44] Interview, Miner #12.
[45] Interview, Miner #12.

While working in the informal economy presents a number of challenges, as it is unregulated, unpoliced and unmonitored, at the same time, it also presents a number of opportunities for those who can adapt. Those engaged in ASM in sub-Saharan Africa, and Ghana specifically, are no exception.

The ASM activities found in the country's informal economy have ignited and sustained a number of other economic activities, as detailed in Chapter 2. As indicated, examples include distributors of equipment, various trading and hotels (Amoako et al., 2022; Kumi et al., 2023; Ofori et al., 2025). Hilson and Garforth (2013) interviewed a miner in the village of Kobriso (also in the Eastern Region) who used finance from ASM to open a chemical dispensary. A decade later, Hilson and Hu (2022), drawing on findings from the gold-rich town of Prestea (Western Region), reported that individuals who were working in the sector informally had used earnings to finance a number of other economic pursuits, such as equipment supply, hotels, petrol stations, restaurants and community facilities and services (a radio station and primary school). In each of these cases, access to mercury, which enables rapid gold extraction from ore to take place made these entrepreneurial pursuits possible. Embracing the "eradication narrative", which would introduce more costly, less efficient, alternatives in a location where markers for each are nonexistent, would bring everything to an abrupt halt.

Much of the same applies to most of the miners interviewed by the author in Asamang and Akwatia for this research. For these individuals, access to mercury, which has facilitated consistent gold production, has also created economic opportunities for them. The case of one gold buyer with seven years' experience in the sector, who "functions as a gold buyer/seller and mining monitor who also sells mining tools and raises pigs as a supplementary income source"[46] is fairly standard. Those interviewed by the author who had been involved in ASM for lengthy periods had also been most successful in entering other sectors, as the following extracts illustrate:

> I operate a provisions shop for my wife alongside mining activities and own a four-acre cocoa farm which is insufficient for supporting my family due to its seasonal nature.[47]
>
> In total, I can say that I have been mining for 30 years and have about 9 people depending on me. At my shop, I have employed two people who are managing the shop…Through mining, I have been able to build two houses—one for myself and my nuclear family, and

[46] Interview, Gold Buyer #1.
[47] Interview, Porter #1.

the other for my parents and my siblings. I have also been supporting my siblings and some of my nieces and nephews through their education.[48]

I function as both a miner and a business owner who sells mining tools and operates as a mobile money merchant.[49]

I function as both a miner and a business owner who sells mining equipment and buys and sells gold.[50]

I function as both a miner and a transport owner who also sells mining tools.[51]

For these individuals, access to supplies of mercury also *creates* these economic opportunities by *sustaining* ASM activity under prevailing conditions. Being mostly poverty-driven, few are in a position to "rethink" their processing techniques with the goal of acquiring the skills needed to adopt some of the alternative technologies the likes of planetGOLD Ghana are piloting in the country.

The broader concern here is how prepared ASM groups operating in Ghana's informal economy who already have minimal interaction with regulators are to embrace the "eradication narrative" being ushered in by the three projects. It is a massive departure from previous programs that emphasized training and technological demonstrations. This was the culture, it seemed, created by the US$1.53 million GTZ project (1991 – 1993), under which money was used primarily to establish demonstration centres and mobile processing units for gold, reclaim lands and supplying miners with fresh equipment. In the case of the latter, several workshops were held at which pumps, jackhammers, crushers and retorts – technologies which help control releases of mercury into the atmosphere by allowing amalgams to be roasted within an enclosed circuit – were demonstrated to ASM groups across the country (Davidson, 1993; Iddirisu and Tsikata, 1998; Yakubu, 2002; Hilson et al., 2022). They were interactive and engaging, and provided a foundation for work carried out subsequently under the World Bank's *Ghana Mining Sector Development and Environment Project*, 1995 (World Bank, 1995). As indicated in the project appraisal document, a total of US$7.82 million was pledged to support ASM to:

- Test Improved Equipment and Processing (US$1.25 million);
- Distribute Technology (US$1.29 million);
- Collect Geological Information (US$1.88 million);

[48] Interview, Miner #14.
[49] Interview, Miner #5.
[50] Interview, Miner #4.
[51] Interview, Miner #3.

- Support the design and implementation of an improved ASM institutional/regulatory framework and setup (US$0.77 million); and
- Support reclamation of lands degraded by ASM (US$2.63 million).

Much like the GTZ project, the work undertaken by the World Bank was also very participatory and engaging, focusing on *prevention* of release of mercury; outright *eradication* had not yet been considered. While there was work being carried out concurrently in Ghana that drew attention to mercury's (that being used to amalgamate gold) pervasive impact on local waterways, lands and human populations (e.g. Amegbey et al., 1997; Bannerman et al., 2003), the focus on *prevention* through *engagement* remained. This approach carried through to the mercury work sponsored by UNIDO in the 2000s. Following the work undertaken by Babut et al (2003) in the township of Dumasi, UNIDO commissioned the German company, Mt Metall-Technic GmbH, to manufacture a transparent mercury retort (the ThermEx® model), made up of a heat-resistant glass, stainless steel and a simple jam jar for cooling amalgam, which was then piloted at sites and sold at Minerals Commission district centres in the towns of Tarkwa and Bolgatanga.

The concern moving forward is that this culture of *prevention* and *engagement*, which is a key to engaging and bringing together the more mobile, itinerate and poverty-driven individuals who depend completely on mercury, has been replaced outright by a strategy emphasizing *eradication* that these very operators are likely to struggle to contend with. Specifically, the centralized processing, high-tech solutions and sophisticated training suitable for skilled and licensed small-scale miners are unlikely to capture the interest nor connect with the hundreds of thousands of people operating informally. Previous technical assistance fostering *prevention* and *engagement* had managed to do this, however. The radical shift toward technical assistance that embraces the "eradication narrative" also poses a threat to the intricate mercury supply chains and distribution channels in the country, elements of which, in the cases of Asamang and Akwatia, are detailed in the next section of the chapter.

**5.3 The Dynamics of Mercury Distribution and Supply in Asamang/Akwatia**

At the beginning of the research, the author interviewed one gold buyer with over 40 years' experience patrolling the innards of Akwatia whose views somewhat set the stage for the fieldwork. He explained that "mercury is a secret because people do not want to reveal their sources" and that people "do not want to tell where it comes from especially now with the *Vanguard* people around".[52] Perhaps intended as a warning of sorts, people were indeed extremely guarded when asked anything about mercury supply and distribution. This posed an

[52] Interview, Gold Buyer #4.

obstacle, given that shedding light on the dynamics of mercury supply in ASM communities in Ghana is central to the second sub research question of this thesis *("What key actors are linked to the supply and mercury in ASM, and what roles do these actors play in distributing supplies to site?"*). To address this question, therefore, this section of the chapter draws on observations made at sites along with selected excerpts from interviews conducted by the author, from which a picture of the supply chain and distribution network for mercury at sites was constructed.

Several interviewees appeared to conceal the truth and to rationalize the secrecy of the network responsible for the distribution of supplies of mercury at multiple levels. Responses such as "I know that selling mercury is illegal, so they [sellers] usually don't reveal their locations [so] I understand why they keep it hidden—it's to protect their business",[53] and "We simply go to the location where it is sold and purchase the amount we need"[54] are a testament to this. Here the GPN framework offers some guidance, specifically on the *horizontal* or *territorial* dimension of the ASM community that those interviewed by the author are a part of, and that in which they are *embedded* (after Henderson et al., 2002; Coe and Hess, 2010; Coe, 2018). There was ambiguity encountered in attempts to uncover who supplies mercury to miners in Asamang and Akwatia. Some interviewees were exceptionally guarded, speaking abstractly when probed about whom they secure mercury. One miner said little more than "I purchase mercury from local suppliers because I don't know of any other place where we can buy it",[55] while two others were equally-vague, stating, respectively, that "We simply go to the location where it is sold and purchase the amount we need"[56] and "I have no knowledge of how mercury suppliers obtain their product".[57]

Others, however, provided important clues on who may be handling mercury and/or supplying it, although whether this was intentional or not remains open to debate. One porter, for example, declared that "Chinese importers bring the mercury into Ghana to Anwia Nkwanta [a neighbouring town], where local sellers purchase it for resale"[58] while another stated that "To be honest with you, I cannot disclose the name of the person and the place where we purchase the mercury since it is illegal".[59] From the evidence gathered, however, and consistent with arguments raised in the literature on informality and the GPN about **trust**, there are highly-complex distributional networks, assembled over time and glued together by the bonds and relationships forged between miners, labourers and suppliers operating at different levels,

[53] Interview, Miner #3.
[54] Interview, Miner #5.
[55] Interview, Miner #4.
[56] Interview, Miner #5.
[57] Interview, Miner #1.
[58] Interview, Poter #1.
[59] Interview, Miner #13.

responsible for delivering supplies of mercury to ASM sites such as those visited in Asamang and Akwatia. Few of its components are visible to the naked eye but locals are very aware of its many components. One miner summed up the situation, explaining that "I know of some people who sell mercury, but I cannot take you to them because they do not sell the mercury in the open market".[60]

Nevertheless, probing did expose that there is a **kingpin**[61] or **influential individual** controlling the network in the informal ASM sites that periodically surface (Asamang and Akwatia – at least the gold mining dimension of the town – being no exceptions). The individuals with a commanding influence over the distribution of mercury locally (more on this point in Section 5.4), are also likely to have assumed their positions of power systematically over time. One miner explained that "Some of the mercury holders come to site as if he is coming to buy gold and if he/she got to know that you have big money then he will introduce himself why he/she is on your site and if you are interested he will drive you a bit far from your site for business".[62] Some data suggested that the individual controlling mercury distribution at the sites visited could be a foreigner. One porter reluctantly claimed in an interview carried out by the author that "Chinese importers bring the mercury into Ghana to Anwia Nkwanta, where local sellers purchase it for resale";[63] the latter seems plausible as many miners mentioned securing their equipment from Chinese merchants as far away as (the country capital of) Accra. Other interviewees suggested that someone regionally in West Africa (i.e. outside of Ghana) held this role. As a highly-experienced miner explained directly in an interview with the author:

> I purchase the mercury directly from a man who imports it from Côte d'Ivoire. He is a native of this town and used to be a miner himself, although he no longer mines. I've continued to buy mercury from him over the years because he is reliable. Before he brings me the mercury, I usually call him to discuss the quantity I need. We meet a designated location, and I collect it from him. After collecting the mercury, I take it home and keep it in my room. The next morning, I place it in a sack I carry to the site. Once I arrive at the site, I keep it in my pocket until it's time to use it. When it's time, I hand it over to the person in charge for that day and collect the leftover mercury afterward. After collecting the mercury, I take it home and keep it in my room. The next morning, I place it in a sack I carry to the site. Once I arrive at the site, I keep it in my pocket until it's time to use it. When it's

[60] Interview, Miner #14.
[61] This was a word commonly used by interviewees.
[62] Interview, Miner #15.
[63] Interview, Porter #1.

time, I hand it over to the person in charge for that day and collect the leftover mercury afterward.[64]

Regardless of who actually controls mercury supply in Akwatia and Asamang, it is clear that he/she operates through various actors to distribute the small cylinders (containing mercury) to sites. These are likely people with whom they have good rapport, forged over many years of business dealings. Unsurprisingly, these are the actors who the kingpin sees as the most reliable and/or the most wedded to his/her location and therefore least likely to relocate on a whim. Primary examples include head miners/"owners" of sites and local shop owners with roots in study locations. The following extracts suggest this:

> The owner of the site is the one who supplies us with mercury to use. At any point in time that we need mercury to work, the owner of the site will contact his suppliers, and they will supply it to us.[65]

> To be honest, mercury is not sold in open places like when you go to the market and buy tomatoes. Because it is harmful to the environment and humans, we do not have an open market for it, which is a secret…We have specific people who are selling, so some of our boys have a relationship with the sellers, so when we need it, they reach out to them and get it for us to use.[66]

> After getting it I measured it in small bottles at a cost of two hundred and fifty Ghana cedis [250 GHC] per bottle and distribute it to my customers, others too come to my shop to buy.[67]

How is trust gained on both sides in this informal economy? Perhaps the most interesting aspect of this is how trust is built with the local kingpin, who, given his/her dealings in what is illegal trade (mercury and the miners extracting gold) has plenty to lose if caught. One miner explained in an interview with the author how they gain the trust of kingpins, which appears to be a lengthy and exhausting process:

> I started mining when I was very young. This is because I live in mining prone environment where mining is the main occupation in the community. It has been a life changer for me and has helped me a lot together with my family. I worked as a miner on someone's site for a while then I stopped and begun to sell mercury for someone. The person buys the mercury in bulk and then shows me how I should sell it for him. I did this for three good years and one way or the other I find my way through to get to the supplier himself. We

[64] Interview, Miner #7.
[65] Interview, Miner #14.
[66] Interview, Miner #12.
[67] Interview, Miner #15.

> talked business and everything changed. One day a miner came to me for a loan and I explained the mercury business to him. He showed positive energy towards the business and from there we've been working together till date as a miner and wholesaler of mercury.[68]

Purchasing relationships often involve agreed-upon conditions, which reinforce the role of mercury in the supply chain. One miner reinforced this very clearly in an interview with the author, explaining that "Besides supplying mercury, he also buys gold from miners", whereby "I acquire mercury on the condition that, once I obtain the gold, I will sell it to the supplier, [and] I pay him based on the amount of gold he purchases from me".[69]

For years, these "middlemen" or "intermediaries" have been portrayed by scholars as being highly exploitative of miners and labourers (See e.g. Hilson and Pardie, 2006; Mawowa, 2013). But the findings from this research suggest a more harmonious collaboration under the circumstances described in this chapter. With gold having appreciated enormously in recent years, there is no shortage of buyers at sites. This is why shop owners, head miners and other local-level actors whom kingpins rely upon to distribute mercury to those operating informally in Ghana's ASM sector are more inclined to support potential sellers more so now than in the past. One miner provided a detailed overview of the dynamics of the arrangement and exchange in an interview carried out by the author:

> The suppliers bring them to us in cylinders. Sometimes he give my colleague direction to meet him for business. ii, with regards to distribution, we use some an then sell the rest to our customers. In addition, we give some to some of the miners who get us gold to purchase at a reduced price. For example ,if the market price of gold is ten thousand Ghana cedis [10,000 GHC] per pound as long as we have giving you mercury we will buy at a cost of eight thousand Ghana cedis [8,000 GHC].[70]

Further mercury arrives to the town weekly via local transport, after which it is distributed to shop owners, mine "owners" and kingpins' other trusted hands. Those reliant on mercury often "come together as a team, gather money and purchase the amount of mercury we need"[71] and occasionally, "get it [mercury] on credit when I run out of mercury".[72]

[68] Interview, Miner #17.
[69] Interview, Miner #7.
[70] Interview, Miner #16.
[71] Interview, Miner #5.
[72] Interview, Miner #3.

The bonds forged and trust among miners and other local actors linked to ASM sites in Asamang and Akwatia are clearly very strong.

### 5.4 Multiple Livelihoods (and Overlaps)?

What has also contributed enormously to the continued functionality of ASM sites at Asamang and Akwatia is the plurality of supply chains at play and inevitable crossover of actors. In other words, there are people who are firmly embedded within not only supply chains and distributional networks for mercury but also those for the gold extracted at the ASM sites where it is used. The findings suggest that actors dabbling in an out of the two (and maybe more) supply chains has a mutually reinforcing effect (as far as the two distinct, yet overlapping, supply chains are concerned). Identifying these (potential) overlaps helps to paint a picture of the embeddedness of the supply chain for mercury in ASM communities, in the process, addressing the third and final sub research question of this thesis (*"What additional roles (actual and potential) do actors play in the wider ASM sector?"*).

This was by far the most challenging sub research question to address due to the limited amount of information available and general reluctance of interviewees to disclose information even when probed. It is, as one miner put it in an interview with the author, the inevitable fallout of examining a supply chain of "an illegal business in the country" in which "suppliers tread very carefully".[73] Nevertheless, interviewees did provide some important clues on potential overlaps, even if they did not intend to do so. Echoing points raised in the previous section of this chapter, the main locations of overlap between supply chains for mercury and gold were at (mercury) selling points, in particular the bases of head miners and shop owners linked to kingpins. The overlap is reminiscent of what Coe and Yeung (2015) refer to as the phenomenon of "aggregation of multiple GPNs" or territorialization of "an industry; intra-industry intersection of GPNs through common strategic partners or specialised suppliers; and inter-industry intersection of GPNs through firms undertaking different roles in different GPNs" (pp. 61–62). Of course this requires "reimagining" the actors involved, as the shops and individual entrepreneurs patrolling ASM sites in Asamang and Akwatia are a far cry from the multinational firms which Coe and Yeung (2015) envisioned to be behind the "aggregation of multiple GPNs". But the findings do reinforce points raised by Todd et al. (2020) on the need to take into account multiple networks and nodes when studying the anatomy of supply chains in the extractive industries, including ASM. This applies to the international suppliers servicing big mines and oil rigs such as Kamatsu and Caterpillar that are "global players with their own GPNs in manufacturing, dealerships and labour stretching across 180 countries" (p. 101) **and** the grassroots-level actors who, in the ASM

[73] Interview, Miner #20.

sector, extract gold and simultaneously sell mercury while masquerading as a shop owner or community leader.

A staple feature of any informal economy is the multitude of unexpected roles certain actors assume (whether intentional or not) in the absence of regulation and regularized structure. The ASM sites visited in Asamang and Akwatia are no exception. While the main overlap between the supply chain for mercury on the one hand, and that for gold on the other hand, is through buyers, it is extensive and through *multiple* individuals. There are, for example, miners who obtain mercury supplies from shops or the head who then sell this on to colleagues, in many cases as part of elaborate sponsorship agreements linked to gold purchasing. For the purposes of this discussion, these individuals are assigned the label "secondary gold buyer/mercury supplier", and are themselves mining but are physically present at the sites where they do most of their buying and selling. These individual are indispensable as they "function as a sponsor to other miners, providing funds for purchasing necessary tools and equipment".[74] One miner described how the opportunity for such a role has emerged in detail during an interview with the author:

> I get mercury from my boss [the head miner] who travel to buy in cylinders into his shop located in town where most miners come to buy. He gets us some to be used at the site to amalgamate gold. Though I am the manager on his site, however, I mostly pay directly with cash from my boss and measure it in small bottles to sell for profit. He does not care about my secondary business under his watch.[75]

What this miner is referring to is the large beer bottle obtained at a cost of GHC30,000 that is subsequently "measured in the small bottles" by secondary gold buyers/mercury suppliers for (re)sale between GH200 and GHC 250 each.[76]

In both Asamang and Akwatia, there are now waves of people engaged in the supply chain for gold produced by ASM operators who are also simultaneously entrenched in networks responsible for the distribution of mercury to sites. These are not only secondary gold buyers/mercury suppliers but even labourers entrenched in the tertiary and quaternary layers of gold supply chains linked to ASM. Some of these individuals, explained a miner in an interview with the author, "play a major role in ASM, including mercury suppliers, miners,

[74] Interview, Miner #1.
[75] Interview, Miner #20.
[76] Interview, Miner #20

concessionaires, and production managers".[77] Nevertheless, the setup remains largely shrouded in secrecy and kept together by trust-based bonds, which means the barriers for entry for even those embedded within the tertiary and quaternary layers are likely formidable. On the one hand, as one miner who doubles up as a mercury supplier explained, focusing on his relationship with his own kingpin, those driving the supply chain are deliberately elusive, never maintaining a fixed position, likely to ensure that regulators are unable to pinpoint their positions:

> She [the kingpin] is a very bold Fanti woman called "Aunty" who is at her late-60s. It's just a matter of giving her a shout that I need stuff badly. Whenever I run out of mercury, I always find it difficult to locate her. She has about four different mobile numbers. She did not give me her official mobile number. I neither know her house nor the shop she sells the stuff. Sometimes when I call her a different person pick and ask me my mission before he/she direct me where we should meet for business. This indicate how illegality the business is and that's why she doesn't want me to know her whereabout. [We meet her] in Ghana. Not at one place. Different places such as hotels, roadside, sometimes midnight [12 AM]. We do not doing business close to many people. We always isolate ourselves. She only provide me with the mercury. She had since not disclosed her identity. I do not know her secondary job.[78]

Another miner explained that, despite the secrecy, for the "Gold dealers and others who are interested in mercury business, there is good relationship between us because we all need each other to run our business" which is why head miners and secondary suppliers are willing to "assist them on credit".[79] These individuals are equally-cautious, explained another head miner, indicating in an interview with the author that "I distribute it [i.e., mercury] to my customers", while "Others come to my doorstep to buy in bottles at a cost of GHC16,000 and measured it in very small bottles to sell for profit and as most of them are gold dealers, they move from site to site to sell and buy gold as well".[80]

The finance at stake is reason enough for all actors to maintain secrecy. One miner put this into perspective:

[77] Interview, Miner #14.
[78] Interview, Gold Buyer #3.
[79] Interview, Miner #18.
[80] Interview, Miner #14.

> Because mining is lucrative so is mercury, which is more profitable. With regards to mercury business no excuses compared to mining. The ore is not rich of the minerals of interest [gold] due to lack of geological data, as a results I have run bankrupt. With mercury, it's the only chemical element used in the extraction of gold. The demand is always high. Though, it's illegal. Subsequently, I'm always cautious.[81]

In summary, and consistent with the GPN literature, mercury supply chains are *embedded* in ASM regions in Ghana. A major reason for this is that many of the actors engaged in the extraction of gold are also involved in some capacity in mercury supply and distribution channels. This overlap is most pronounced with influential miners (head miners), who have taken up roles as suppliers of mercury and inspired others to do the same.

**5.5 Concluding Remarks**

This chapter has shared findings from the research with the goal of addressing the three interrelated sub research questions of this thesis, as follows:

1) How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa?
2) What key actors are linked to the supply of mercury in ASM, and what roles do these actors play in distributing supplies to site?
3) What additional roles (actual and potential) do actors play in the wider ASM sector?

To summarize the ideas put forward in this chapter, first, findings were used to locate mercury in the ASM livelihoods debate in sub-Saharan Africa. Findings from Asamang and Akwatia suggest that while recognized as a "silent killer", similar to how it has been portrayed in the literature (see Zafar et al., 2024), mercury makes ASM possible for many otherwise poverty-stricken people. Moreover, through bolstering ASM, those engaged have been able to develop other businesses through which, supplementary income sources have been secured. If anything, mercury is an important, albeit largely misunderstood, strand of the livelihoods dimension of ASM in sub-Saharan Africa.

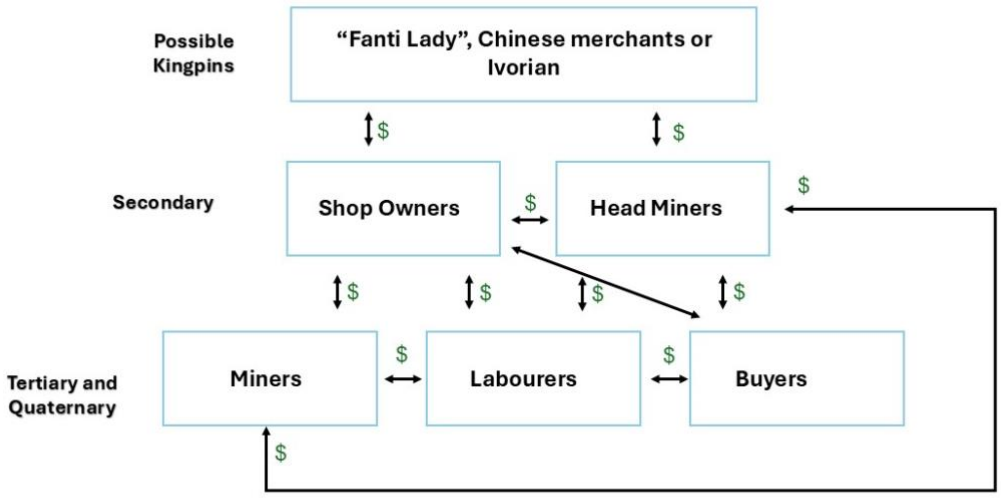
Findings also shed some important light on the various actors entrenched in the mercury supply chain and distribution networks at the site level. There are kingpins, head miners, shop owners and mine labourers who all play a part in circulating mercury to sites albeit in secrecy. As was further explained, drawing on data from fieldwork, many of these actors are also firmly

[81] Interview, Miner #18.

entrenched in the gold supply chain. Both supply chains, therefore, overlap through these actors. These dynamics are presented in Figure 5.1.

The data supplied here were undoubtedly limited but certainly sufficient in providing an idea of what the supply chain for mercury looks like in Ghana and potentially elsewhere in sub-Saharan Africa. More research is needed to fill in the blanks but there is enough information presented here to suggest that the roles of these actors are shaped by the informal economy that they are a part of. The next chapter sums up the ideas presented in this thesis, outlines next steps for research, and prescribes policy recommendations which if operationalized, could take the findings presented here forward.

Figure 2: Figure 5.1 Depiction of the dynamics of the mercury supply chain at ASM sites in Asamang-Akwatia



# CHAPTER 6

# CONTRIBUTIONS AND CONCLUDING REMARKS

## 6.1 Introduction

The ASM sector accounts for close to 40 percent of global anthropogenic emissions of mercury. Consequently, over the last few decades the donor community financed a series of technical assistance projects aimed at reducing emissions of mercury at sites through awareness raising and promotion of substitute technologies. The latest policy intervention made to address the mercury pollution problem is the *Minamata Convention on Mercury*, a global treaty launched in 2013 by the United Nations (which came into force in 2017) with the explicit intention of engaging ratifying countries to work toward minimizing emissions of mercury from ASM and to eradicate its use altogether where possible. The work carried out under the auspices of the *Minamata Convention*, including planetGOLD, a US$350 million project funded by GEF that "works in partnership with governments, the private sector, and ASGM [artisanal and small-scale gold mining] communities to significantly improve the production practices and work environment of artisanal and small-scale miners".[82] has sparked criticism from the media and general public toward ASM.

This thesis aimed to reorient the discussion of mercury use at ASM sites in sub-Saharan Africa by providing evidence in support of how its supply and distribution networks are intertwined and entrenched within the sector. Accordingly, eradicating mercury from the sector is by no means straightforward: mercury's efficiency and cost-effectiveness, and an absence of alternatives has led to tens of millions of people in the region depending on it to process their gold, which is ultimately the source of their livelihoods. As indicated in the previous chapter, decades of use of mercury has led to its embeddedness in broader gold purchasing relationships and supply chains, particularly for the most vulnerable and low income participants in the ASM sector. The case study of Asamang-Akwatia in Ghana's Eastern Region presented in this thesis reinforces these points.

After summarizing the findings of this thesis and the limitations of the research in Section 6.2, the chapter proceeds to identify the main contributions of the work and prescribe next steps in Section 6.3, the conclusion of the thesis.

## 6.2 Summary of Key Findings

[82] "About the Programme", http://planetgold.org/about (Accessed 3 June 2025).

This thesis set out to answer the following research question: *How does the issue of mercury supply and distribution feature in the debate on the livelihoods dimension of ASM in sub-Saharan Africa, with special focus on Ghana?* A case study of Asamang-Akwatia in Ghana's Eastern Region was used to answer this question. Some 36 actors were interviewed by the author at sites within these adjoining localities, each of whom was asked specific questions related to mercury supply and distribution.

Three sub research questions followed from this central research question. They were as follows:

1) How does analysis of mercury use and supply fit into the broader discussion on the livelihoods "dimension" of ASM in sub-Saharan Africa?

2) What key actors are linked to the supply of mercury in ASM, and what roles do these actors play in distributing supplies to site?

3) What additional roles (actual and potential) do actors play in the wider ASM sector?

While interviewees were willing to engage, most were reluctant to disclose details about mercury supply chains and distribution networks. This was unsurprising, given that the trade is shrouded in secrecy and sustains hundreds of thousands of informal operators countrywide whom the government is attempting to remove- at times, by force – from sites.

This led to a second formidable barrier encountered during the research: the guarded nature of communities. The ASM populations in Asamang-Akwatia, like most such communities across Ghana, are scarred by continuous military sweeps that are often associated with equipment destruction and human rights abuses (Hilson, 2017). With the study communities on edge, it was at times difficult to extract information from individuals because of their fears of being reported to the authorities; they were very vocal about this. Only through social relationships developed through previous research in these communities that some communications on this sensitive issue were possible. Often, the author found herself piecing things together using information gleaned from observations as well as extracts from interviews she carried out with actors.

What did the data gathered actually reveal? To reiterate the findings discussed in Chapter 5, experiences from Asamang-Akwatia reveal that mercury makes ASM possible for many otherwise poverty-stricken people, which, in turn, has positioned some to invest monies in other ventures to obtain supplementary income sources. It is for this reason that mercury use needs to be discussed with greater depth and nuance in the context ASM and rural livelihoods in sub-

Saharan Africa. Findings also provided sufficient detail to map the various actors embedded within mercury supply chain and distribution networks at the site level. In the Ghana case examined here, there are kingpins, head miners, shop owners and mine labourers. All play a part in circulating mercury to sites albeit in secrecy. Many are also firmly entrenched in the gold supply chain: the likelihood of overlapping actors across multiple supply chains (mercury and ASM gold) is high. Overall, findings from this research confirm that the supply of mercury in ASM is made possible by a complex socioeconomic network that sustains hundreds of thousands of rural livelihoods (Hilson and Maconachie, 2017). In doing so, the study challenges oversimplified policy and technical approaches to tackle the mercury problem.

Although based on a confirmed site (Asamang-Akwatia) within a case study (Ghana), there are some broader takeaways from this research worth considering, the relevance of which would be amplified by additional complementary work. The first concerns the question of overlap once again. As there are actors, finances and trust-based relationships that that spill over from the supply chains and distribution networks linked to mercury into ASM and *vice versa*, it is likely that the two reinforce each other. Given that both are embedded in the region's informal economy, taking action that disrupts either or both is bound to have significant, negative impacts on local livelihoods. These dynamics are likely to persist beyond an individual site and extend to larger ASM communities (Geenen, 2012; Cuvelier, 2019). Simply put, in such settings, it is impossible to separate mercury distribution from gold production activities because the dealers, equipment suppliers, pit owners, and other stakeholders work in unison and within overlapping networks.

Second, given the challenges faced by operators inhabiting informal ASM economies, where access to alternative technologies, finance, and regulated markets is often non-existent, a ban on mercury could have catastrophic impacts on local livelihoods. Findings point to how under current conditions, mercury remains essential to ASM in Asamang-Akwatia, underscoring its role in nourishing the artisanal gold production networks that are the lifeblood for hundreds of thousands of families. The analysis presented here highlights the importance of integrating analysis of the mercury supply and distribution in ASM, whether in sub-Saharan Africa or elsewhere, into dialogue centring on the sector's livelihoods "dimension".

Finally, existing policy frameworks, particularly those implemented in response to ratification of the *Minamata Convention on Mercury*, fail to adequately address the socioeconomic realities that support mercury use. They have concentrated mainly on environmental and health issues while ignoring local dependency on it for gold production. There is certainly scope for shifting

focus to the latter, given the promises most NAPs – Ghana's included – make to supporting vulnerable groups.

### 6.3 Contributions

Revisiting the ideas shared in Chapter 2 helps to articulate some of the main contributions of this thesis. This thesis offers a number of significant theoretical insights into the use of mercury in ASM. **First**, it has revealed how Global Production Network (GPN) and rooted networks frameworks can capture the horizontal and vertical linkages within mercury supply chains (Henderson et al., 2002; Rocheleau & Roth, 2007). By reorienting the focus from environmental and health effects to supply-side dynamics that facilitate mercury use, the study adds to the body of knowledge on ASM, illuminating how socio-spatial relationships shape resource distribution and access.

**Second,** this work has significant policy implications that call into question the way that mercury is currently managed in ASM (Hilson et al., 2018). Effective mercury reduction strategies, according to the research, should address the structural factors that make its use economically viable and attractive for residents of mining communities, going beyond awareness campaigns and technology promotion (Veiga et al., 2014). This makes it imperative that policies are implemented that simultaneously recognize reliance on mercury and the environmental impacts linked to its use.

**Third,** results caution against pursuing quick mercury phase-out policies that do not offer practical economic alternatives because they run the risk of exacerbating rural poverty. Perhaps taking more into account local knowledge and recognizing the influence of informal sector institutions when designing regulatory frameworks should be prioritized. Effective policy hinges heavily upon taking into account the dynamics of mercury supply chains and distribution channels and using this as a foundation to design and implement new interventions.

What are the next steps? While this research only scratches the surface of the broader dynamics of the mercury supply chain and distribution network tied to ASM in sub-Saharan Africa, it has been illuminating nonetheless. An initial next step is to intensify work that seeks to generate further insights on the organizational structures of these supply chains and networks across the continent, and the actors who populate them. This thesis merely provided a glimpse of what may be out there in Ghana and wider sub-Saharan Africa; more detail is needed to assemble a much fuller picture that articulates more clearly miners' dependency on mercury and the embeddedness of its distribution and supply channels across the region.

The second recommendation is to revisit the goals of planetGOLD. Thus far, this project has been underwhelming, failing to offer tangible solutions to the mercury pollution problem in sub-Saharan Africa. There needs to be a pivot away from a ban on amalgamation in this sector and a push towards improving management and handling of mercury at sites. A detailed analysis of the supply chain and distribution network from mercury in the region would reveal very clearly how many people are embedded within these structures, which would provide an impetus for engineering this shift. It is safe to say that mercury management policy in the region is not aligned with the needs of local artisanal and small-scale miners.

It remains to be seen whether mercury will receive visibility in the debate on livelihoods in the region's ASM sector remains to be seen. As long as the mercury pollution problem continues to be predominantly examined by African policymakers through a technical lens, the policy choices made and equipment implemented at sites are likely to continue being unpopular with miners.

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## APPENDICES

### Appendix I: Core Questions Asked to Interviewees

1. **Demographic Section**
   - 1.1. Age
   - 1.2. Gender
   - 1.3. Country/Region
   - 1.4. Sub-National Region
   - 1.5. District
   - 1.6. How long have you lived at this specific site?
   - 1.7. Are you moving between multiple sites to work? [Y/N]
     If so, how many?
     What was the last time you were in another site?
   - 1.8. How many people live in your household at the mining site, including yourself?
   - 1.9. Could you tell me what best describes your PRIMARY role in mining?

***Mine Site Role (Direct: Prospection, Extraction, Processing)***

Head of mining team (responsible for on-site management)

Miner (Digger, extraction-focused laborer)

Porter/Transporter (responsible for movement of ore, water, etc.)

Processor (Grinder, Crusher, Panner)

Other, specify

***Service Provider to Mine Site***

Food Vendor (sells food, water)

Seller of Goods

Security

Mining equipment (Rental, sales, servicing equipment)

Other, specify

***General Mining Role***

Owner of tunnel/pit/hill (license holder)

State agent (government-affiliate)

Buyer (purchaser of mineral)

Exporter (sale of goods out of country)

Customary authority

Civil Society

Non-governmental organization

Private Business

Other, specify

1.10. How long have you worked in the mining sector (cumulatively)? [years, months]

1.11. Highest level of education completed
- No school
- Primary incomplete
- Primary complete
- Secondary incomplete
- Secondary complete
- Higher than secondary
- Other, specify
- No response

**2. Miners**

Background and experiences

a. Could you briefly describe your background and how you got involved in small-scale mining?
b. How long have you been involved in small scale mining?
c. What method and tools do you use to extract gold?
d. How are mercury supplies obtained for your operations?
e. Could you explain the steps involved in using mercury to extract gold?
f. In your opinion, what are the health and environmental impact of using mercury?
g. Are you aware of Ghana's license requirements for small-scale mining? Do you have a license? Yes or No
h. What challenges must you overcome to formalize your mining operations?

**3. Social and Economic Repercussions**

a. What is the relevance of mercury for the success of your mining operations?
b. What effects does your family and community receive from your mining income?
c. Are you aware of any mercury free methods, and have you tried using that method? Why and why not?
d. What kind of assistance do you believe is required to transition to mercury free mining?

**4. Mercury Dealers**

a. What is your background and how did you get involved in the mercury trading business?
b. Where does your mercury come from? And What is the mercury supply chain from your suppliers to the miners?
c. What are the common financial agreements in the mercury business?
d. When handling mercury, are there any rules or regulatory requirements that you have to comply with?, and if there is any, what challenges do you have to overcome to follow these rules?
e. What is your opinion on the shift towards mining mercury free technologies?

**5. Equipment Suppliers**

a. Could you briefly describe your background, and how you got to be involved in the mining equipment supply chain?
b. What kinds of tools do you offer small-scale miners?
c. How do you choose what products to sell?
d. Who are your main clients, and how do you keep up your relationships with them, and in what ways do you assist miners with equipment maintenance?

e. Which of the equipment you sell uses mercury, and has there been a rise in interest in mining mercury free technologies? If so, why has this demand been created?
f. What difficulties do you have running your company in the small-scale mining industry?
   What effects do changes in regulations have on the business and the customers you serve?
g. - What are your thoughts on Ghana's small-scale mining industry's future?
   - What do you think about the movement towards mining methods free of mercury, and how is your company responding to these developments?