Formalisation as a strategy of ASM 'sanitisation': So far, how far?

Abstract

Purpose

For decades, a significant number of studies have examined the agenda of the formalisation of artisanal and small-scale mining (ASM) operations. There is now enough anecdotal evidence that formalisation of ASM operations can help promote safe working conditions. However, very few studies have examined the internal dynamics and outcomes once ASM operations become formalised. This notwithstanding, these few studies provide very useful insights that could help reshape policy and refine scholarly ideas about formalisation. This present study, therefore, performs the task of (re)visiting the empirically oriented insights of the literature that explores the ASM activities of operators that are in possession of mining licences and are in operation.

Design/methodology/approach

The study seeks to answer the following question: How far have formalisation mechanisms succeeded in 'sanitising' the ASM sector? To achieve this, the authors draw on the findings of qualitative case studies examining the operations of formal ASM actors. Other data for the inquiry were sourced from published documents providing insights and discussions on the dynamics of the formalisation of ASM.

Findings

Synthesising the findings of the studies that have examined formalised ASM operations, the evidence seems to suggest that monitoring and supervision can mediate good environmental management practices. Formalisation seems to have positive impacts on the working conditions and the health and safety of the operators; however, this might not be true for access to credit, reinforcing the fact that unaided formalisation cannot completely cure the excesses of informality.

Originality/value

Analysing the literature on formal ASM operations, this present study provides useful discussions of where we stand and how research and policy discussions on ASM formalisation may proceed from here.

Introduction

Formalisation – a strategy to move people and transform practices from the informal to the formal economy (Chen, 2005) – has often been heralded as an important policy strategy for informal artisanal and small-scale mining (ASM) operations (Ankenbrand et al., 2021; Geenen, 2012; Veiga and Marshall, 2019). But why is formalisation of ASM operations important? Evidence from mineral-rich regions suggests that the scale of ASM operations has continued to expand over the last couple of decades due to extreme socio-economic pressures such as rising poverty (World Bank, 2019). This continuous expansion of the operations also means the expansion of the socio-economic and environmental negativities associated with the operations (Snapir et al., 2017). Meanwhile, the socio-economic and environmental externalities of the ASM industry generally continue to generate negative reactions from governments and policymakers (Clifford, 2022; Hilson, 2017; Ofosu et al., 2024b). ASM has thus become mostly peripheral to livelihood improvement and mineral sector development programmes (Fisher, 2007). Formalisation, then, is considered the panacea to curb socio-economic and environmental excesses and help properly promote ASM in policy development circles (Geenen, 2012; Hilson and Maconachie, 2017; Verbrugge and Besmanos, 2016).

ASM activities range from mining activities involving intense manual labour with a zero to minimum level of mechanisation to mining activities characterised by semi-mechanised operations (Johnson et al., 2024). According to IGF (2017a), ASM is a complex and diversified sector that includes poor informal individual miners seeking to eke out or supplement a subsistence livelihood as well as small-scale formal commercial mining activities that can produce minerals in a responsible way respecting local laws. In sub-Saharan Africa, for example, the sector is known to contribute significantly to local economic development (Hilson and Garforth, 2013; Mkodzongi and Spiegel, 2019), providing unique career-paths for many of its operators (Bryceson and Jønsson, 2010).

However, many of these extractive operations are confined to informal environments (IGF, 2017b; Veiga and Marshall, 2019). Most operators are thus labelled as illegal miners since they mine without any licence or legal permit (Veiga and Marshall, 2019). The informal nature of most operations has meant that, over the years, the sector has been associated with high

environmental costs including poor occupational and health safety records and incidents of occupational accidents; the working conditions of the miners are usually dangerous and unsanitary (Arthur-Holmes and Abrefa Busia, 2022a; Bartrem et al., 2022; Siaw et al., 2023; Stemn et al., 2021; Wagner, 2016). Finding reliable financial sources for ASM operations is also a challenge (Hilson and Ackah-Baidoo, 2011; Paschal et al., 2023). Although informal financial sources (like private sponsors and mineral buyers) are reported to be exploitative and insufficient, miners are known to depend on them, as they face challenging procedures to access credit from formal sources like banks and government microcredits (Paschal et al., 2023).

While ASM is routinely depicted as ungovernable and as hosting many social and environmental risks (Clifford, 2022; Gyan and Behrends, 2024), a plethora of research has highlighted its importance in providing rural populations with the means to enhance and diversify their livelihoods (Bansah et al., 2023; Hilson and Garforth, 2013; Mkodzongi and Spiegel, 2019; Tschakert, 2009). More recently, the significance of ASM for both national economies and local livelihoods, and its enduring negative environmental and social impacts, have attracted more attention from scholars and policy-makers, with formalisation being offered as the primary solution to mitigate the negative impacts (Ankenbrand et al., 2021; Bester and Groenewald, 2021; Rochlin, 2021; Salo et al., 2016; Siegel and Veiga, 2009; Siwale and Siwale, 2017; Veiga and Marshall, 2019).

In recent times, scholars have made significant progress toward theoretically understanding the mechanisms that lead to formalisation outcomes and the conditions that make them more likely (Geenen, 2012; Siwale and Siwale, 2017). However, despite the burgeoning calls for the formalisation of ASM operations, the empirical evidence and reports suggest that, to date, very few operations have been formalised. Globally, it is estimated that over 80-90% of ASM operations are informal (IGF, 2017b; Wagner, 2016). Relatedly, very few studies have empirically examined the outcomes once ASM operations become formal (Martinez et al., 2021). This notwithstanding, the few case studies that have examined the internal dynamics and outcomes once ASM operations become formal provide very useful insights that could help (re)shape policy and refine scholarly ideas about formalisation. This present study, therefore, seeks to revisit the insights and synthesise the findings.

Methodologically, our study is oriented towards examining the themes of studies that have explored the internal dynamics of formal ASM operators. In other words, we seek to (re)examine the literature that explores the ASM activities of operators that are in possession of mining licences and are in operation. ASM operations can be broadly categorised into two main groups: those without licences but who are in operation, often referred to as informal or illegal miners, and those with licences and who are in operation, referred to as formal operators. Following this, the literature can also be put into two main categories: studies examining the operational outcomes of informal/illegal operators (Arthur-Holmes and Abrefa Busia, 2022a; Banchirigah, 2008; Geenen, 2012; Libassi, 2022; Mkodzongi, 2020; Smith, 2021), and those exploring the outcomes and internal dynamics of the formal operators. Although many studies have examined the issue of formalisation, the majority of the studies have concentrated on the operations of the informal/illegal miners, explicating how the informal operations can be brought under formalisation. This is not surprising considering that, as already indicated, the vast majority of ASM operations worldwide are informal.

Conversely, case studies examining the operations of formal operators (see Botchwey et al., 2022; Jiménez et al., 2024; Martinez et al., 2021; Ofosu and Sarpong, 2023, 2022a; Robles et al., 2022; Siwale and Siwale, 2017) remain in the minority. Although not exhaustive, these works serve as quintessential examples of the literature on the examination of formal operations, the empirical details of which provide insights that can help deepen our understanding of the formalisation phenomenon. Hence, as already stated, this study performs the task of (re)visiting the themes of the above-mentioned works to provide more insights into where we stand and how research and policy discussions on ASM formalisation may proceed from here. By so doing, this study builds on and adds to the growing body of research on ASM formalisation, specifically with regard to the impact of reform measures intended to make ASM more beneficial to the livelihoods of the operators. It highlights the benefits as well as the challenges of ASM formalisation initiatives as empirically examined; thus, the study seeks to enhance our understanding of the prospects and limitations of approaches to the formalisation of informal resource extraction (Ankenbrand et al., 2021). In this regard, we summarily highlight that monitoring and supervision can mediate good environmental management performance. Formalisation seems to have positive impacts on the working conditions and the health and safety of the operators; however, this might not be true for

access to credit, reinforcing the fact that unaided formalisation cannot completely cure the excesses of informality.

ASM informality: the manifestation

The informal economy, as explained by Chen (2005), comprises economic operations and employees that remain in the sphere of unregulated/unlicensed economic activities and unprotected employment relationships. Informal employment is embedded in the informal economy (Chen, 2012; La Porta and Shleifer, 2014) and is usually characterised as employment with minimal labour or social protection; this includes uncertainties related to dramatic fluctuations in workers' income, operating in an insecure environment, and being prosecuted for undertaking illegal activities (Chen, 2012; La Porta and Shleifer, 2014). Informal employment also includes self-employment on a small-scale basis, unregistered enterprises, and wage employment in unprotected jobs (Chen, 2005). Low wages, low levels of education, high rates of poverty, and long working hours are some of the main features of employment in the informal economy; informal activities are often self-financed, under-capitalised, and basically cash-based (Chen, 2012, 2005; La Porta and Shleifer, 2014). Production of goods and services in the informal sector is often labour-intensive, and the skills required for the production activities are usually gained outside formal education (Verick, 2006). These phenomena have considerable resonance with the context of the ASM sector.

As highlighted by ASM scholars, one of the most salient features of ASM is persistent informality; indeed, informality characterises the sector as a permanent rather than transitory feature (Salas-Urviola et al., 2021; Tschakert, 2016; Veiga and Fadina, 2020). But why are ASM operations highly informal? A set of causal explanations for persistent informality refers to the clear 'incentives' to operate informally (Cartier and Bürge, 2011; Geenen, 2012). As noted elsewhere, operating without a licence offers many gold miners greater mobility and flexibility in their search for commercially viable mineral deposits, and it also suits more rudimentary, temporary, and seasonal mining activities, thereby facilitating the undertaking of complementary agricultural and mining activities (Cartier and Bürge, 2011; Smith, 2021).

Another set of explanations refers to the wide expansion of large-scale extractive activities (Hilson, 2019). Since the 1980s, industrial mining operations have moved from their traditional core (North America, South Africa, Australia etc.) into a wide range of new mining destinations – precisely those extractive spaces with a significant presence of ASM (Bridge,

2004; Hilson, 2019; Hilson et al., 2020; Verbrugge and Geenen, 2020). As part of the structural reforms promoted by the World Bank, for example, many countries have continuously welcomed foreign direct investment (FDI) in their embryonic extractive industries (Bridge, 2004; Hilson et al., 2020; Verbrugge and Geenen, 2020). On the ground, this influx of FDI has led to a notable expansion of LSM concessions (Bridge, 2004; Hilson, 2019). In many countries, then, the formalisation of ASM has become a 'legislative afterthought', introduced long after LSM companies have monopolised access to mineral-rich lands (Hilson and Banchirigah, 2009). The release of large tracts of land, including farmlands, to large-scale mining entities has led to few employment opportunities in the rural economic space; informal ASM has thus become the only viable economic option (Banchirigah, 2006; Hilson and Yakovleva, 2007; Teschner, 2013). As large parcels of land have been long occupied by industrial mining operators, for ASM actors keen on securing permits, only very limited amounts of land that are geologically viable are available (Banchirigah, 2006; Hilson, 2019). This makes it more attractive for ASM operators to continue operating informally, specifically outside the legal framework (Aubynn, 2009; Hilson, 2019; Hilson et al., 2020).

Informality, however, means that ASM operations are conducted beyond the purview of governmental scrutiny and monitoring; indeed, they are highly unregulated (Adranyi et al., 2024; Siwale and Siwale, 2017). This has various consequences. Given the fleeting and inherently environmentally destructive nature of unregulated mining, informal ASM activities are known to have led to the contamination of water bodies in most mining communities (Martinez et al., 2018; Wagner, 2016). Biodiversity has been destroyed, vegetation has been removed, and soil resources have been depleted as a result of the activities of informal ASM operators (Bansah et al., 2016; Kitula, 2006; Macháček, 2019; Ofosu et al., 2020; Wagner, 2016).

Most operators have limited knowledge of work safety regulations, and workers do not use personal protective equipment (PPE) such as helmets, earplugs, masks, or gloves (Arthur-Holmes and Abrefa Busia, 2022a; Kyeremateng-Amoah and Clarke, 2015; Stemn et al., 2021). This summarises the low safety procedures for work at ASM operation sites (Bansah et al., 2016; Mantey et al., 2016). Also, managers of mine sites usually do not care much about labour concerns and transparency assessments in their operations (Verbrugge, 2015). Just like

operations in other sectors of the informal economy (Chen, 2012), there is an absence of employment contracts in the informal ASM sector, and employers almost single-handedly determine work benefits and wages (Arthur-Holmes et al., 2023a; Verbrugge, 2015). ASM workers are often employed as temporary workers, which means they are deprived of legal work-related benefits (Arthur-Holmes et al., 2023a; Verbrugge, 2015). These problems are compounded by long-term job insecurity, and workers' income-related dissatisfaction due to a lack of decent wages (Verbrugge, 2015). In this sense, formalisation has been expounded as the cure for the excesses of informal ASM, a discussion we now turn to.

Formalisation of ASM

According to Chen (2005), the formal economy comprises regulated economic units and protected workers. The associated formal regulatory framework consists of government regulations, policies, and laws, which are also key features of the formal sector (Chen, 2012, 2005). Formalisation is often conceptualised in academic works and policy circles as a process facilitating the development and movement of people and business entities from unregulated domains into more legally recognised and supported environments (Chen, 2012, 2005; Ofosu, 2023). Formalisation provides incentives and the enabling environment for people and other entrepreneurial operations to become legally-known (Chen, 2012, 2005). Often seen as the process of registering and organising business ventures, formalisation is meant to ensure that business entities and other associated operations are conducted within the legal framework of the state, in a legal and formal environment (Chen, 2012, 2005).

Thus, in ASM contexts, one of the key strategies usually deployed by many mining governance regimes to curb the socio-economic and environmental excesses of informal mining primarily hinges on the agenda of formalisation (Geenen, 2012; Hilson, 2020; Ofosu, 2023). Formalisation of ASM operations, just like other operations (Chen, 2005), entails legalisation, i.e., the observance and adherence to all the provisions and requirements contained in a minerals and mining code (Geenen, 2012; IGF, 2017b). Consistent with the explanations of Chen (2012, 2005), the ASM formalisation phenomenon is aimed at bringing illegal or informal ASM operations into the formal sector (Chen, 2012; Geenen, 2012; Hook, 2019; Martinez et al., 2021; Salo et al., 2016; Spiegel, 2015; Veiga and Marshall, 2019).

Advocates of the ASM formalisation strategy indicate that the best way to ensure socio-economic development is to bring operations into the legal domain (Hook, 2019; Siegel and

Veiga, 2009). According to Siegel and Veiga (2009), formalisation hinges on the fundamental view undergirding the *legalist* school of thought and the ideas of De Soto. In this regard, it has been observed that one of the disincentives for investment in ASM has been the absence of formal structures (Hook, 2019; Ofosu, 2023; Siegel and Veiga, 2009). Put differently, legal titles arising from formalisation mechanisms related to ASM operations would allow miners to access credit from formal financial arenas in order to improve their operations (Ofosu and Sarpong, 2022a; Ofosu, 2023; Siegel and Veiga, 2009). This way, ASM activities would be included in the formal market economy; ultimately, formal titles would lead to increments in wealth and the promotion of socio-economic and environmental growth, on both the macro and micro level (Geenen, 2012; Ofosu, 2023; Siegel and Veiga, 2009). In this sense, the ASM sector would be maximised for its environmental and socio-economic development potential (Geenen, 2012; Siegel and Veiga, 2009). In effect, economic progress, for example, in resource-endowed areas, is pillared on ASM operations being recognised as legal operations through licensing procedures (Geenen, 2012; Ofosu, 2023). Formalisation mechanisms would also ensure that ASM operators have formal, decent jobs and can operate peacefully without being pursued (Hilson, 2020; Jiménez et al., 2024). This would enable them to make investments in, for example, production, equipment and technology (Siegel and Veiga, 2009). The ability to work undisturbed would also allow miners to have consistent incomes (Jiménez et al., 2024). It would then mean that miners could operate in a secure, continuous manner without fearing that their machinery and equipment would be confiscated or destroyed, as has happened in many ASM swoops (Ofosu et al., 2024b; Spiegel, 2014). Formalisation would also help miners escape the phenomenon of becoming the victims of bribes and extortion from official circles (see, for example, Bansah, 2019; Geenen, 2012).

On the national level, the need for formalisation is premised on the policy framework of seeking to control the ASM environment in order to minimise the environmentally-related chaos and promote order and prosperity (Geenen, 2012; Ofosu, 2023; Siegel and Veiga, 2009; Siwale and Siwale, 2017). First, formalisation, it is argued, would enable the diversification of government incomes through the broadening of the tax net to include the taxing of various extractive operations, including ASM (Geenen, 2012; Ofosu, 2023; Siegel and Veiga, 2009). Second, mining governance regimes and international development agencies would be able to take hold of efficient intervention strategies—those that promote contact with miners, and

enable the collection of credible data to guide project development (Heemskerk, 2005; Ofosu, 2023). Third, rights and formalisation principles would not only bestow benefits on mining operators, but legal recognition would also impose obligations to conform to ethical, labour, and environmental standards (Ofosu et al., 2025a; Siegel and Veiga, 2009). Thus, in theory and practice, the state would receive benefits through the taxing of the ASM economy, while miners would benefit by receiving the collateral and security of tenure that enhances their credit score, as well as better technologies to overcome the challenges associated with their operations (Ofosu, 2023; Ribot and Peluso, 2003; Siegel and Veiga, 2009).

Formalisation challenges

Following on from the above, many mining governance regimes continue to pursue the formalisation instrument in many different spheres. The pursuit and implementation of the formalisation agenda, however, come with inherent challenges. As evinced by *legalist* proponents, formalisation processes can be costly and bureaucratically cumbersome (Chen, 2012; Geenen, 2012; Ofosu, 2023). The processes of formalisation and the facilitation of the same invariably requires money (Geenen, 2012). Thus, although formalisation is often considered a pillar of socio-economic advancement, it is subject to failure if individuals and business entities cannot afford the cost of joining the formalised economy (Siegel and Veiga, 2009). This is particularly the case for ASM, which is largely considered a low-production, labour-intensive, and 'poverty-driven' industry (Hilson, 2016, 2009; Siwale and Siwale, 2017). Indeed, many case-studies have demonstrated that, in some cases, the costs of formalisation policies in ASM have often exceeded the benefits (Banchirigah, 2008, 2006; Siegel and Veiga, 2009).

In addition, formalisation has been observed to be fraught with ineffective policies and bureaucratic inefficiencies. These include lots of paperwork, long waiting periods, and travelling distances to secure licences; there is also the case of bribery and extortion where corrupt mining officials seek to extort monies from miners before allowing them to register their operations (Aryee et al., 2003; Siwale and Siwale, 2017). According to Banchirigah (2008, 2006), bureaucratic inefficiencies have stifled the smooth running of the formalisation machinery, making informal activities more appealing. For Siwale and Siwale (2017), the complexity of formalisation regulations has dissuaded many ASM operators from attempting

to adhere to them. Also, in contexts where the agencies leading formalisation efforts are often weak and limited in capacity, formalisation has achieved only partial success (Siwale and Siwale, 2017).

A plethora of studies have shown that, apart from costs, a rigid implementation of formalisation mechanisms, while favouring others, can often disadvantage certain entities and groups (Fisher, 2007; Geenen, 2012; Hook, 2019). Some groups of people may not be able to acquire or access property within formalised systems (Hook, 2019). Elsewhere, in the case of Ghana, for example, Arthur-Holmes and Ofosu (2024) offer perspectives on the 'one small-scale' mining licence or one-size-fits-all formalisation system arguing that this is a problematic issue contributing to the informality of ASM operations and the failure of government interventions to halt informal mining activities. According to Banchirigah (2006), efforts made to bring ASM operators into the legal domain under formalisation mechanisms branded as 'reforms' have marginalised already impoverished miners. Along similar lines, Hook (2019) highlights that 'pre-existing inequality and exclusion have been effectively reinforced or legitimated by the state through the process of formalization'. Formalisation efforts are also known to rely on top-down, command-and-control approaches; such approaches not only disregard miners' lack of incentives to formalise but may even result in the criminalisation of ASM actors (Hilson, 2017). In some cases, formalisation has been paired with the violent repression of informal ASM, for example, in DR Congo (Geenen, 2012), Ghana (Hilson, 2017; Ofosu et al., 2024b), and Zimbabwe (Spiegel, 2014)

At this point, it is very important to note that despite the burgeoning calls for the formalisation of ASM operations, very few studies have empirically observed the outcomes when ASM operators become formalised (Martinez et al., 2021). It is, however, important to examine what these empirical works have found in order to determine how these findings can help reshape and refine policy and scholarly ideas about formalisation. It is thus important to ask the following questions: i) To date, how far have formalisation mechanisms succeeded in 'sanitising' the ASM sector? Are the theoretical and anecdotal arguments that formalisation could be the panacea to curbing the negative socio-economic and environmental excesses of informal ASM empirically real? The paragraphs below seek to answer these questions by examining case studies that have explored the 'optimal cases of formalisation' where miners

have been able to organise, have obtained legal titles to concessions and mining rights, and have become formal (Martinez et al., 2021; Ofosu and Sarpong, 2023). In this case, we examine the empirical findings of the following works: Botchwey et al. (2022), Martinez et al. (2021), Ofosu and Sarpong (2022a, 2023), Jiménez et al. (2024), Siwale and Siwale (2017), and Robles et al. (2022) under the following headings: environmental management performance, working conditions, health and safety, and access to credit.

Environmental management performance

As indicated throughout, the mining sector in general presents salient characteristics as a generator of significant environmental challenges in the territories affected by extractive operations (Jacka, 2018). ASM, being an extractive activity, invariably engenders environmental challenges (Ofosu et al., 2020). However, these environmental problems are exacerbated by the informal nature of most ASM operations (Siegel and Veiga, 2009). In other words, the environmental challenges associated with the sector are occasioned by the fact that the sector is highly unregulated and operates outside the legal domain (Geenen, 2012; Siegel and Veiga, 2009). But has formalisation solved the problem? To what extent have the assumed benefits of formalisation materialised?

Ofosu et al. (2022a, 2023), studying the operations of a formalised entity in the Eastern region of Ghana, found that indeed formalisation has been instrumental in ensuring good environmental management practices. The mining company (the case organisation) was labelled as 'champions' of reclamation and environmental management due to the fact that they had comprehensive policies that ensured the remediation/reclamation of the mined pits. Martinez et al. (2021) also observed (in Peru) that formalisation had helped address environmental concerns related to ASM operations. At the mine sites examined, there was evidence of the safe use and handling of mercury. In addition, the good environmental management practices included the construction of settling ponds where suspended solids in wastewater from mineral processing settled out, and the water was then recirculated and reused (see also Ofosu and Sarpong, 2022b).

Formal ASM operators in Colombia also adopted formal environmental practices, according to the environmental regulations, to manage the waste and impacts from their mining operations (Jiménez et al., 2024). The implementation of environmental management practices

included, for example, the construction and maintenance of nurseries, perimeter gutters, gabion walls, and special handling of solid and hazardous waste. This environmental management meant a significant transformation in the operational management for the formalised miners to reduce environmental impacts and prevent legal and environmental liabilities. With the construction of civil works and forest planting, formalised ASM managed to reduce and mitigate their operation's impacts (Jiménez et al., 2024).

Despite the positive outcomes highlighted in the paragraphs above, however, data gathered from formal small-scale mining operations in Ghana by Botchwey et al. (2022) suggest that formalisation may not be a panacea for improving environmental governance; the findings show that legal status is insufficient to guarantee good environmental governance. Based on a survey of legal/formal small-scale miners, the researchers observed a low level of environmental awareness, with most operators not adhering to proper environmental standards. Thus, monitoring and management by the authorities, the researchers claimed, are a prerequisite if formalisation is to achieve its aim of sanitising the ASM sector.

The critical need for the monitoring of formal ASM operations is also underscored by the findings of Ofosu et al. (2023) and Martinez et al. (2021). A critical reading of the studies reveals that monitoring and supervision catalyses good environmental management practices. Ofosu et al. (2023) observed during the research period that officers of the Minerals Commission (MC) of Ghana, the official government agency responsible for the regulation of the mining sector, visited the mine site on three different occasions. An officer of the MC revealed that they regularly monitored the company's activities to make sure its management systems were up to standard. The mining company was even doubly monitored since the large-scale mining company, on whose concessions the small-scale mining operator worked, also performed some monitoring functions. The good environmental management practices reported by Jiménez et al. (2024) were also made possible due to the fiduciary monitoring activities of a large-scale mining operation that had cooperation arrangements with the small-scale miners. Similar monitoring observations were made in Peru, with miners who had become formalised feeling more scrutinised than they did when they operated informally (Martinez et al., 2021).

Working conditions

In informal ASM settings, most workers are hired through verbal agreements and on a temporary basis (Arthur-Holmes et al., 2023a; Verbrugge, 2015). Hence, workers do not have access to non-wage benefits such as health insurance or fixed and regular salaries. Evidence from formal operations, however, shows that formalisation has been a catalyst for implementing good working conditions. Martinez et al. (2021) observed that miners were compensated for their work regardless of the grade of the material or the amount of gold produced. The formalised miners generally worked two, 4-h shifts per day, separated by an hour break, and employees were on the cooperative's payroll and received insurance and paid time off. They had set schedules, working 15 days followed by 15 days off.

Ofosu et al. (2022a) also observed similar practices, including the payment of regular salaries and the provision of work breaks. The formal mining company also provided well-structured apprenticeship programmes, and skills and training for employees. Refreshingly, retrenched workers were given compensation packages in accordance with labour regulations and practices associated with decent work (Ofosu and Sarpong, 2022a). Elsewhere in formal small-scale operations, miners held contracts with a fixed salary, health insurance, and legal bonuses, and practised safer mining, which translated into more secure places to work (Jiménez et al., 2024).

Robles et al. (2022), however, observed that the optimistic view of formalisation conceals how, at least in the domain of working conditions, formal mining may replicate rather than alleviate some of the challenges typically associated with informal mining. They highlighted that formalisation seemingly fails to address some of the structural disadvantages facing workers at the lower end of the labour hierarchy. Also, they found that workers have a clear preference for non-standardised forms of remuneration. Based on these observations, they argued that formalisation efforts need to take into account the needs and preferences of those involved and that these preferences do not always align with mainstream notions of decent work (Robles et al., 2022). Table 1 provides a summary of the formalisation outcomes as examined in this study.

[insert table 1 about here]

Study	Research context	Positive outcomes	Downsides
Ofosu et al. (2023, 2022)	Ghana	-improved environmental (land and water) performance - improved labour conditions - improved health and safety performance - access to credit	- low level of localisation of labour - low rate of female employees
Martinez et al. (2021)	Peru	- improved environmental performance - improved labour conditions - improved health and safety performance	- difficulty in accessing credit -inadequate governmental (technical) support
Robles et al. (2022)	Philippines	- improved health and safety performance	- poor labour conditions for low-end workers
Botchwey et al. (2022)	Ghana	- Good water management practices (washing ponds in accordance with government specifications)	- poor environmental management practices - low awareness of environmental management
Siwale and Siwale (2017)	Zambia	-	-difficulty in accessing credit -inadequate governmental support
Jiménez et al. (2024).	Colombia	- enhanced environmental performance - improved labour conditions - improved health and safety procedures -Provision of training for miners	-low rate of women participation

		including women miners	

Source: Authors own work

Health and safety

Generally, the informal ASM sector is associated with occupational injuries and hazards due to inadequate health and safety procedures and protocols at mine sites (Arthur-Holmes and Abrefa Busia, 2022a; Stemn et al., 2021). However, the findings of Ofosu et al. (2022a) and Martinez et al. (2021) present alternative images. Formalisation mechanisms had ensured improvements in health and safety practices and reduced accidents and fatalities. Robles et al. (2022) observed that 'at the tunnel entrance, there was a portal guard registering workers' entrance, making sure that everyone had a safety equipment' (p.5). The observations showed that, indeed, formalisation has positive impacts. It was observed that workers worked with the required PPE and that sufficient security was provided at mine sites. Due to formalisation requirements, the mine sites had implemented safety strategies to create a healthier and safer working environment (Martinez et al., 2021; Ofosu and Sarpong, 2022a). Similar observations were made in Colombia. For example, at the time of the fieldwork, the miners were implementing technical controls such as ground stability, ventilation, and health and safety (Jiménez et al., 2024).

According to Robles et al. (2022), formalisation had made significant contributions in relation to improvements in workers' safety; the type of tools and equipment that the formal operators provided to their workers, both at lower and higher ends, was far better than those observed in the informal workplace. Examples included proper safety suits (helmet, overalls, boots) and access to the depths of the tunnel using an elevator and concrete-filled steel tunnel structures; these were continuously monitored, assuring maintenance and quality. Also, workers were not exposed to hazardous substances like mercury or cyanide. However, while accident percentages at the formal operation were not alarming, the results suggested that a more careful attention to the working conditions for low-end workers was still needed. For example, while high-end workers were granted health insurance, the low-end workers, often

hired on an informal-temporary basis, received no such non-wage benefits (Robles et al., 2022).

Access to credit

Informal ASM operators are known to often face significant challenges to access the banking system and legally recognised financial assistance for their operations (Hilson and Ackah-Baidoo, 2011; Paschal et al., 2023). Hence, one of the key differences that is supposed to distinguish formalised ASM operators from their informal counterparts is their increased ability to access credit (Siwale and Siwale, 2017). Ofosu et al. (2022a) reported that a formalised mining firm in Ghana was able to access capital from the financial market using the mineralised concession as collateral. Evidence from Peru, however, indicates that it was difficult for the formalised operators to access capital and funds from formal financial institutions (Martinez et al., 2021). Similar evidence is also provided by the study of Siwale and Siwale (2017); their findings suggest that formalised miners had difficulty in accessing credit. However, this was because the formal operators did not have access to most of the economically-active mineral areas; the substantial amount of capital needed to set up an emerald mine also served as a big challenge. But would the miners have secured access to credit if they had economically-viable zones to provide as collateral? This question, and other questions which are worth exploring, are tackled later in the discussion and conclusion section.

For now, we settle on the suggestion by Martinez et al. (2021) that the difficulty for formal operators to access funds or obtain bank loans could be because of criminalisation and marginalisation. After so many years of criminalisation, it appears that financial institutions have not changed their mindsets to work with ASM operators (Martinez et al., 2021). Rather they continue to see ASM as a problem, and this affects how miners are treated and portrayed. According to Martinez et al. (2021), this difficulty highlights the disparities between the perceived benefits that it is purported miners are able to capitalise on and the actual benefits that ASM entrepreneurs sometimes truly receive from formalisation. This type of

misunderstanding and misalignment between the state and the ASM sector inhibits the success of formalisation efforts (Martinez et al., 2021). The lack of significant short-term gains also contributes to a general reluctance among miners to become formalised, as well as a lack of perceived benefits once they do become formal (Martinez et al., 2021).

In all, the evidence from the studies examined above shows that formalisation can engender improvements in health and safety practices and labour conditions at mine sites. Monitoring can mediate enhanced environmental management performance. However, even in the optimal cases where miners are able to organise and so obtain legal titles to concessions and mining rights and become formal, formalisation might not necessarily be the magic bullet to address all the challenges associated with ASM (Botchwey et al., 2022). Thus, there is a need for well-structured post-formalisation strategies (Martinez et al., 2023, 2021), which leads us to our discussion and conclusion section below.

Discussion and conclusion

The ASM sector globally continues to expand, with this expansion driven largely by economic crises and declining agricultural fortunes. The ASM sector is evident in almost all mineral-rich regions of the world, but it has a particularly notable presence in areas such as Africa, Asia, and Latin America (IGF, 2017b). The sector can generally be considered both a blessing and a curse, offering opportunities and risks in equal measure (Brunnschweiler et al., 2024). It is a blessing because it is not an enclave economy (as is large-scale mining); on the contrary, it provides employment to an unskilled labour force, it dynamises and diversifies local economies, and it improves livelihoods tangibly (Arthur-Holmes et al., 2023b; Arthur-Holmes and Abrefa Busia, 2020; Geenen, 2012; Hilson and Garforth, 2012).

However, in practice, the sector is characterised by high levels of environmental contamination, degradation, and exposure to health risks (Arthur-Holmes and Abrefa Busia, 2022a; Betancourt et al., 2005; Siaw et al., 2025; Tomicic et al., 2011). In this regard, many mining officials and policymakers continue to devise strategies as a way of seeking to bring 'sanity' to the sector. Numerous initiatives worldwide have been developed to address the challenges of the sector and support its socio-economic potential (IGF, 2017a). These initiatives are primarily developed in the context of ridding the sector of the challenges and fostering local development. Among others, these strategies primarily entail the formalisation of ASM

(Damonte, 2016; Geenen, 2012). For governments, formalisation strategies provide a platform to better govern and consequently manage the social and environmental impacts of ASM (Salo et al., 2016).

In this regard, it is beginning to be seen that formalisation seems to be achieving its desired objectives. Some formal ASM operators are undoubtedly irresponsible and uninterested in protecting the environment (Botchwey et al., 2022), but equally, there are others who comply fully with the legislation. The empirical studies are beginning to show that some formalised operations have better working practices and make use of cleaner technologies to process mineral ores, dramatically reducing their environmental impact (Jiménez et al., 2024; Martinez et al., 2021; Ofosu and Sarpong, 2023, 2022a). These responsible operations provide insights and offer hope that, contrary to the dominant narrative, small-scale miners can be good stewards of the environment and proper caretakers of mining communities.

However, the evidence also points to the reality that formalisation is a multifaceted project, the broad perspectives of which understand formalisation as a process during which the granting of formal titles is only the initial step in a wider intervention strategy (Siwale and Siwale, 2017). Relatedly, some policy discussions are worth exploring. Formalisation should ensure that policies are implemented, enforced, and monitored, and that ASM actors receive the technical, administrative, and financial support required to enable adherence to regulations (Martinez et al., 2023, 2021; Siwale and Siwale, 2017). Broader formalisation approaches call for bottom-up and decentralised measures that ensure ASM has positive impacts both on those involved in and those affected by the activity (Jiménez et al., 2024).

Formalisation depends on well-structured post formalisation programmes to help operators remain formal (Martinez et al., 2023); it requires an array of competent and efficient government agencies as well as streamlined coordination between them. Against the backdrop of the findings of Botchwey et al. (2022), for example, the agencies that oversee mining need to be formidable in a number of ways. They need to be able to properly monitor ASM operations, often in the regions where government machinery does not have a strong presence. Once miners are formalised, the regulatory agencies require the capacity to inspect mining sites for regulatory compliance, and to embark on phases of enforcing regulations (Botchwey et al., 2022; Martinez et al., 2021). Robust land remediation programmes are

necessary to restore mining degraded landscapes to help ecosystems re-flourish and to contribute to the socio-ecological development of mining communities.

Considering the empirical insights of Siwale and Siwale (2017) and Martinez et al. (2021), governments can help provide technical assistance and grants or credits to miners to cover the costs of operations and training processes, or can provide the funding required for financial institutions to do so. Robles et al.'s (2022) insights help us to understand that governments and policymakers should pay attention to the working conditions of low-end workers, while the refreshing perspectives of Ofosu and Sarpong (2023, 2022a) and Jiménez et al. (2024) call for formalisation processes to involve training in safety, environmental, and mining programmes.

Having touched on where we stand currently, it is also important to consider how research and policy discussions on ASM formalisation may proceed from here. It is essential to ask: what can a focus on ASM in formal spaces add to policy frameworks geared towards formalisation; From a policy perspective, how can a focus on formal ASM activities offer unique and (or) sustainable practices, strategies and regulations that can be tapped into for transitioning towards wider national and international formalisation efforts? In this vein, it is important to invite scholars to examine areas that could help generate a better understanding of the formal ASM sector so that future policies and regulations could be more applicable to miners' actual practices. First, as indicated earlier, the literature on formalised ASM seems to suggest miners experience difficulty in accessing credit (Martinez et al., 2021; Siwale and Siwale, 2017). Scholars could therefore help extend our understanding of recent developments in ASM formalisation and their impact on miners' access to credit and various types of working capital. It would be worth examining how the relationship between formal ASM operators and formal financial institutions play out; are formal operators able to secure funds from the capital market securely?

Moving on, it is beginning to emerge that the formalisation of ASM invariably comes with mechanisation (Martinez et al., 2021; Ofosu and Sarpong, 2023; Robles et al., 2022). Meanwhile, increased mechanisation undervalues and dislocates manual labour from the mines, particularly affecting women's roles in ASM, since their basic roles (carrying and washing) become eroded through capital-labour substitution mechanisms (Conteh and

Maconachie, 2021; Ofosu et al., 2024a, 2022). For example, in their field study in Colombia, Jimenez et al. (2024) highlighted that women's participation within formalised mining associations was low, with some of them performing administrative support and very few working in underground mining. Ofosu et al. (2022a) found that the number of female employees at the case organisation was very small (out of the 98 employees, only 5 were females). The women were engaged in roles as health assistant (1), cleaner (1), production member (1), receptionist (1), and secretary (1). However, although formalisation may negatively impact on women's roles, it may provide opportunities for the recruitment of more managerial administrative staff as well as professional and specialised hands including mining engineers, environmental engineers, health and safety engineers, topographers, accountants, managers, nurses, secretaries etc. Scholars should therefore examine these dynamics, with formalisation policies tying in with the training of women professionals in these areas.

Also, importantly, Jiménez et al. (2024) empirically examined some successful cohabitation arrangements between a formalised ASM and a large-scale mining (LSM) operation. However, the general cohabitation phenomenon so far explored in practice, and in the literature (especially in the sub-Saharan African context), has been known to be unsuccessful in the medium- and long-term (Aubynn, 2009; Hilson et al., 2007; Sauerwein, 2023; Teschner, 2013). This phenomenon is because the LSM companies have mostly had to deal with informal/unlicensed ASM operators (Aubynn, 2009; Hilson et al., 2007; Hilson and Yakovleva, 2007). Crucially, issues regarding formal/licensed ASM cohabitating or working on the concessions of LSM companies have not been thoroughly explored either in practice or in the literature (theory) (Ofosu et al., 2025b). This phenomenon seems new to the policy and scholarly discussions on the LSM-ASM interactions. As such, our understanding of how cooperation between formalised/licensed ASM and LSM can flourish and configure the mining landscape has remained incomplete. So far, studies have established that when LSM meets informal/ unlicensed ASM, the relationship becomes tenuous, often culminating in violent confrontations between ASM actors and LSM operators (Aubynn, 2009; Hilson and Yakovleva, 2007; Teschner, 2013). The critical question, then, is regarding what happens when formal/licensed ASM meets LSM. How are interactions and negotiations between LSM and formalised/licensed ASM formulated and manifested in practice? If working with artisanal-

informal miners has proven difficult (Aubynn, 2009; Hilson et al., 2020; Sauerwein, 2023), how about working with already formalised operators? Thus, to provide new and refreshing perspectives on the discussion on the cohabitation of LSM and ASM, transcend the preoccupation with ASM informality, and add to the gradually growing body of scholarship on formal ASM operations (see (Jiménez et al., 2024; Ofosu et al., 2025b, 2025a; Ofosu and Sarpong, 2022a), scholars and policymakers could help by providing case studies interrogating further the arrangements between formal ASM and LSM in different mining contexts and regions.

Also, in contrast with large-scale mines, ASM operations are known to serve as an avenue of employment for the vast majority of miners due to the fact that the entry barriers are low (Arthur-Holmes et al., 2022; Arthur-Holmes and Abrefa Busia, 2022b). However, the extant literature on the employment generation numbers is predominantly saturated with accounts from informal contexts, (see (Arthur-Holmes and Abrefa Busia, 2022b; Yakovleva, 2007), and while these contexts have provided invaluable insights in highlighting the 'good' in ASM in terms of employment generation, we hope that turning attention to contexts not particularly well represented in the literature would resolve the oversight. Further studies might therefore begin to focus on the employment generation numbers of formal ASM. Are they any different from those of informal operations? If so, why so?

Lastly, further studies could also help explore the linkages between formal ASM operations and local industries in mining communities. Additionally, the anecdotal evidence suggests that the formalisation of ASM operations can help provide governments with significant levels of funding through taxation of the industry. The empirical evidence is, however, missing. Scholars might therefore help fill this gap by providing evidence of how formal ASM operators are responding to government tax regimes.

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