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Becoming a friend of the foe: The evolving perspectives on the 'cohabitation' strategies of large-scale and artisanal and small-scale mining operations

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ABSTRACT

As mining governance regimes become far more welcoming to foreign investors, the dispossessed and disenchanted small-scale miners have staked their own claims to part of the mining wealth in the majority of mineral-rich regions across the globe. Alongside large-scale mineral extraction, there has been a proliferation of smaller mines operated by artisanal and small-scale mining (ASM) actors. The coexistence of all forms of mining – large and small, formal and informal – have often come at the cost of significant socio-economic and environmental impacts. Thus, the concept and the practice of 'cohabitation' and 'autonomy' have dominated the policy and scholarly discourse on large-scale mining (LSM) and ASM interactions for decades, with an upsurge in the amount of scholarly literature reporting on the conflictual relations. In this vein, we review the LSM-ASM research and integrate it with the stream of theoretical scholarship: the 'partnership' perspective. Our perspective holds that the failure of past cohabitation arrangements, particularly in sub-Saharan Africa, can be attributed to i) legitimacy and legality issues, ii) a focus on containment over collaboration, and iii) environmental remediation oversights. LSM companies often have to negotiate with informal or unlicensed ASM operators. Consequently, cohabitation agreements frequently overlook the legitimacy and legality of these arrangements, resulting in a lack of legally binding contracts. Hence, of critical importance, attention to 'partnership' principles, encapsulating among other things, attention to LSM economic-related interests, and ASM environmental-remediation obligations could help both scales and types of mining partner to flourish together. Our work has important implications for research and policy decisions on the mining landscape and suggests important directions for the practice of both LSM and ASM.

1. Introduction

Extractive industries in general and artisanal and small-scale mining (ASM) projects in particular have grown exponentially, fuelled by resource-seeking economies and rising poverty, particularly in sub-Saharan Africa and Latin America, where mineral resources abound (Gilfoy, 2022; World Bank, 2009). While many governments and pro-industry activists have been quick to herald investment numbers, the local realities and 'cohabitation' arrangements between large-scale mining (LSM) operators and ASM actors have been anything but harmonious (Aubynn, 2009; World Bank, 2009). Across many mineral-rich regions, as LSM corporations have taken up more and more concessions, protests and violence have flared up around productive mining sites (Hilson et al., 2020; Kemp & Owen, 2019).

As LSM is growing worldwide, the probability of it clashing with ASM is also increasing. As a result of their simultaneous expansion in recent years, LSM operations and ASM activities increasingly share the mining landscape, and interact in most resource-rich areas (Verbrugge & Geenen, 2019; World Bank, 2009; Yakovleva & Vazquez-Brust, 2018). Obviously, the resource-rich concessions LSM extractors seek to develop and exploit are also of economic interest to other mining operators, prime among them, ASM parties (Patel et al., 2016; Verbrugge & Geenen, 2019). Thus, ASM and LSM operations usually interact at the both physical and the economic level in situations where they are in close

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proximity (Cano & Kunz, 2022; Kemp & Owen, 2019), significantly increasing the opportunities for a peaceful coexistence/cohabitation, as well as the probability for conflict (Libassi, 2022; Rodríguez-Novoa & Holley, 2023). Both LSM and ASM are known to be attracted by the presence of the other. From the perspective of LSM operators, the presence of small-scale, artisanal mining activities at particular areas can be a positive signal; LSM mostly consider ASM actors to be 'valued pathfinders' – the leaders of the way to healthy, mineral-rich ores (Luning, 2014). In a similar vein, where LSM activities usually take place in the vicinity of traditional small-scale mining sites, ASM can be attracted to LSM sites where excavated ground or tailings provide rich access to mineralised ores (Kemp & Owen, 2019). Paradoxically, however, these forms of attraction and 'cohabitation' often become the same forms of antagonism between the operations with land encroachment issues becoming the centre of controversy between the two parties (Kemp & Owen, 2019; World Bank, 2009).

Generally defined, LSM activities are capital-intensive, formal mineral extraction operations often performed by companies or associations with more efficient means of production (Kemp & Owen, 2019; Sidorenko et al., 2020). Embedded in global capital markets, the operations are typically associated with multi-national companies (Hilson et al., 2020; Kemp & Owen, 2019). In contrast, ASM is broadly defined as labour-intensive mineral extraction activities with limited capital investments using basic tools and manual devices where miners work individually or in small groups, sometimes on a seasonal and subsistence basis (Ferring et al., 2016; Sidorenko et al., 2020). However, in recent times, ASM operations are becoming highly mechanised, underpinned by the support of commercial business entities (Ofosu & Sarpong, 2022; Sidorenko et al., 2020; Verbrugge, 2015). In this regard, ASM, according to IGF (2017a), can be defined as a complex and diversified sector that ranges from poor informal individual miners seeking to eke out or supplement a subsistence livelihood to small-scale formal commercial mining activities that can produce minerals in a responsible way, respecting local laws.

The presence of informal ASM operators within concession areas often generates conflicts with LSM title holders (Güiza-Suárez & Kaufmann, 2024). A common behaviour observed worldwide is the LSM companies insisting on the exclusivity of their 'concessions and legally acquired rights' and therefore seeing the ASM operators as 'invaders' (Güiza-Suárez & Kaufmann, 2024; Yakovleva & Vazquez-Brust, 2018). On the other hand, ASM operators perceive their activities as traditional (Aubynn, 2009; Tarra et al., 2022; Yakovleva & Vazquez-Brust, 2018). To minimise conflicts and ensure cooperation among LSM and ASM interests, scholars, governments, and other policymakers have advocated for, and sought to negotiate, mining cohabitation schemes, what is sometimes referred to as 'cooperation' (Veiga et al., 2022; World Bank, 2009; Yakovleva & Vazquez-Brust, 2018). These negotiated schemes fundamentally entail, among other things, LSM companies allowing ASM operators to work in specific areas of titled mining concessions on the condition that they minimise access to the area and control incursions into leased sites (Veiga et al., 2022; World Bank, 2009). This move from confrontation to cooperation often starts at the operational level; following failures to enforce the exclusion of informal ASM actors through public policy intervention, LSMs have started to adopt a co-management governance solution with ASM operators (Aubynn, 2009; Yakovleva & Vazquez-Brust, 2018). In this way, LSM companies cooperate directly with informal miners and cohabitate on the same concessions, allowing them to mine in selected areas (Yakovleva & Vazquez-Brust, 2018).

According to some scholars and policy analysts, if properly executed, mining cohabitation programmes, whereby LSM operators cede considerable portions of mineralised areas to ASM actors, as exemplified by Jiménez et al. (2024), for example, can become an important way to counteract criminalisation and defend the legitimacy of traditional ASM livelihoods and the many socio-economic functions they provide in settings with a long history of mineral production (Güiza-Suárez & Kaufmann, 2024; Yakovleva & Vazquez-Brust, 2018). However, some scholars have argued that in Africa, for example, the context of the mining frontier, replete with mergers and acquisitions, provides a very fragile and unsustainable foundation for cohabitation (Hilson et al., 2020; Sauerwein, 2023); the idea of cohabitation between LSM and ASM as a development strategy is short-sighted and untenable (Camba, 2021; Hilson et al., 2020). According to Hilson et al. (2020), the fluctuating prices of mining commodities (which would always mean that LSM companies take back concessions in times of higher prices) would always have crippling consequences for ASM operations, who are the weaker party in the cohabitation phenomenon.

According to similar arguments, cohabitation arrangements are deliberate policy positions that prioritize the interests of LSM actors and that are operationalized through cohabitation contracts; in this regard, an important factor that reinforces a 'large-scale mining bias' in mining cohabitation is that the terms are often defined at company headquarters, thus significantly limiting the participation of ASM actors in decision-making processes (Hilson et al., 2020; Sauerwein, 2023). Given these uncertainties, it is suggested that host governments and policy-making promote the *autonomous* coexistence of both parties; in this regard allowing the overlap of land titles between ASM and exploration permits, as well as reducing the size of exploration permits for LSM would be an approach that would yield maximum economic returns (Hilson et al., 2020; Hilson, 2019; Sauerwein, 2023).

Despite the burgeoning academic and policy interest in the LSM-ASM cohabitation phenomenon in recent years, some questions remain unanswered regarding why the cohabitation arrangements fail in the medium to long term. Hence, in seeking to provide a narrative review of the literature studying recent experiences regarding the typical LSM-ASM interactive dynamics, this study also seeks to answer the following question: Can formalised ASM and LSM 'partner' and flourish together? Our perspective holds that the failure of past cohabitation arrangements, especially in sub-Saharan Africa, can be attributed to several issues:

1. Legitimacy and Legality Issues: LSM companies often have to negotiate with informal or unlicensed ASM operators. Consequently, cohabitation agreements frequently overlook the legitimacy and legality of these arrangements, resulting in a lack of legally binding contracts (Aubynn, 2009; Hilson & Yakovleva, 2007).
2. Focus on Containment Over Collaboration: The primary benefit for LSM companies in these agreements is often the containment of informal ASM operators, whose operations could otherwise be detrimental to LSM activities. This leads to a policy focus on preventing social conflicts rather than fostering genuine economic collaboration and revenue-sharing (see for example, Teschner, 2013).
3. Environmental Remediation Oversights: The agreements typically do not address environmental remediation obligations for ASM actors operating within LSM concessions. This neglect can lead to environmental degradation, further straining the relationship between LSM and ASM.

Here we note that in recent times, our understanding of ASM is evolving from purely informal artisanal to formal small-scale operations (Martinez et al., 2021; Ofosu and Sarpong, 2023, 2022; Ofosu, Arthur-Holmes, & Siaw, 2025a). Thus, our understanding of innovative policies and the design of flexible policy interventions should also continuously evolve. This therefore calls for a renewal of the thinking about policies to identify potential fertile areas for the design and implementation of new/modern policies that fit the current and emerging LSM-ASM cohabitation phenomenon. In view of this, in this study, we integrate the 'partnership' lens with the LSM-ASM scholarship to propose a framework where economic interests and environmental obligations are prioritised in LSM-ASM engagements – LSM companies become economic beneficiaries (through revenue-sharing mechanisms)

while ASM operators become champions of environmental remediation (through environmental obligation principles).

2. Friends or foes: the LSM-ASM cohabitation/coexistence phenomenon

The literature on extractive industries has witnessed a significant increase in the amount of research advancing the LSM-ASM cohabitation/coexistence conundrum. The literature recognises the mounting contestations and the growing need to find sustainable solutions to the competition for land areas between LSM companies and ASM operators, as LSM/ASM companies increasingly come across ASM/LSM workers during their exploration or production activities (Andrew, 2003; Bainton et al., 2020; Güiza-Suárez & Kaufmann, 2024; Holley et al., 2020; Katz-Lavigne, 2019; Lahiri-Dutt et al., 2021; Rosales, 2019; Verbrugge, 2017; Yakovleva & Vazquez-Brust, 2018; Yankson & Gough, 2019). The relationship is often conflictual because both types of mining activities compete for the same resource or because each perceives the other as a threat (Aubynn, 2009; Kemp & Owen, 2019; Libassi, 2022; World Bank, 2009).

Despite the conflicting relationships, however, both entities realise that a harmonious relationship is extremely important if both parties are to maximise their contributions to the economy and livelihoods of the operational areas (World Bank, 2009). Hence, most LSM companies have come to realise that despite ASM being technically illegal, in order to maintain cordial relationships with ASM communities, they have to tolerate ASM actors working on their concessions (Aubynn, 2009; Tarra et al., 2022). Thus, although conflictual, evidence of amicable and tolerating relationships between both mining entities has been noted; trade arrangements in relation to tailings between the two mining entities exist (Bansah et al., 2018; Veiga et al., 2022). Purchase agreements between the two entities have also been observed elsewhere (Deberdt, 2022; World Bank, 2009, p. 17). Tolerated ASM activities at LSM sites are not uncommon (Aubynn, 2009; Geenen & Verweijen, 2017). In Colombia and other regions, arrangements by LSM companies to purchase the produce of ASM operators have been observed (Veiga et al., 2022).

However, as noted earlier, basically, ASM operators tend to maintain a feeling of injustice over obstacles such as the inadequacy or complete lack of mineral-rich areas on which to operate (Libassi, 2022). This is because public policy has long ignored the realities of ASM communities, where poverty-stricken communities seeking productive employment and income earning opportunities have been driven to ASM (Hilson & Garforth, 2013). Policymakers have insisted that informal miners should be excluded from accessing mineral resources and from the design of policy interventions (Banchirigah, 2006; Bester & Groenewald, 2021). Additionally, ASM communities and operators are usually not properly consulted or informed about LSM plans to undertake production activities in a particular area (Banchirigah, 2006). The lack of consultation and communication usually generates tensions and an attitude of resistance, especially when there is the fear that access to a traditional mineral/natural resource would be lost (World Bank, 2009). Government officials might step in to provide the information required and settle disagreements (Güiza-Suárez & Kaufmann, 2024). However, informal ASM operators have little to no trust in the government system (ASM actors generally believe that the government systems are biased in favour of a large-scale investment) (Hilson et al., 2020; World Bank, 2009). Table 1 provides a summary of some of the prevailing conditions underpinning the LSM-ASM conflicts.

Although LSM companies may actually sometimes be interested to exploit resources that are not accessible to ASM for technology or other reasons, ASM communities still consider LSM as a threat because of, for example, the set-up of necessary security or safety constraints within the area, or, more broadly, because of the overall changes caused by the mine with respect to socio-economic conditions and local markets (World Bank, 2009). In same vein, ASM operators might be interested in exploiting resources that may be of little to no interest to LSM companies. However, LSM companies may reject the operations on the grounds of security and environmental threats (World Bank, 2009).

Table 1
Prevailing underlying conditions fuelling the LSM-ASM conflicts.

LSM	ASM
Possess legal mining titles and therefore own the mining concession rightfully	Possess traditional rights to access and mine resources on traditional lands even without legal certificates
Contribute to macro-economic development through the payment of royalties and taxes	Contribute to subsistence and local community development
Have the support of national governments and international policymakers, including the media	Have local support from traditional authorities, local residents and local administrators
Possess the power to engage national security forces and police to protect mining concessions	Can organise local miners to protest and agitate against large-scale mining operations

Also, worryingly, ASM operations, which usually target alluvial deposits situated at or near the land surface, do not pay much attention to land remediation/reclamation practices (Mantey et al., 2017, 2016). This undoubtedly renders successive land use operations impossible; degraded lands may pose significant challenges for LSM operators who might be interested in mining subsurface or hard rock ores in concession sites. Relatedly, ASM is often highly informal; thus, formal LSM operators seeking global capital investments would not want to partner with ASM operations, which could imply the promotion of illegality. These cases have been generally reported in many resource-abundant settings such as Indonesia (Libassi, 2022), Ghana (Hilson & Yakovleva, 2007; Okoh, 2014), Tanzania (Pedersen et al., 2019), and the DRC (Geenen & Claessens, 2013; Geenen, 2014). Highlighting one of the LSM-ASM conflicting situations, for example, Yankson and Gough (2019) explicate how the loss of employment opportunities, due to capital-labour substitution mechanisms, and a shift from underground to surface mining in LSM led to a proliferation of ASM activities. The LSM operators, however, could not tolerate the proliferation of the coexisting ASM, leading to significant conflicts.

In many places, ASM operations have been displaced from the mineral-rich zones to make way for the setting up of LSM projects (Geenen, 2014; Kemp & Owen, 2019). Releasing vast concessions for the construction of industrial scale mining projects is, however, detrimental to ASM activities; the growth of LSM projects means a decline in ASM activities, thus leading to fewer employment opportunities in the rural economic space (Andrews, 2015; Geenen, 2014). Contesting their marginalisation, ASM operators continuously encroach on to the leased concessions of LSM operators, which, in turn, leads to conflicts (Aubynn, 2009). In this vein, small-scale, artisanal miners are often provided with alternative mining locations; however, these sites are usually not as productive or appropriate for mining as were previous mining sites (Hilson & Yakovleva, 2007; Hilson, Yakovleva, & Banchirigah, 2007). In some cases, alternative economic programmes are offered, but, again, these might not be as productive as ASM (Hilson & Banchirigah, 2009; Hilson & Yakovleva, 2007). Within these contexts, miners have often found ways to contest what they perceive to be the dispossession of their collective mining and livelihood rights by, for example, seeking justice through illegal/informal mining (Andrews, 2015), which sometimes includes 'clandestine' mining on concessions of LSM operators (Katz-Lavigne, 2020; Libassi, 2022). As the state has granted the LSM operator exclusive rights to extract minerals, public and private security firms are usually empowered to apprehend trespassers and remove them from the mining area (Aubynn, 2009).

These conflicting cohabitation/coexistence situations continue to ignite debates on LSM-ASM interactions. Divided between 'cohabitation' and 'autonomy', arguments for the former contend that policymaking needs to help ASM and LSM cooperate and work together (Jiménez et al., 2024; Ofosu et al., 2025b). As observed by Yakovleva

and Vazquez-Brust (2018), cooperation would help address developmental challenges and would also ensure the survival of foreign investment in countries where informal rules regulating mining activities are prevalent. However, proponents of 'autonomy' suggest that states need to institute different policy frameworks, goals, and organisations for autonomous developments in ASM (Hilson et al., 2020). Hilson et al. (2020), especially, are more sceptical of cohabitation arrangements, arguing that even when cooperation is possible, these partnerships are only optimal under an exceptional set of circumstances and sustainable for a finite period (Sauerwein, 2023). For example, the relationship between ASM and LSM is subject to significant changes throughout the mining cycle (Hilson et al., 2020; Kemp & Owen, 2019). During the exploration phase, junior/young LSM companies might tolerate ASM-operators, or might even use them as 'pathfinders' providing 'exploration info' (Luning, 2014). However, at the production stage, mining companies may, at best, opt to put up with ASM operators only in marginal parts of their concession or might try to evict them altogether (Hilson et al., 2020).

Hilson et al. (2020) identify two main problematic trends that make cooperation untenable either in the short or long term: fluctuating prices of mining commodities and the frequent merger and acquisition of LSM companies. With regard to their analysis, LSM-ASM cooperation appears palatable to LSM companies when prices of mineral commodities are low. Under such conditions, it may not be economically prudent for companies to access the less valuable areas of their concessions, which they can leave for ASM; however, when the price increases, profit maximisation may encourage them to evict ASM operators. The merger of different companies and changes in mine site ownership undermine agreements and reduce trust between different actors. For these reasons, a model of 'autonomous co-existence' is proposed in which ASM operators receive support through policy reform and access to mineralised areas such that they operate in separate arenas from LSM (Hilson et al., 2020).

What all these studies share is a near-universal agreement that the LSM-ASM interactions are fraught with problems, primarily access to and control over mineralised lands. And with the mining-regulatory framework becoming more welcoming to LSM arrangements, ASM would inevitably be the losing partner. A reading of these studies also reveals a certain particularity – a focus on informal ASM. Thus, we examine ASM's informality in order to contextualise the other discussions that follow.

3. Cohabitation with whom? Only informality?

3.1. ASM informality

The ASM frontier continues to advance in many resource-rich countries with reports describing the operations as one of the most important rural non-farm activities in the developing world (World Bank, 2019). The expansion of the operations, among other factors, has been attributed to rising economic hardships in rural spaces and the 'agricultural poverty' syndrome (Arthur-Holmes et al., 2022; Hilson & Garforth, 2013).

ASM is an avenue of employment for most inhabitants in mineral-rich areas (Arthur-Holmes et al., 2022; Ofosu et al., 2020). Despite the positive attributes, the sector has often been highlighted as an enemy of the environment (Arthur-Holmes & Abrefa Busia, 2022; Cordy et al., 2011; Ofosu, 2023; Wagner, 2016). This is, however, not surprising considering that ASM operators are known to have little or no regard for environmental and safety mechanisms (Arthur-Holmes & Abrefa Busia, 2022; Mantey, Nyarko, & Owusu-Nimo, 2016). Indeed, increased ASM activities have resulted in the destruction of farmlands and a reduction in agricultural productivity (Boadi et al., 2016; Donkor et al., 2024; Obodai et al., 2024; Siaw et al., 2025, 2023). Degraded pits are usually left uncovered, thus posing a danger to human and animal life (Mantey et al., 2017, 2016).

With regard to health and safety issues, Arthur-Holmes and Abrefa Busia (2022) provide evidence highlighting the very serious occupational health hazards and safety concerns at a typical ASM site in Ghana. The evidence includes a lack of regulations and guidelines regarding safety protocols at mine sites, non-usage of PPE, odd working hours, and poor physical conditions at mine sites. Other findings include the creation of risky and dangerous pits within the abandoned open mine pits of LSM companies, the carrying of mineralised materials in head pans, and the lack of childcare support at the ASM site (Arthur-Holmes & Abrefa Busia, 2022).

Very important to our discussions in this section is the astronomically high rate of informality surrounding the sector. It has been noted that although minerals and mining laws in mineral-endowed countries require ASM operators to be licensed and their operations regulated, the vast majority of ASM actors, worldwide, operate informally without the security of a licence (McQuilken & Hilson, 2016; Ofosu, 2023; Veiga & Marshall, 2019). Globally, it is estimated that over 80–90 % of ASM operations are informal (IGF, 2017b; Wagner, 2016). In the Latin American region, the estimation indicates that less than 1 % of ASM operators in the region are formalised (Veiga & Fadina, 2020; Veiga & Marshall, 2019). In Ghana, a globally renowned ASM jurisdiction in Africa, informal mining, prior to its ban in 2017 (Eduful et al., 2020; Ofosu et al., 2024), and even at present (Ayelazuno & Aziabah, 2023), is worryingly widespread. Teschner (2013) perfectly captured the problem at hand: 'In fact, illegal mining is so public that the casual observer may not believe it could possibly be illegal' (p. 312).

This is the current ASM situation (regarding the high rates of informality), and this is what most LSM companies have had to deal with in their operations, especially in sub-Saharan Africa and Latin America.

3.2. Cohabitation of LSM companies with informal ASM operations

Some studies have empirically examined the cohabitation arrangements between LSM and ASM (Aubynn, 2009; Jiménez et al., 2024; Ofosu et al., 2025b; Teschner, 2013). Although there are empirical reports of some successful cohabitation arrangements in parts of the Latin American region (Jiménez et al., 2024; Tarra et al., 2022; Veiga et al., 2022), 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, Yakovleva, & Banchirigah, 2007; Sauerwein, 2023; Teschner, 2013). This phenomenon, according to our extensive reading of the literature and to our understanding, is because the LSM companies have mostly had to deal with informal/unlicensed ASM operators (Aubynn, 2009; Hilson & Yakovleva, 2007; Ofosu et al., 2025b). Legitimacy and legality arrangements are usually not addressed in the cohabitation agreements and nor are revenue-sharing arrangements and environmental obligations (Ofosu et al., 2025b). In the agreements, the main benefits to the LSM companies are usually encapsulated in the containment of informal ASM operators whose operations would otherwise be detrimental to the operations of the LSM companies (Ofosu et al., 2025b). The cohabitation arrangements are usually enacted as a conflict-prevention measure but have succeeded only in providing short-term responses to mitigate tensions between LSM and ASM parties (Sauerwein, 2023).

Examples abound in the literature where in Prestea (Ghana), for example, Golden Star Resources had to coexist with informal mining operators (*galamsey*) on their concessions (Hilson & Yakovleva, 2007; Hilson, Yakovleva, & Banchirigah, 2007). Similarly, Abosso Goldfields Limited had to accommodate informal ASM operators on its concessions in Tarkwa in the Western Region. Also, the interaction between Gold Fields Ghana and ASM touched on issues with informal ASM operators (Teschner, 2013). Similar situations are highlighted by Yakovleva and Vazquez-Brust (2018). In other parts of the sub-Saharan Africa region, similar findings confirm interactions between LSM companies and informal ASM operators in Cote d'Ivoire (Sauerwein, 2023).

Crucially, formal/licensed ASM cohabitating with or working on the concessions of LSM companies has not been thoroughly explored either in practice or in the literature (theory) (Ofosu et al., 2025b). Furthermore, questions around revenue-sharing arrangements, and environmental remediation obligations on the part of ASM actors have not been addressed (Ofosu et al., 2025b). These phenomena seem new to the policy and scholarly discussions on 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, as earlier stated, 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 & Yakovleva, 2007; Teschner, 2013). The critical question (and one that has been left unexamined), then, is what happens when formal/licensed ASM meets LSM. How are interactions and negotiations between LSM and formalised/licensed ASM formulated and manifested in practice (Ofosu et al., 2025b)? If working with artisanal-informal miners has proven difficult (Aubynn, 2009; Sauerwein, 2023), how about working with already formalised operators (Jiménez et al., 2024; Ofosu et al., 2025b)?

Not surprisingly, also, due to the high rates of informality of ASM operations, the LSM-ASM contestations have often been viewed through conceptual frameworks such as resource conflicts and grievance (Okoh, 2014), access, displacement and resistance (Geenen, 2014), subjectivities (Libassi, 2022) etc. More worrisome is that the usually proposed cohabitation arrangements fail to address issues such as legitimacy, trust, environmental-remediation obligations, economic benefits, and revenue-sharing arrangements. For example, if LSM operators cede portions of their concessions to ASM actors, what should be the economic benefits to the LSM companies (Ofosu et al., 2025b)? Should there not be arrangements for the LSM companies to share in the production and revenues accruing from the operations on their concessions (Ofosu et al., 2025b)? How should post-mining environmental reclamation arrangements be approached and who should be obligated to undertake such activities? Should ASM operators be allowed to keep informal labour arrangements with their employees in contrast to the labour arrangements of LSM operators seeking legitimacy in the eyes of investors (Jiménez et al., 2024; Ofosu et al., 2025b)? We strongly believe that these are questions governments, LSM and ASM companies, and policymakers ought to address in seeking to find sustainable solutions to the LSM-ASM conundrum.

Thus, to provide new and refreshing perspectives on the discussion on the cohabitation of LSM and ASM, and to transcend the preoccupation with informality, here we seek to address these issues through the lens of 'partnership', proposing a framework where LSM companies become economic beneficiaries (through revenue-sharing mechanisms) while ASM operators become champions of environmental remediation (through environmental remediation obligation principles). Before the proposition, however, in the paragraphs that follow, we examine through our theoretical lens the concept and practice of partnerships.

4. The concept and practice of partnerships

The practice of 'partnerships' is widely known to play pivotal roles in tackling pressing socio-economic and environmental issues (Lee, 2011). Hence, partnership approaches continue to receive widespread support from across the socio-political spectrum, including policymakers, officials, and local communities (Knoben & Bakker, 2019; Lee, 2011; McQuaid, 2000; Ofosu et al., 2025b; Sarpong & Davies, 2014). However, the term 'partnership' covers greatly differing concepts and practices and is used to describe a wide variety of types of relationship in a myriad of circumstances and locations (McQuaid, 2000; Moss et al., 2022). Basically, partnership involves co-operation or collaboration, i.e., 'to work or act together' for mutual benefit (Holland, 2017; Moss et al., 2022). Bennett and Krebs (1994) define partnership as co-operation between actors where they agree to work together towards a specified economic development objective. According to Harding (1998), one type of partnership, i.e., 'private–public partnership', can be construed as any action that is based on the agreement of stakeholders in the public and private spheres and which also contributes in some way to the improvement of an economy or the quality of life (Hodge & Greve, 2017). Elsewhere, partnerships are defined as relationships that are formed largely to address common-interest social issues and causes (Lee, 2011). These relationships engage the partners on an ongoing basis and are often strongly project-oriented (Googins & Rochlin, 2000).

Partnerships are usually constructed in the context of collaborative agreements with the shared commitment of resources to achieve the mutually agreed aims of a number of partners; all contributors commit resources to the collaboration and mutually determine its objectives (Brink, 2017; Lee, 2011). Crucial to the success or otherwise of a partnership is a high level of trust. This can be exemplified as in the view of partnership as a marriage; it develops over time but is undergirded by mutual trust and a belief in the positive gains for both partners (Knoben & Bakker, 2019; Moss et al., 2022; Zhang & Gu, 2021).

Generally, most relationships in partnerships are constructed in formal domain structures ranging from formal, legally-binding contracts to unenforceable public agreements or general agreements to co-operate (Hodge & Greve, 2017). Formal partnerships generally include specific objectives and mechanisms. More rigid sets of formal partnerships are usually based upon legally-binding contracts, particularly where there are direct commercial transactions (McQuaid, 2000, 2010; Ofosu et al., 2025b; Zhang & Gu, 2021). In many cases, partnerships are moving towards a legal basis with legal contracts tying partners to specific inputs and actions. However, there are dangers with this mechanism or approach. The 'contract culture' phenomenon has been known to often lead to a 'bureaucratic paperchase' and may reduce voluntary co-operation or decrease the speed with which projects are executed (McQuaid, 2000).

But why do individuals, businesses, communities, and organisations collaborate in partnership relationships? The following paragraphs review the various motivations and benefits for partnerships, as discussed in the literature.

4.1. Motives and benefits of partnerships

The 'win-win' potential of partnerships draws extensively on efficiency arguments – maintaining that organisations or different stakeholders working in partnership can combine complementary resources and expertise, access broader networks, and share good practice in order to accomplish specific tasks (Lee, 2011). These synergistic benefits constitute what is termed 'collaborative advantage' (Huxham, 1996), or what Nelson and Zadek (2000) call 'partnership alchemy' – outcomes not possible if organisations or different stakeholders work independently. According to Polenske (2012), partnership or collaboration arrangements can lead to internal economies of scale, affecting the position of the firm on its long-term average cost curve. In other words, by collaborating, e.g., on the production of a product, two or more firms can lower their adaption costs in the long run. Also, one of the basic advantages of partnership is the potential to achieve a synergy of some form so that projects can benefit each partner or the broader community, and thus 'the sum is greater than the parts' (McQuaid, 2000; Moss et al., 2022; Zhang & Gu, 2021). According to Eshel and Shaked (2001), individuals would seek to become partners when it is in their best interest to help each other, if by doing so they increase the probability of being together in the future when, for similar reasons, they will continue to help each other.

Continued or greater involvement in partnership approaches can be due to pragmatic factors such as resource constraints (McQuaid, 2010, 2000). These factors include a belief in the overall advantages of a partnership approach and a recognition that any one stakeholder often does not have all the competencies or resources to deal with the interconnected issues raised in many policy areas (McQuaid, 2000).

Accordingly, one of the main reasons for entering into a partnership may be to gain extra resources by joining various types of resources in order to transform one or more of the partner organisations (Hodge & Greve, 2017). This may include allowing one or more of the partners to act more entrepreneurially through loosening some constraints or impediments and introducing new, efficient, and effective ways of operating (McQuaid, 2000; Moss et al., 2022).

Additionally, a partnership may help to manipulate one of the partners to support various or diverse activities or to overcome local opposition in relation to the implementation of certain community-sensitive projects (Moss et al., 2022). In addition to alleviating social problems, Lee (2011) highlights that business-community partnerships can provide partner-specific benefits; these include obtaining a competitive advantage, building trust in communities, managing external perceptions by enhancing public reputation, and increasing attractiveness to prospective employees among others.

In the study of partnership collaboration between large-scale and small and medium-scale enterprises (SMEs), Brink (2017) explicates the notion of partner-driven cooperation. Here it is explained that the notion of innovation collaboration enforces a need for long-term collaboration from both larger enterprises and from SME suppliers simultaneously (Brink, 2017). This is said in other terms to be the utilisation of new opportunities, where firms persistently engage in joint projects. This emphasises the need for persistent collaboration between equal partners, where both parties are interested and possess valuable knowledge and capabilities for value creation in collaboration. This in the following is called 'partner-driven' collaboration (Brink, 2017). In such collaborations, both parties contribute to integrative adaptations regarding the search for solutions to a particular challenge. In many situations, the technical specialised SME suppliers possess more thorough application knowledge and practical experience on specific business tasks (Brink, 2017). Thus, the SME suppliers and the larger enterprises can together contribute to the innovation and competitive advantage of projects; the key issue is the development of an efficient and effective collaboration (Brink, 2017).

These partnership situations and practices can be applied in LSM-ASM partnership arrangements where the ASM firms can utilise their specialised knowledge on the workings of for example alluvial mining deposits or other mineral ores amenable to small-scale mining. We examine these in detail in the paragraphs that follow.

5. Becoming friends through partnership: proposing LSM-ASM partnership arrangements

Important to our discussions in this study is the fact that partnerships help achieve some substantive or symbolic goals that no partner could achieve independently (Harding, 1998; Lee, 2011; Peters, 1998). Hence, in addition to tackling pressing community issues, the case for partnerships argues that bringing together unique and complementary resources can benefit the various participants in the collaboration (Lee, 2011). To help achieve the desired results of partnership arrangements, however, there ought to be legitimacy and certainty. Thus, contrary to the known LSM-ASM 'cohabitation' arrangements (see, for example, Aubynn, 2009) where the parties involved have few rights, few obligations and few responsibilities, the parties involved in partnership arrangements are principal contributors with substantial rights and obligations to share in the risks and profits (Jiménez et al., 2024; Ofosu et al., 2025b). More rigid sets of formal partnerships are usually based upon legally binding contracts, particularly where there are direct commercial transactions. In many cases, partnerships have a legal basis with legal contracts tying partners to specific inputs and actions. Also, embedded in partnership arrangements are formal arrangements and legally binding contracts that protect the interests of all parties involved. This goes beyond ad hoc situations, which are features of cohabitation/coexistence (Jiménez et al., 2024; Ofosu et al., 2025b; Yakovleva & Vazquez-Brust, 2018).

Based on this, we suggest that emerging and future arrangements between LSM companies and ASM entities (especially the formal/registered operators) should be based on partnership arrangements where formal, long-term agreements and binding contracts become essential and embedded. Although informal operators may lack some form of legitimacy, it is also important to have some form of flexible, legally binding arrangements between them and LSM companies to ensure certainty and reliability.

In this regard, the mineral concessions to be allocated to the ASM parties should be properly prospected and much exploration conducted to determine the volume and tonnage of the economically viable mineral riches available on the concessions. This could determine, with certainty, the number of years the concession could be granted to the ASM parties. Based on this, the contract agreements must be honoured – the 'pacta sunt servanda' (agreements must be honoured) principle should apply, and ASM operators should be allowed to work irrespective of whether mergers and acquisitions occur or mineral prices go up on the international market.

In these situations, even with informal operators, the contract details should include provisions for LSM companies to have a share in the production and revenues generated by the ASM operations on their concessions. There should be formal plans to share the revenues generated. Revenue-sharing arrangements could be the panacea to curtail the phenomenon where ASM parties are evicted when mergers and acquisitions occur and when mineral prices go up. These arrangements, we reiterate, should be formalised beyond the ad hoc 'live and let live' phenomenon. Table 2 provides a summary of the proposed partnership arrangement highlighted in this study.

The partnership arrangements could prove to be a win–win for all parties concerned. First, LSM companies would receive real financial benefits and save labour and operational costs on concessions amenable to ASM, where ASM operators serve as the ideal partners to develop other deposits (secondary, alluvial deposits) on the concessions. Second, the LSM companies could supervise the ASM operators to ensure that labour conditions are formalised and workers' rights protected. Third, the government would receive the needed revenues through taxes and levies on the ASM operations. In this regard, from the side of government, a reduction in registration fees, and the abandonment of bureaucracy would help to catalyse the ASM formalisation processes. Although this could mean additional costs with formalising, it would also mean a decrease in 'informal taxation' levied by corrupt police and other government officials who benefit, economically, from ASM groups' informal status.

Also, we note that environmental remediation obligations should be enshrined in the partnership arrangements. A reading of the literature on the cohabitation arrangements reveals such obligations were usually not part of the agreements. Here, we suggest that ASM operators working on the concessions of LSM operators should be obligated to remediate the lands post-mining – similar to the universally-accepted 'polluter-pays' principle, which requires that any agent compensates all other agents and should seek to remediate the damages caused by their pollution (Ambec & Ehlers, 2016). This would ensure post-mining

Table 2
Summary of proposed partnership arrangements between LSM and ASM.

Action	Purpose/Reason
Cede portions amenable for small-scale operations to formal ASM operators.	1. ASM have access to mineralised concessions2. LSM saves labour and operational costs.
Quantify the tonnage of minerals on the concession.	To determine with certainty the number of years ASM operators can occupy the area.
Decide on revenue-sharing arrangements.	To cater for LSM-economic related interests.
Decide on environmental-remediation obligations.	To ensure good and sustainable environmental management practices.
Document and legalise the agreement.	To forestall evictions and disruptions.

land use activities would not be disrupted.

6. Discussion

In the LSM-ASM interactions, the dominant narrative is that government policy favours LSM operators and informal ASM operates on the margins, and that when LSM makes concessions available to ASM, it is to forestall a conflict or violent situation (Aubynn, 2009; Hilson, Yakovleva, & Banchirigah, 2007). Hence, to provide new and refreshing perspectives on the discussions on the cohabitation of LSM and ASM operations, and transcend the preoccupation with ASM informality, this present study has sought to review and synthesise the literature on the dynamics of the LSM-ASM interactions. In doing so, we seek to answer the question: Can formalised ASM and LSM partner and flourish together?

Several issues are worth discussing. First it ought to be acknowledged that governmental policies have failed the ASM sector. In this regard, some scholars have called out national governments for their insistence on excluding ASM from legal frameworks (Bester & Groenewald, 2021; Hilson, 2017; Hook, 2019). These scholars maintain, among other things, that formalisation procedures have failed because they ignore the socio-economic factors that push miners into informal ASM, and by extension, to commit environmental crimes (Hilson, 2020; Siegel & Veiga, 2009; Tschakert, 2009). Relatedly, many scholars argue that the capacity and financial resources required to meet the range of requirements to obtain mining permits for ASM operations are high, causing a barrier for miners who want to mine legally (Arthur-Holmes & Ofosu, 2024; Bester & Groenewald, 2021; Geenen, 2012; Siwale & Siwale, 2017).

Obviously one of the root causes of the tensions between LSM and ASM is the phenomenon of 'LSM bias' (Hilson, 2019; Sauerwein, 2020). Following this perspective, Banchirigah and Hilson (2010) highlight that in most countries, ASM formalisation has been a 'legislative afterthought', introduced after mining companies have monopolised access to mineral-rich zones. Thus, an omnipresent narrative of the ASM sector describes its informality as an intentional construct on the part of policymakers and donors, who prioritise LSM over ASM, while making it almost impossible for individuals to secure the necessary paperwork and licences required to participate in ASM (Hilson & Maconachie, 2020; Siwale & Siwale, 2017). Over the years, government policy has also prioritised investor-friendly LSM regimes by providing enabling environments such as tax incentives to attract foreign investment (Hilson, 2017). This has also meant the release of vast concessions to LSM companies, thus denying local people access to mineral-rich areas that might not even be viable for LSM operations in the first place (Hilson, Yakovleva, & Banchirigah, 2007). As such large parcels of land have long been occupied by LSM operators, for ASM actors keen on securing permits, only very limited amounts of land that are geologically viable are available (Banchirigah, 2006; Hilson et al., 2020). This makes it more attractive for ASM operators to continue operating informally, specifically outside of the legal framework, and usually on the concessions of LSM companies (Banchirigah, 2006).

Thus, one of the best policy interventions by the state, aimed at reducing tensions between different mining operators, should really focus on prioritising, reserving, and identifying geologically viable land for ASM as well as implementing a more effective formalisation strategy for the sector (Sauerwein, 2023). This could include reducing the size of exploration permits for LSM as well as allowing the overlap of land titles between ASM and exploration permits (Hilson et al., 2020; Hilson, 2019; Sauerwein, 2023).

Aside from these policy measures outlined in the above paragraphs, we suggest that in seeking to examine the issue of the ramifications emanating from the cohabitation agreements between formalised/licensed small-scale mining operators and LSM companies, a new framework – partnership – is required. Therefore, it is very crucial to delve into LSM-ASM cohabitation arrangements in different socio-economic contexts considering the fact that the often-proposed cohabitation arrangements fail to address issues such as legitimacy, trust, environmental-remediation obligations, economic benefits, and sharing arrangements. However, a clear separation of economic and environmental obligations should be established. These issues raise important questions.

We propose that LSM and particularly formal ASM operators should engage on partnership grounds to help the two mining entities cohabitate with beneficial consequences to both parties. Good and sustainable relations between LSM and ASM can be realised through partnership arrangements. With the creation of the right conditions, LSM companies can support and complement ASM operators and vice versa. This, however, requires a strategy including a process of licensing and formalising their relationship. The strategy also requires ceding to ASM portions of concessions that may be economically viable. The LSM companies should help quantify the tonnage of minerals available on the concessions. For ASM-LSM partnerships to work, any mining regulatory and ASM formalisation frameworks should acknowledge mining areas or communities where indigenous people have limited or no access to mineralised lands, since LSM companies possess the larger portions or entirety of these lands as their concessions (Arthur-Holmes & Ofosu, 2024).

However, the arrangements should be made to structure revenue-sharing arrangements with the ASM operators; any arrangements should be structured to generate concrete economic/financial benefits to LSM companies whose concessions the ASM operators work. Perhaps, what might have escaped the attention of governments, policymakers, and scholars is that LSM companies decide to evict ASM operators from their concessions when gold prices are high and when mergers and acquisition of LSM companies occur (Hilson et al., 2020; Sauerwein, 2023) because the LSM operators do not actually receive financial or economic benefits from the cohabitation arrangements with ASM operators. Perhaps if formal partnership policies could be put in place to enable LSM operators benefit financially (through revenue-sharing arrangements), the 'live and let live' strategies could be sustained (Ofosu et al., 2025b). This partnership arrangement could be a win–win for both parties because LSM companies would receive financial benefits; they would also save labour and operational costs on working on concessions amenable to ASM, while curtailing conflict with local communities and helping to improve livelihoods by providing mineralised concessions and employment opportunities to ASM operators and mining communities (Ofosu et al., 2025b). In many ways, partnership with ASM actors can increase the legitimacy and salience of the miners in the eyes of the government, financial institutions, and other stakeholders, in a process similar to what Yakovleva and Vazquez-Brust (2018) refer to as 'legitimization through engagement'.

In addition, ASM operators should be obligated to remediate the concessions post-mining. Similar to the arguments above, LSM companies might decide to evict informal ASM operators from their concessions because they (LSM companies) have to bear the burden of remediating the degraded lands. Therefore, environmental remediation obligations should be incorporated into partnership arrangements. The LSM companies serving as the 'big watching brother' could help the ASM operators fulfil their environmental obligations to remediate the lands through the provision of equipment and technical know-how. The LSM-ASM cohabitation arrangements should not only be couched as a conflict containment measure; considering that ASM operators, even the formalised ones, have little to no regard for responsible environmental management practices (Botchwey et al., 2022; Veiga & Marshall, 2019), perhaps, the solution to many of the socio-environmental and fiscal problems associated with ASM can be reached with the direct partnership involvement of LSM companies (Tarra et al., 2022; Veiga et al., 2022; World Bank, 2009; Yakovleva & Vazquez-Brust, 2018). Given that mining governance regimes have limited capacity to deal properly with the environmental quagmire associated with ASM operations (Ofosu et al., 2020; Siwale & Siwale, 2017), partnership arrangements, if

properly executed, might help achieve goals of environmental protection by reducing the negative environmental impacts arising from the poor resource extraction practices of ASM actors.

7. Conclusion and the way forward

In this paper, we have demonstrated that in order to fully recover the dynamics surrounding the LSM-ASM interactions, scholars and policymakers would need to move beyond the narrative of ASM as a low mechanisation and informal activity. Policymakers and scholars have to re-direct attention to new ways of understanding the LSM-ASM interactions. Otherwise, we stand the risk of getting stuck at one pole position with narrow interpretations from which few scholarly and policy lessons can be learnt, or at another position that does not broadly consider other external and possible underlying principles, which may hinder or help LSM and ASM exist and flourish together. Policymakers would also need to break out of traditional mindsets and develop a peripheral awareness of the inarticulate and emerging socio-economic and environmental relationships between LSM and ASM. In this regard, we urge governments and policymakers to seek to (re)enact mining codes that can provide legal grounds for partnerships between different types of mining operations. As noted by Arthur-Holmes and Ofosu (2024), in many countries, including Ghana, the lack of ASM-LSM partnerships is partly due to a state-inclined ASM formalisation that focuses on one type of small-scale mining licence for all ASM operations. This approach fails to recognise the complexities of the operations and the lack of mineralised lands available for indigenous people or prospective ASM miners to acquire a small-scale mining licence and operate within legally binding mining codes and regulations. However, due to the complicated dynamics of ASM-LSM interactions, which often result in conflict, partnerships involving the government and traditional authorities could be critical in creating extraction agreements based on mutuality, trust, and benefits for all parties (Arthur-Holmes & Ofosu, 2024). As Arthur-Holmes and Ofosu (2024, p. 9) clearly state, "The arrangement by the state-LSM-ASM/traditional authorities would be possible if a particular licence type were to support ASM-LSM cohabitation and partnership". These authors recommended that Ghana or other countries should recategorise ASM licensing system to include an ASM-LSM coexistence/partnership licence. This latter focus seems a neglected area of LSM-ASM studies and policymaking, yet it is vitally important in addressing the major LSM-ASM issues of our time and beyond. In these contexts, we call for more studies to investigate the LSM-ASM interactions in different socio-economic contexts to reveal if there is evidence of LSM and formal-ASM partnerships and what conditions characterise such partnerships. Such empirical evidence would help guide policy reforms for sustainable LSM-ASM partnerships.

CRediT authorship contribution statement

George Ofosu: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **Francis Arthur-Holmes:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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No data was used for the research described in the article.

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