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Cover Page Footnote

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Finding Workable and Mutually Beneficial Solutions to Eradicate Illegal Gold Mining

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Abstract. Illegal gold mining is a controversial activity. It provides livelihoods for rural communities in gold-rich areas and contributes to poverty alleviation; however, it also creates environmental devastation, losses to state revenue and often triggers social conflicts. Various eradication efforts have been made, ranging from persuasive approaches to harsh law enforcement involving the military and police, yet this illegal activity continues. This qualitative study aims to find and propose workable solutions to eradicate this activity, particularly in Indonesia. The study was conducted at two illegal-mining sites in Kalimantan, involving some 6,000 illegal-gold-miners. Data were collected through field observations and in-depth interviews with primary stakeholders, including authorities, perpetrators, and the community. The study identified eight sets of solutions to be implemented with an integrative approach, covering alternative livelihoods, cooperation and assistance, education and training, information dissemination, formalization, multi-sectoral collaboration, regulatory changes, and law enforcement. This paper contributes to model development in similar social circumstances and, in practice, provides workable solutions to illegal-gold-mining in other sites, particularly in Indonesia.

Keywords: collaboration, cooperation, eradication, formalization, illegal-gold-mining

INTRODUCTION

Gold has always attracted people because of its high value. Gold miners have been searching for this mineral since ancient times. Gold mining in Indonesia started well before the colonial era. Old Sanskrit documents indicate that Sumatra was rich in gold and that small-scale gold mining had begun before the Dutch Indies Company arrived in the 17th century (Aspinall, 2001).

Mc. Mahon et al. (2000) classified gold mining by throughput and types of equipment used. Large-scale use large capacity equipment with daily throughput above 5.000 MT, medium-scale use smaller capacity equipment with daily throughput from 1.000 to 5.000 MT, small-scale use small capacity equipment with daily throughput below 1.000 MT, and artisanal mining uses rudimentary tools. Large and medium scale are formal mining companies (industrial mining), while small-scale mining (SSM) and artisanal mining (ASM) are the community and individual mining. There are two groups of SSM in Indonesia, regulated and non-regulated. The former consists of Local Village Cooperatives (KUDs) and People's Mining, and the latter includes individual and ASM, which are generally without permits, hence considered illegal.

From the perspective of mineral wealth allocation, the existing legislations are more in favor of industrial mining. Despite clauses' existence to allow people's mining in the prevailing legislation, the licensing process is over-convoluted. To acquire an operating license, applicants must undergo a series of procedures and studies, all subject to the government's approval, which for the community, not only time-consuming but also expensive. Therefore, it is not surprising that almost 90% of people's mining remains

illegal (Aspinall, 2001; Subiman & Resosudarmo, 2010).

Illegal gold mining (IGM) is defined as any mining operation carried out without an official permit (McMahon et al., 2000; Aspinall, 2001) or within an unauthorized area, such as forest reserves or near water resources, or with an unauthorized method (Aspinall, 2001). Different terms are used to refer to IGM in different countries, such as galampsey (Ghana and other Sub-Saharan countries), garimpeiros (Brazil), ninjas (Mongolia), makorokoza in Zimbabwe (Mawowa, 2013), and zama (South Africa), which in Zulu's term means 'try and try again' (Banchirigah and Hilson, 2009). Domestically, it is called PETI (Penambang Emas Tanpa Izin); however, some nicknames are also known in different parts of Indonesia, such as gurandil in West Java (Lestari, 2007), meaning 'people who dig holes like rats' (Lahiri-Dutt, 2006) and brunak in Kalimantan.

Buxton (2013) projected that some 20 to 30 million people in around 80 countries, including five million women and children, engaged in this activity and produced 12 to 15 percent of the world's gold (Ismawati, 2014), while Basu et al. (2015) claimed that 37% of global atmospheric mercury emissions was due to ASM. Meanwhile, Balifokus (2015) estimated that IGM provided livelihoods to more than one million people in Indonesia, and at the same time discharged 70 to 150 MT of mercury into the environment annually, rated Indonesia the world's second-largest mercury polluter (Ismawati et al. 2013 and Veiga et al. 2014).

In 2014, IGM was found in 27 provinces, 80 regencies, and two cities; it produced 130 MT of gold, with no tax collected, compared to 66 MT of national output by industrial mining (Ismawati, 2014). With these estimates, IGM generated more than IDR 80

trillion losses of state revenue per year (Gunawan, 2015). The latest data from the Ministry of Energy and Mineral Resources indicated 18 locations of IGM operation within companies' concession, with total occupied land of 2,577 ha and 65 locations beyond the companies' concession area, spread in 16 provinces (Arif, 2020). At an official meeting and discussion on the Potential of People's Mining organized by the Ministry of Energy and Mineral Resources in Jakarta on March 3, 2020, the Indonesian Association of People's Mining (APRI) presented that people's mining (*tambang rakyat*) provide jobs to around 1.4 million people, 90% of which are considered IGM, compared to only 18,645 people employment provided by industrial mining in Indonesia (Arif, 2020). In terms of gold production, APRI claimed that people's mining produced 120 tons of gold in 2019 compared to 109 tons produced by industrial mining in the same year (Arif, 2020).

Kalimantan is one of the oldest illegal mining hotspots in Indonesia. The operations have been practiced for centuries, even before the Dutch colonial era (Aspinall, 2001). Some abandoned gold mining sites are well-known as the moon face areas and can be seen from above using Google Maps. IGM activities are spread in all the provinces on this island, with some 43,000 miners operated in Central Kalimantan alone (Nainggolan, 2015). Together, they produced 13.3 tons of gold in 2008, worth roughly US\$ 500 million based on the then currency conversion (Nainggolan, 2015). In 2020, Arif (2020) indicated that in Central Kalimantan, there were as many as 106,985 ha areas occupied by IGM beyond companies' concession area, and another 801 ha within mining companies' concession, namely in Ensburu Kalteng Mining (524 ha), Indo Muro Kencana (238 ha), and Kalimantan Surya Kencana (40 ha). Whereas in South Kalimantan, IGM mainly operates in Mount Meratus within Pelsart Tambang Kencana area, where IGM occupied 185 ha (Arif, 2020).

Although there is no data for the exact number of people involved in IGM for its illegality, the company data obtained during the field observation indicated that around 6,000 illegal miners around Mount Muro in Central Kalimantan operated within or beyond the boundaries of industrial minings' concession. Meanwhile, in the Meratus site, the company reported that 4,525 illegal miners operated in the northern block of its concession area in 2017.

It is undeniable that small-scale mining provides an alternative income source to the community, thus contributing to rural economic development and poverty alleviation. However, on the other side, the government either incapable of or does not have a strong willingness to develop proper people's mining (Setiadji, 2015).

On the corporate side, IGM is one of the main challenges, which has, to some degree, caused some frustration. Companies are obliged to protect the environment within their area but do not have the power to evict illegal miners. On the other hand, the

local community regarded mining companies' presence as not bringing wealth to most of the population but instead created more social inequality. Investors also disregarded the indigenous peoples' existence, tribal rules, and indigenous traditions (Setiadji, 2015). These conditions exacerbate the relationship between the company and the community.

This study aims to find workable solutions to eradicate IGM in Indonesia, particularly in the study areas, and deliver a mutually beneficial share of natural resources between the key stakeholders, namely the community, the company, and the government. In order to achieve the objective, the following research questions need to be answered:

(1) How does IGM structured that makes it so difficult to eradicate?. (2) How can workable and mutually beneficial solutions that lead to the eradication of IGM be developed?

Various eradication approaches identified from the literature, from friendly approaches, such as training on good-mining-practices to harsh law-enforcement, using police and military personnel.

In Sub-Saharan Africa, the mainstream effort is formalization. The governments allocate particular mineral-bearing lands and grant legal rights to the ASM (Verbugge, 2016). As such, governments can control the activity and secure state revenue from taxes or royalties (Spiegel et al., 2015; Verbugge and Besamos, 2016; Marshal and Veiga, 2017). The World Bank, the United Nations, and the UK Department for International Development (DfID) have also launched a global effort to regularize and provide assistance to ASM (Hilson, 2007). However, formalization under legal structures has mostly failed due to top-down policies that make reform challenging and burdensome for miners (Persaud et al., 2017). Spiegel (2016) even speculated that formalization is a mechanism for benefitting big corporations and driving ASM out of the picture rather than empowering rural communities.

Another effort on stream is providing alternative livelihoods in mining areas (Kervankiran et al., 2016; Andrew & Osei-Kojo, 2016; Mkhize, 2017; Spiegel et al., 2018). Governments and mining companies have launched many alternative livelihood initiatives to improve living conditions and reduce IGM. For example, AngloGold Ashanti has introduced several programs to improve Ghana's income-generating activities, such as farming and snail cultivation (Carson et al., 2005) and training in accounting, water management, and sanitation. However, these efforts have little impact on addressing IGM problems (Banchirigah and Hilson, 2009; Tschakert, 2009). People only follow the proposed alternatives if it is less arduous than his/her role in IGM (Banchirigah & Hilson, 2009). Various analysis raised on these failures; some suggested that failures due to the poor understanding of the target populations, viewing that all community member have similar backgrounds, skill levels, and educational training, which lead to inappropriate design and implementation of the

Table 1. Mainstream approaches and measures to eradicate IGM

No	Measures	Description	Result / Drawback
1.	Repressive measures (e.g.: Banchirigah, 2008; Spiegel, 2016; Adu-Gyamfi et al., 2016; Crawford & Botchwey, 2017)	Security forces raid on illegal mining, destroy facilities, and arrest the miners.	Temporarily succeed, but soon after, illegal-mining activities recurrent. Costly, inviting resistance and miners' solidarity.
2.	Persuasive approaches (e.g.: Saptono et al., 2014; Nopriadi, 2016)	Including education, information dissemination, and socialization on the danger of mercury, safety, and environmental devastation.	Not very successful, as there is no immediate result for the miner's community. It could give a positive result in the long run.
3.	Community development (e.g.: Carson et al., 2005; Tschakert, 2009; Kervankiran et al., 2016; Andrew & Osei-Kojo, 2016; Mkhize, 2017; Spiegel et al., 2018)	Including the development of alternative livelihood (mainly agriculture), provision of technical, financial, and management assistance.	So far, give few positive effects due to the inconsistency of the program. Low and slow economic return compare to easy cash from ASM.
4.	Formalization/legalization (e.g.: Nainggolan, 2015; Spiegel et al., 2015; Verbugge, 2016; Verbugge and Besamos, 2016; Marshall and Veiga, 2017; Persaud et al., 2017)	Formalize/legalize the activity by allocating specific concession areas for the community or cooperation between ASM and industrial mining.	Mostly failed due to top-down approach, bureaucratic procedure complexity, additional cost for the miners, and half-hearted effort of the government.
5.	Collaborative actions (e.g.: Spiegel et al., 2018)	Involving multi-stakeholders in developing the program.	Show positive effects (in Africa and Latin America), but it has not been very successful. In Indonesia, it has not been found.

program and the support system (ILO, 1999; Hilson, 2007).

Moreover, military and police raids' old-time repressive measure potentially abuses human rights (Spiegel, 2016; Adu-Gyamfi et al., 2016; Crawford and Botchwey, 2017), has also failed to deliver improvements. Despite a significant amount of funds spent, this type of operation has exacerbated the problem in many cases (Banchirigah, 2008), resulting in some fatalities (Boadi et al., 2016). After the raid, the miner's return, and they continue operation secretly.

In Indonesia's context, efforts to overcome IGM are mostly law enforcement on legality aspects (Lestari, 2007; Setiadji, 2015; Nainggolan, 2015; Nopriadi, 2016), sometimes are backed up by military forces. Similar to the case in Africa, such efforts have proven to be ineffective, not only for the inconsistency but also it does not touch the root cause of the problem.

Another effort identified is the "half-hearted" Community Development (CD) program. This effort relies on the companies' seriousness and commitment (Lestari, 2007; Welker, 2009; Hidayati, 2011). So far, there has not been any literature showing CD programs succeeded in providing viable livelihoods that could drive people to abandon IGM. In Antam, for example, Lestari (2007) pointed out that despite management's claim of success, observers argue that Antam's CD was more to do with the effort to eradicate IGM than genuinely helping locals. The decline of IGM was more related to the depletion of reserves than the CD program. Lestari (2007) proposed a double-edged strategy; the company should work with the locals and the miners to find a solution while ensuring local authorities and law enforcement agencies adopt more careful approaches to handle IGM.

Other researchers proposed various other measures. Saptono et al. (2014) proposed mediation between miners and the authority to develop mutually agreed solutions. Nopriadi (2016) proposed combined measures: education on mercury's danger and protection of the environment, coordinated efforts between law enforcement agencies, and close monitoring and disciplined actions against perpetrators. Nainggolan (2015) proposed the legalization of the activity

and technical assistance on good mining practices, whereas Spiegel et al. (2018) proposed long-term community-based approaches based on trust-building relationships to engage the influential group in the community.

Table 1 summarizes the eradication measures identified in the literature and the results or drawbacks of measures taken. IGM is a complex social phenomenon, encompassing broad spectrums of social aspects, from economic, political, power, psychological, and social. The researchers believe that addressing the issues with technical and legality measures alone will not provide sustainable solutions. Therefore, it is worth considering the power dynamics inherent in divergent ways in visualizing IGM conditions by combining technical and legality approaches with psychological and social approaches, exploring and understanding the underlying motivation, existing interaction, collaboration, and participation of the stakeholders. Diving deep into the stakeholders' social and psychological aspects to understand the real problem could be critical in finding more acceptable, workable, and sustainable solutions.

RESEARCH METHOD

This study took place in two sites, namely Meratus in South Kalimantan and Muro in Central Kalimantan (Figure 1).

Figure 1. Location of the study



Meratus is an isolated area, with one village 15 km away, located 250 km northeast of Banjarmasin. The illegal miners operate within an industrial mining concession, which is under the exploration stage. Meanwhile, the Muro site is surrounded by 23 villages with 23,945 inhabitants and a workforce of 11,642 (Murung Raya in Figures, 2020), located 450 km northeast of Palangka Raya. The IGM activities take place within and beyond the industrial mining concession. In both sites, IGM has been ongoing since the 1990s after the concession holders explored the region. Industrial mining subsequently exploited Muro, but the Meratus area was ignored for many years.

This research is an exploratory study using a qualitative phenomenology approach, exploring the perpetrators' underlying motivations, perceptions, aspirations, and psychosocial conditions (Richard and Morse, 2013) and the other stakeholders' insights, opinions, and expectations. Data were collected using field observations to understand the structure of IGM and find out the challenges in eradicating IGM, followed by in-depth interviews to explore deeper the underlying motivation, psychosocial conditions, and the aspirations of the perpetrators, the community, and the other stakeholders.

Field observations were conducted from February to July 2018 and from March to May 2020 through daily interaction with the community, including IGM perpetrators. Data were collected in the form of field notes and pictures (Creswell, 2014). Meanwhile, in-depth interviews were conducted in August 2018, between August to October 2019, and between February and April 2020, involving four stakeholders' groups: the authorities, business association, corporate executives, and the community, including illegal miners. Semi-structured interview questions were used as the guideline to direct the interview and explore as much information as possible (Richard and Morse, 2013; Saunders et al., 2009). Interview protocols were pilot-tested before finalizing the protocols and guidelines. The interviews were finally concluded with 35 interviewees (Table 2), as the information collected has reached theoretical saturation.

Table 2. Informants profile for the in-depth interview

Government Authority	
G01	A senior officer in the Ministry office, involved in the revision of mining law. Reputable academia and well known to mining communities in Indonesia.
G02	Deputy Director, extensively involved in mining supervision, including ASM/IGM.
G03	Politician, served three terms as local legislature prior to the current position, very knowledgeable about IGM activity in central Kalimantan.
G04	Head of the Environmental Agency Office, extensively interacts with the community, including IGM in the past 25 years
G05	Police Resort Head; assigned to various posts in the Kalimantan Central Police, exposed to a number of IGM law enforcement operations.
Association	
A01	Board Member of the Indonesian Mining Association, well connected with the mining community and the relevant government agencies.
A02	Chairperson of the Indonesian Association of Mining Peoples (APRD), actively fighting for the legalization of ASM/IGM; more than 25 years in traditional mining.
Enterprise/company	
E01	Operation Director, coordinates on-site mining operations; in direct contact with the community, often deals with IGM conflicts.
E02	General Manager (Muro), in charge of site operations; extensive contact with IGM within the concession area over the past five years.
E03	General Manager (Meratus), in charge of site operation; dealt with IGM for more than 20 years in various sites in Indonesia
E04	HSE Manager, extensive contacts with IGM on safety and environmental issues; experienced the 2013 conflict between IGM and the company
E05	CSR Manager, extensive contacts with the local community, both miners and non-miners.
E06	Security Manager; handles IGM issues within the company's areas, works closely with the Police
E07	External Relations Manager, extensive contacts with local government and the community, including IGM
Community, include illegal-miners and non-miners	
C01	Community Leader; served as a customary judge for dispute resolution between communities, including with the company.
C02	Village head; also part of IGM, owns several processing plants and mining sites.
C03	Miners' group leader; has been involved in IGM for more than 20 years.
C04	Local business-owner, controls several mining sites, works with financiers from outside the area.
C05	Farmer, causally involved in IGM at a low price of agricultural commodities.
C06	Informal leader; served as a Marriage Registrar officer and leader of religious study groups.
C07	Miner-digger; under the coordination of a group leader on a revenue-sharing scheme.
C08	Miner-digger; occasionally take ore from industrial mining pits.
C09	Miner-digger; occasionally take ore from industrial mining pits.
C10	Village head; owns processing plants; actively fighting for community participation in mining.
C11	Former miner, turned to retail business, participates in company's CSR program.
C12	Former miner; currently an ambulance driver, participates in company's CSR program
C13	Former miner; currently work as a farmer, also involved in the company's CSR program
C14	Involved in IGM as a logistic supplier, now work for industrial mining.
C15	Group leader, control large mine sites, own processing plants, lead around 500 miners
C16	Transporter, occasionally work as miner-digger
C17	Transporter, occasionally work as miner-digger
C18	A group leader; controls large mine sites, own processing plants, leads approximately 500 miners
C19	Provides logistic supplies to the mine site
C20	A processing-plant owner; provides processing services on a service-fee basis.
C21	Logistic supplier, provides and deliver various supplies to the mine site

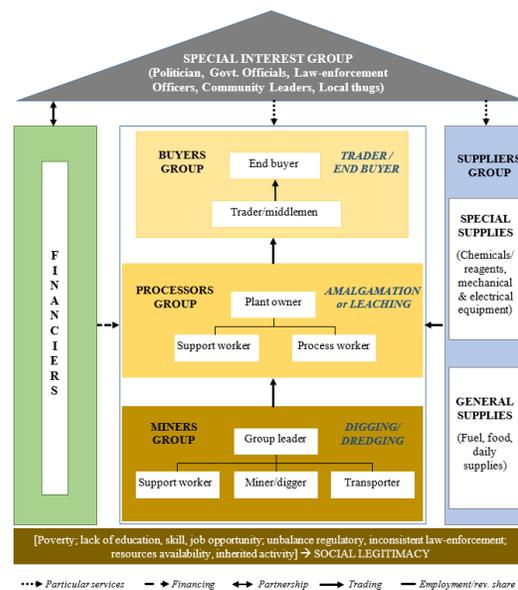
All interviews were recorded, which took around forty to ninety minutes per interview. Interview records were transcribed and then analyzed and coded using the content analysis method with qualitative data analysis software, NVivo version 12. The coding was performed in three stages, started with the identification of themes during the open coding stage, then categorizing the themes for their similarity during the axial coding, and finally perform selective coding by iteratively revisiting the data and comparing the codes that more suitable to illustrate the themes (Richard and Morse, 2013; Neuman, 2014). With this process, eight main categories of codes were encountered, with a total of 31 codes. The coding process was iterative; the researchers revisited, reviewed, and re-coded the data to refine the analysis and ensure the correct coding of the quotes from the interviews' transcript.

RESULTS AND DISCUSSION

Illegal mining structure

Findings from field observations indicate that IGM is a complex and problematic social situation involving multiple stakeholders, from ordinary citizens to particular interest groups, including politicians, government officials, law enforcement officers, and community leaders. Six types of actors were identified based on their roles in the activity: miner, processor, supplier, trader/buyer, financier, and the particular interest groups that provide non-technical services. Figure 2 illustrates a typical business structure of IGM identified from the field observations.

Figure 2. Typical IGM structure



Meanwhile, in terms of driving factors for IGM, two key drivers have been identified, i.e., poverty and business, which are rooted in the classical supply and demand nature of every business. Miners and processing workers need cash, driven by poverty due to limited job opportunities or inadequate agricultural income. On the other side, there is a stable demand

for gold for its high value, and it is a cash market, encouraging capital owners to engage in the activity (Hasibuan, Tjakraatmadja, and Sunitiyoso, 2020).

Moreover, abundant gold resources are accessible, within or beyond industrial mining's concession; relatively low-tech required for extraction, and workforces are available in rural areas for the low skill required; all these ease IGM business' entry barrier. These factors, coupled with law enforcement's inconsistency, weak regulatory and policies, political power interest, and rising psychosocial factors in the community, drive people into IGM (Hasibuan, Tjakraatmadja, and Sunitiyoso, 2020).

Gold extraction needs equipment and reagents, which require significant amounts of funds for initial investment and operational expenses. Most IGM operates by digging or suction and dredging to get fresh ore and process it at the processing plants. Therefore, the actors have to work together in an integrated structure, with certain interrelatedness.

Field observations indicate six groups of actors in IGM, i.e., miner, processor, supplier, buyer, financier, and particular interest group.

Miners.

The first group is the miners, which consists of the mining coordinator (group leader), worker/digger, and transporter. Their role is to deliver mineral ore. They could be self-financing (usually by the group leader) or pre-financed by the financier. There are two types of working relationships: an employment basis (the group leader employs the workers) or a revenue-sharing basis (the group leader or financier pre-finances all the operation and shares the revenue after deducting all operational expenditures). Based on the observation, the financier gets two portions, miner/digger, and all other workers get one portion each.

Quite often, the miners/workers hardly have anything to give to the family after the job, as the results are just enough to cover operational expenses and money they left to support the daily needs of the family while they are on site. Refer to Maslow's classical Hierarchy of Needs (1954), miners' and workers' engagement in the activity are generally for subsistence economic reasons. For the impoverished community in gold-rich areas, engagement in IGM is a matter of survival due to limited skills and job opportunities. The finding is in line with previous studies' findings in other countries (e.g., Banchirigah, 2008 p.4; Tschakert, 2009, p.4), and this situation is one of the factors making IGM persist.

Processor.

The processing group consists of the processing plant owner and the workers. The business relationship between the owner and the worker is on an employment basis. There are three types of processing plants identified in the fields: mercury amalgamation process, cyanide leaching process, and gravity extraction process. The former two use chemical reagents in the process. The latter extracts

the mineral mechanically, applicable for alluvial type minerals obtained by dredging the mineral sands from the riverbed or riverbank. Both amalgamation and leaching processes need to crush ore received from the mine site first, whereas the gravity process dredges the mineral sands from the source and flows it through mechanical filters (traditionally use carpets), retrieving mineral nuggets or granules from the filter.

Building and operating a processing plant require relatively large amounts of funds. Initial investment varies from 300 million to billions of IDR, depending on the processing plant's capacity and type. Operating cost needs other hundreds of millions to purchase grinding balls, reagents, and fuel to run the plants. The money pours into the business is expected to be recovered in three to five years. It is a capital-intensive operation; therefore, in line with Banchirigah (2008, p.7), abandonment of IGM is difficult, if not impossible, for which they need protection.

Processing plant owners are local entrepreneurs who take gold mining business opportunities in an unbalance regulatory regime. Amidst the government's minimum attention in developing traditional gold mining, these entrepreneurs have contributed to rural economic development. Therefore, they get social legitimacy from the community and the local leaders, making IGM more challenging to eradicate.

Suppliers.

There are two types of suppliers, i.e., general supplier supplying daily needs (food, fuel) and specialized supplier supplying equipment (e.g., generator, ventilator, pump, processing equipment) and chemical/reagent (e.g., mercury, cyanide, lime, carbon, borax). Their relationship with the other actors is purely trading. Similar to the processors, they take the opportunity of the IGM's presence.

Despite the prohibition of mercury utilization in mineral extraction, and that mercury trading requires specific permits, as stipulated in the Ministry of Trade's Regulation (PERMEN No. 75/2014), the supply is always available, confirming the arguments of Ismawati (2014) that hundreds of MT of mercury were smuggled into Indonesia. It is known that the suppliers have particular relationships with law enforcement and supervisory authorities to ensure the trading activity's smooth operation.

Buyers.

There are two types of buyers, the middlemen or trader who buy the product on-site, resell it to the end buyer in town, and the end buyer, who mostly resides in big cities. The middleman accepts buying the semi-finished product, containing 30% to 70% gold and other metals such as silver and copper. He/she refines the product in the city and sells the final product to the end buyer. Some buyers, called 'the big bosses,' also serve as the financier. Although they reside in the city, they run and control the operation(s) through their men on-site. In this study, most of them live in Banjarmasin and Batu Licin, South Kalimantan, and suspected of having covert cooperation with law enforcement authority.

Financiers.

The financiers are generally invisible to the ordinary community but play an essential role in the activity. They could be the business owner from the cities like Palangka Raya, or Banjarmasin, or even politicians, government officials, and law enforcement officers. They finance the operation through the local business owner or power holder. In some cases, the financiers also act as the buyer of the end product. Some assign family members or relatives

to the mining area to distribute funds to several plant owners or mining coordinators. As an informant commented on the financier:

“He resides in Rantau and rarely comes here, only sends money, controls the flow and distribution by phone, and puts his nephew on-site to monitor the activity.”

Based on informants' information in the Meratus site, billions of IDR pour into the activity in one prospect area by some twenty financiers. They finance the

Table 3. Proposed solutions to eradicate IGM

Categories and Factors	Authority G01 to G05		Association A01 to A02		Company E01 to E07		Community C01 to C21		Total	
	N	Ref	N	Ref	N	Ref	N	Ref	N	Ref
AL Alternative livelihood	4	9	-	-	1	3	16	63	21	75
AL01 Commodity price control	-	-	-	-	-	-	9	12	9	12
AL02 Marketing support	4	4	-	-	1	1	9	14	14	19
AL03 Assistance and mentoring	1	4	-	-	1	2	10	16	12	22
AL04 New job creation	1	1	-	-	-	-	13	21	14	22
CA Cooperation & assistance	5	14	1	3	7	26	16	31	29	74
ET Education & training	2	5	2	4	3	3	4	5	11	17
ET01 Formal education	1	2	-	-	-	-	3	3	4	5
ET02 Motivation training	1	2	-	-	-	-	1	1	2	3
ET03 Vocational training	1	1	2	4	3	3	1	1	7	9
FL Formalization/legalization	5	32	2	3	7	25	12	27	26	87
FL01 Access to system	2	3	1	1	3	3	1	1	7	8
FL02 Implementation monitoring	3	6	-	-	2	2	-	-	5	8
FL03 Provincial govt. seriousness	5	14	2	2	5	9	3	4	15	29
FL04 Specific area allocation	4	9	-	-	5	11	11	22	20	42
ID Information dissemination	5	8	1	2	3	7	9	11	18	28
ID01 Clear program	5	7	1	1	1	1	-	-	7	9
ID02 Cultural approach	1	1	1	1	3	6	9	11	14	19
LE Law enforcement	5	28	2	12	6	20	6	10	19	70
LE01 Shutdown processing plants	1	1	1	3	3	4	-	-	5	8
LE02 Cut financial links	-	-	-	-	-	-	2	2	2	2
LE03 Cut chemical supplies	4	11	1	2	4	9	1	1	10	23
LE04 Expel migrant miners	3	6	2	6	2	2	1	2	8	16
LE05 Integrated law enforcement	1	2	1	1	1	1	4	5	7	9
LE06 Regular law enforcement	1	3	-	-	2	3	-	-	3	6
LE07 Relocate to WPR	3	5	-	-	1	1	-	-	4	6
MC Multisector collaboration	4	21	1	2	5	9	4	5	14	37
MC01 Capable & committed team	2	2	-	-	1	1	-	-	3	3
MC02 Clear objectives	3	6	-	-	-	-	-	-	3	6
MC03 Inclusive stakeholders	3	9	1	1	4	5	4	5	12	20
MC04 Powerful coordinators	3	4	1	1	3	3	-	-	7	8
RC Regulatory change	5	36	2	3	5	26	12	29	24	94
RC01 Natural resources sharing	4	11	2	2	1	3	10	20	17	36
RC02 Partnership possibility	3	8	-	-	3	11	4	4	10	23
RC03 Simplified regulation	3	5	-	-	5	7	4	5	12	17
RC04 Specificity	1	2	1	1	-	-	-	-	2	3
RC05 Structural improvement	2	4	-	-	3	3	-	-	5	7
RC06 Underlying regulation change	4	6	-	-	1	2	-	-	5	8
Total	5	292	2	55	7	212	16	331	29	890

N : Number of interviewees
Ref: Number of codes references

operation of around 1.500 miners and 86 processing plants. Referring to Hope (2009), one of the motivating factors to start the business is the capability to encounter the barrier, and financing availability is generally one of the business barriers. Therefore, the availability of financing is one of the critical factors making IGM persist, and the amount of funds pours into the business makes it challenging to eradicate.

Particular interests.

This group provides protection and informal permits, which allow the activity to run smoothly all along the business chain. This group includes police and military officers who protect the illegal trading and distribution of chemicals from the supply origin until the retail shop at the mine site. The services provided include guarding the delivery during

transportation, giving information before any law enforcement operation, and releasing the actor from the prison in case of imprisonment.

Another player included in this category is the area ruler, usually the powerful thugs or gangsters who claim a particular area. Any activities in the area need his prior approval and pay both entry and protection fees.

Except for the miners and workers, the engagement of the other actors in IGM is business-driven. The illegal operations are running smoothly, mainly due to the particular interest groups' involvement, which provides multilayer and multidimensional protections, explaining why IGM is challenging to eradicate.

To summarize, this study reveals five key factors that make IGM challenging to eradicate: (1) Existing supply/demand coupled with weak regulatory and lack of law enforcement, (2) Poverty in gold-rich rural areas for lack of education and skills, and limited income-generating activities, filled with opportunities provided by IGM, (3) The large amounts of fund pour into the business by the business-driven actors, (4) The availability of resources (financial, supplies, minerals, tools, and workforces) ease the entry barrier to the activity, (5) Existence of cohesive networks amongst IGM actors, especially with the involvement of politicians, government officials, and law enforcement officers protecting the activities.

Proposed solutions

Various proposed solutions that emerged from the interview data were grouped in the initial codes during the coding process, and after going through iterative processes, eight groups of approaches were defined as the final codebook (Table 3).

Regulatory change.

Regulatory change is a critical factor in providing solutions to IGM, as the weak regulatory and policies were identified as one of the causes of IGM (Hasibuan et al., 2020). Grounded from the provisions of article 33 of the 1945 Indonesian Constitution, point 4: the organization of the national economy shall be conducted based on economic democracy upholding the principles of togetherness, the efficiency with justice, continuity, environmental perspective, self-sufficiency, and keeping balance in progress and unity of national economy, there is a growing injustice feeling within the community in the government's way managing natural resources. As informant A02 stated:

"The government's stance on the existence of people's mining is still ambiguous. Although Mining Law No. 4 of 2009 on Mineral and Coal accommodates the existence of the people's mining, until now, the derivatives regulations which were supposed to be issued by the government as the implementation guide were still half-hearted; therefore, the majority of people's miners are very difficult or even unable to get the mining permit."

Regulatory change is one of the leading solutions considered by the vast majority of the interviewees,

highlighting fairer distributions of mineral resources between the company and the community. The community has to get fair and proportionate opportunities to access the mineral-rich area. Community mining regulation(s) need to be simplified, and partnerships between industrial mining and community mining should be accommodated. To do that, some interviewees highlighted the necessity to reform the underlying regulations on community mining and improve mining authorities' structure. Quoting informant G01: 'there should be a separate directorate dedicated to community mining in the ministry.' Informant G02 supported the idea, while informant A01, in different wording, stated that: 'the community mining has to be regulated specifically, or at least sufficient details of provisions should be stipulated in the upcoming revision of mining law.'

Moreover, in line with the increasing demand for 'green gold' (traceable gold) internationally, the lawmakers should consider incorporating this international standard in gold trading in the regulation. This issue has not been brought to the surface in the previous studies reviewed.

Regulatory change is a fundamental step in providing solutions to IGM; therefore, the lawmakers should seriously consider this measure, although it is a lengthy process.

Information dissemination.

Interviewees consider that transparent information could help eradicate IGM, including on the government economic development programs and the companies plans on the community, not merely on the danger of mercury and the legality aspects as it were previously.

Interestingly, most of the traditional miners refused to be labeled as illegal miners. They conduct the activity on their land and have been going on since their ancestors without permits. For them, the illegal miners' term only exists after the presence of industrial mining. Four interviewees expressed their concern on this term to refer to community/people's mining; "it criminalizes the community" (A02), "it is the label given by the investor" (C01), "we are not criminals, what do we do wrong?" (C02); "it did not exist when we started the activity in the 80s" (C04). Therefore, they urged the government and company to put forward a cultural approach in disseminating information to the community.

Meanwhile, informants from the government and mining association highlighted the importance of disseminating clear and consistent programs to the community to make the community well informed. Clear information and good communication minimize misunderstanding and reduce psychosocial tensions as one of the driving factors to IGM.

Formalization.

Formalization/legalization is another measure that emerged from interviews. The majority of interviewees voiced that formalization or legalization will provide grounds for tighter control over IGM, leading towards better mining practices, environmentally

friendly, and secure the state revenue. However, formalization needs strong commitment from all stakeholders: government's seriousness on the program, the readiness of industrial mining to relinquish part of its concession for community mining, simplification of regulations and policies to ease access of community miners to the legalization system, and continuous training, monitoring, and supervision during the implementation.

Access to the legalization system is one of the issues in formalizing community mining. Failure in formalization measures in many countries is mainly due to the complexity of procedures (Verbugge and Besamos, 2016; Marshall and Veiga, 2017). Similarly, in Indonesia, there are various costly, lengthy, and complicated pre-conditions set by the prevailing regulation(s) to apply for an operating permit, including establishing a business entity (cooperatives or private limited), submitting a feasibility study, and environmental assessment reports. Informant A02 criticized: 'These requirements are discriminatory; it is the colonial way to prohibit the people from progressing and prospering.' Moreover, interviewees G03 and G04 criticized the provincial government for the 'half-hearted attitude' on the designation of WPR, whereas the community mining permit, called IPR, could only be granted within the WPR.

Provincial government seriousness and allocation of WPR are two main issues in the formalization process. Interviewees from the government, associations, and companies questioned the provincial government's seriousness in solving the IGM issues, especially on the allocation of WPR. Interviewees also voiced out that the existence of reasonably mineral-rich WPR is the most favorable solution for IGM. The government controls the implementation, including providing qualified and dedicated mentors in implementing environmental protection and acceptable mining practices.

Law enforcement.

Law enforcement is the most common practice in eradicating IGM; however, inconsistent law enforcement tends to make the activity even flourishing, such as the case in Kuantan Singingi, Riau (Nopriadi, 2016).

Various measures within this category emerged from the interview. Some suggested closing down of processing plants, assuming that mineral ores will have no value without processing plants. The processing plant owner, in some cases, also finances the mining operation; therefore, closing them down will cut the business chain of IGM.

Interviewees from the authorities, associations, and companies proposed more stringent controls on illegal chemical trading. Cutting the supply chain of chemicals from the sources (traders) to the users (processing plants) will cease the processing plant and mining operations, except the rivers' gold panning activity. It is believed to be the most practical way to cease IGM rather than closing mining sites or processing plants as it was in the past. Therefore, law

enforcement should be prioritized on illegal chemical trading and the authorities protecting the activity.

Migrant miners are also considered as the trigger for the flourishing IGM activity. In the Meratus field, informant C16 mentioned that 95% of the miners are migrants; therefore, expelling all migrant miners is one of the first solutions to eradicate IGM in the area.

However, law enforcement must be an integrated and continuous operation, involving all relevant agencies, such as personnel from the trade, mining, environment & forestry agencies, and the police. Interviewees consider the persistence of IGM was primarily due to sporadic, incorrect target, and uncoordinated law enforcement.

Cooperation and assistance.

Cooperation between industrial mining and the community emerged with the strong supports of the interviewees. Almost all interviewees voiced the necessity of cooperation between the company and the local community. Prioritizing the local community as the company's business partner, such as in food supplies or labor supplies for operational supporting activities (e.g., security, catering, cleaning services). The community also expects to have technical and financial assistance from the company to start the business, which could be on a free interest or soft loan basis, and assistance in marketing the products.

Cooperation could also be extended to the formation of local cooperatives or associations of local producers to increase capacity and bargaining power. The company provides management, technical, and financial assistance to establish the business entity and help the entity running. Having a growing business in the community will reduce the interest in IGM, hence reducing the IGM driving factors.

Moreover, mentoring is the key success factor of every program in the community. As an informant (C06) stated, 'the previous programs' failure was due mainly to the absence of mentoring and discontinuity of support.'

Multi-sector collaboration.

A multi-sector collaboration involving government agencies, industrial mining, traditional mining associations, IGM perpetrators, community, and law enforcement authorities emerged from the interviews as another measure proposed as a solution to IGM. However, certain conditions are needed to make the collaboration work: a clear objective of the collaboration, executed by a capable and committed team, involving all the stakeholders, including the IGM community, and led by a powerful coordinating board. This type of collaboration needs a powerful coordinating board encompassing all sectors to have a high representation, legitimacy, accountability, and ownership (Edi, 2014, p.5). The absence of a powerful coordinating board is a critical factor that has not been addressed in the previous multi-sector collaboration approaches.

Alternative livelihoods.

The provision of alternative livelihoods to rural communities is one of the highest aspirations that

emerged. Interviewees from the community and the authority voiced that provision of alternative livelihoods is one solution to eradicate IGM. There are four measures proposed in this category:

(a) control agricultural commodity price, (b) assist in the marketing of the community's agricultural products, (c) close mentoring during the implementation of any alternative livelihood program, and (d) creation of other job opportunities.

Various alternative livelihood programs have been pursued in many countries (e.g., Carson et al., 2005; Tschakert, 2009; Mkhize, 2017), with little success, mainly due to poor understanding of the target population and the top-down approaches. In this study, there is a specific locality issue voiced by the interviewees. As most of the population cultivate rubber trees, the high fluctuation of the commodity prices disturbs their income. Traditional mining is the most feasible way out, as it provides immediate cash (Hasibuan et al., 2020), similar reasons to the finding in many Sub-Saharan countries (Banchirigah and Hilson, 2009, p.4-5). Therefore, they proposed the government's intervention to control the price, such as setting floor prices of agricultural products to allow farmers to secure decent profits to fulfill their reasonable needs. As informant C07 stated:

"If the rubber price stays above IDR 10.000/kg, most miners will switch back to the rubber plantation, not only because IGM is illegal, but also unhealthy, risky, and dangerous."

Besides, marketing support such as assistance to open access of local agricultural products to the market is another approach to making alternative livelihood programs succeed. The crucial factor in the success of alternative livelihood programs is close mentoring and continuous technical assistance. Interviewees claimed that the past rural economic development programs' failures were mainly due to the program's discontinuity and the absence of mentoring.

Another solution proposed by the interviewees was creating new jobs in rural areas by encouraging the development of agricultural-based industries, such as natural rubber processing plants, palm oil mills, and food processing plants. This initiative would bring direct and multiplier effects on the rural economy: the agricultural output would directly access processing plants, new employment opportunities will be available, and other related businesses will emerge.

Education and training.

It is common in developing countries, including Indonesia, that one of the rural areas' problems is education; the rural community's low education level limits their opportunity to get formal employment. It also limits their capacity to capitalize on the available natural resources. Education and training were also voiced as an essential issue; the interviewees acknowledged that the low formal education level and lack of training limit the community's opportunity to develop economic endeavors.

Moreover, low education and limited skill are part of the community's push factors to engage in IGM

Table 4. Integrated efforts in providing workable solutions to IGM

Approaches	Roles and contribution			
	Government	Corporate	Associations	Community
Regulatory change	Adjust prevailing regulations to be more favorable to SSM/ASM and create a specific ministry structure to manage SSM/ASM.	Provide input to find mutually beneficial solutions to IGM	Coordinate members' inputs to support the change	Participate and provide inputs in formulating the regulation
Information dissemination	Disseminate the objective of program	Assist government in the program	Assist government in the program	Proactively clarify any unclear information to the authority
Formalization / legalization	<ul style="list-style-type: none"> Simplify legalization process, allocate WPR, ease access to IPR, monitor and supervise the program 	<ul style="list-style-type: none"> Relinquish part of concession for WPR, provide technical and management assistance 	Coordinate members to support the program	<ul style="list-style-type: none"> Participate in the program, cooperate with the companies
Law enforcement	Strict law enforcement on business-driven IGM actors, migrant miners, and unlawful law enforcement officials, politicians, and government officials	Provide information regarding unlawful government officials	Regularly coordinate with law enforcement authorities	Support the authorities on the program
Cooperation & Assistance	<ul style="list-style-type: none"> Facilitate corporate-ASM/IGM cooperation, provide access of ASM/IGM to financing 	<ul style="list-style-type: none"> Prioritize locals as business partners, provide financial & technical supports 	Coordinate joint efforts and resources between members	Participate actively and diligently
Multisector collaboration	<ul style="list-style-type: none"> Form Joint Management Board set clear objectives, provide area & permits 	Provide management and technical supports	Coordinate joint efforts across all members	Obey the collaboration agreement
Alternative livelihood	<ul style="list-style-type: none"> Control commodity price, ease investment on agricultural-based industries 	<ul style="list-style-type: none"> Assist marketing of local commodities, provide mentors and facilitators 	Assist in providing mentors from the members	Provide inputs on preferable and suitable fast-yielding programs.
Education & training	<ul style="list-style-type: none"> Provide higher education, provide training facilities and trainers 	<ul style="list-style-type: none"> Provide on the job training, higher education scholarship 	Coordinate the provision of access to members' facilities and resources	Participate actively

(Zvarivadza, 2018). Therefore, improving education and providing various training to the community will leverage their chances to access employment opportunities both locally and in the adjacent cities or develop rural income-generating activities other than IGM. In turn, it will reduce their involvement in illicit, risky, and uncertain IGM activities. In the long run, higher education will open broader opportunities for the younger generation to find higher-paying jobs with rewarding careers outside the area. However, formal education could not provide an immediate result, for which this measure is somehow less attractive to the impoverished community, hence have little success in the past. Specific life skill training, which could bring an immediate financial return, would be more suitable in the short term.

Learning from the failures of similar measures in the past, as shown in Table 1, this study offers more detailed implementation strategies in each of the programs, and it is essential to integrate all the measures which require all stakeholders' participation. Table 4 summarizes the proposed integrated approaches and the corresponding stakeholder's role in providing workable solutions to eradicate IGM.

CONCLUSION

This study reveals six groups of actors involved in IGM activities with different relationships. As the lower strata in the IGM structure, the miners mostly engage for substance needs (poverty-driven), while the other's engagement merely for profit-taking (business-driven).

Five key factors that make IGM challenging to

eradicate are rooted in the steady supply/demand of gold as a precious metal with a cash market. Eight categories of solutions emerged from this study that should be integrated and carried out continuously, and each group of stakeholders (the government, associations, industrial mining, and the IGM community) should contribute and play their roles in the integrated efforts.

The fundamental solution is the regulatory change, which will ease all the other efforts. The lawmakers should internalize the increasing demand for 'green gold' internationally into the regulatory, and policymakers should encourage the 'fair-trade gold' initiatives. The two trade-related factors will trigger clean and more environmentally friendly artisanal mining and processing, reducing the negative impacts on the environment and increasing impoverished miners' revenue.

However, regulatory change is a lengthy process and should pass through multi-layers lawmakers' approval. An intermediate solution, such as providing alternative livelihood, cooperation, and training, could be pursued while continuously pursuing more sustainable solutions through regulatory change and formalization. The critical success factors for these programs are the consistency of the program and continuous mentoring during implementation.

As a first step, it is recommended that the government initiate multi-stakeholder dialogues involving all stakeholders, including IGM communities, to define and agree on integrative and comprehensive solutions. All stakeholders, especially the government, mining associations, and companies, should support the initiatives and eradication approaches, with particular adaption based on the multi-stakeholder dialogues.

Besides, poverty alleviation initiatives targeting IGM communities are recommended, including training to improve their skills to increase formal employment chances or develop alternative income-generating activities.

Specific local legislation is required to facilitate cooperation or partnership between industrial mining and IGM communities. More importantly, the unlawful and corrupt authorities, including government officials, politicians, and law enforcement officials, must be disciplined by applying harsh law enforcement and strict sanctions.

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