FACT SHEET

30 November 2022

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Training and Practical Demonstration on Converting whole Amalgamation Process to Mercury-Free Technology Interventions Lessons Learned from GOLD-ISMIA Project

Background

Many case studies illustrates that technology solutions for ASGM suffer from a lack of adoption by artisanal and small-scale miners. The challenges include a lack of knowledge by the miners, lack of capital for new technology, and a lack of trust that the new solution delivers the promised results. These insight are an important lessons for the range of efforts and approach on the part of governments, international organizations, and civil society organizations, to promote the use of clean and efficient technology for ASGM. In addition, any effort and approach to change the alternative technological set-up for ASGM needs to consider how it may differentially affect the actors involved.

One of the Integrated Sound Management of Mercury in Indonesia's Artisanal and Small-scale gold mining (ISMIA) outcome is increasing capacity for mercury-free ASGM through provision of technical assistance and technology transfer which support to mercury reduction efforts and the adoption of alternative technologies to be cost-effective and sustainable. It becoming the challenge for the project to provide the target and considering other effort and approach on introducing alternative technology at 6 project sites since each of project site has their own habit on processing their ore, the differences on the ore characteristic, the access on the equipment and chemical purchase, the availability of chemical use.

Approaching Step

For achieving the target, project has conducted partnerships with training centers that already provide or could provide in the future, training on sound ASGM practices. The project make use of already existing training centers as demonstration and training sites which have already been established by the Ministry of Environment and Forestry, the Artisanal Gold Council (AGC), the Agency for Assessment and Implementation of Technology (BPPT; *Badan Pengkajian dan Penerapan Technology*). The availability of such installations represents excellent opportunities for using these training plants as model sites, train miners on location, extract and apply lessons learned and replicate successful practices and successes in the project's sites.

There are few aspects that the project could learn from this partnership with the existing training centers:

Point of interest	Lesson-learned
1. Equipment used	Miners not familiar with the equipment used on the facility. The energy supply facility is high cost
2. Chemical used	Miners not familiar with some of chemical used, difficult to find and to buy. (e.q glycerin on AGC facility)
3. The used of facility	The facility create of conflict between miners and local stakeholders due to unclear regulation mechanism for using it, unclear funding mechanism for using it.
4. Legality of the facility	Most of the facility positioned not in community mining area with no environmental permit provided.
5. Miners acceptance	Most of the miners hesitate to accept the facility and would not responsible for the sustainability of the facility.

Learning from the partnership with the existing processing plant, the project has conducted some strategies to avoid the similar situation with hoping that these strategies will be accepted by the miners, more

efficiency and effective for recovering the gold and sustainability.

A. Supporting mining communities in the adoption of alternative gold ore processing methods that utilize less or preferably no mercury through formalization.

The GOLD-ISMIA project encourages the formalization of ASGM which is considered as the first step towards reducing and eliminating mercury which is still widely used in the ASGM sector. Formalization is an action that shows high standardization of a task or position in an organization or group. In the ASGM sector, formalization is interpreted as an effort to improve ASGM sector governance so that it is in line with applicable laws and regulations in order to create responsible and sustainable ASGM. The formalization process creates more sustainable income opportunities and safer conditions. Formalization is important because it can provide access to formal financing to purchase more environmentally friendly ASGM technology.

Formalization efforts can be achieved if miners can access and study information, particularly regarding the requirements and procedures for applying for People's Mining Permits (IPR), mining business entities for applying for permits for establishment and business management in the ASGM sector, as well as plans for mercury-free gold processing and integrated waste management. according to environmental standards. Therefore, the Training of Trainers (TOT) was conducted in six locations of the GOLD-ISMIA Project using the ASGM Formalization Module that had been prepared previously by the project as training material.

The strategy to support is conducted through developing training module which the main target of this module is the ASGM community, especially miners who depend on the ASGM sector for their lives and livelihoods. This module aims to build miners' understanding of the general picture of ASGM in Indonesia. After developing the training module, then a training has been conducted in all 6 project site. The technique of training is delivered based on Training of Trainer model (a new participant gets to watch an experienced trainer teach, complete the exercises, and then practice teaching segments to other participants) where the representative of miners invited is designed as a trainers to other miners.

TOT Formalization in the Small Scale Gold Mining Sector (ASGM) aims to prepare cooperative and BUMDes administrators in the ASGM sector so that they can provide training for administrators and their members in aspects of ASGM formalization. Specifically, this TOT aims to provide an understanding of:

1. Procedures for establishing cooperatives and BUMDes in the ASGM sector;
2. Leadership in the ASGM sector;
3. Procedures for fighting for the rights of the ASGM community;
4. Procedures for applying for permits and operating processing facilities in the ASGM sector;
5. Mineral processing and waste management in the ASGM sector; and
6. Technical rules on People's Mining Permits

By the end of the TOT, the trained participants are expected to have sufficient skills and capabilities to convey the materials to the group members during the training replications. To begin with, the TOT participants are expected to meet the minimum requirements, as follows:

1. Preferably good at public speaking;
2. Have previous experience as trainer or facilitator or speaker in community level events;
3. At lease have basic skills/knowledge/understanding about facilitation and engagement of adult learners;
4. Familiar with ASGM local and national related topics, practices, and issues;
5. Familiar with adult learning methodology; and,
6. Available when needed as trainer (flexible).

Following this activity, the project continued to facilitate activity the miner's trainer to deliver the training module to other miners in their respective site. After completing the training, participants are expected to be able to convey information to their cooperative members and wider community. it is expected that miners will be able to disseminate it to others and make this module the main reference. This module can also be used by government and non-government agencies related to the ASGM sector, as a reference in working and providing assistance and guidance to communities in the ASGM sector.

B. Assessing existing processing method and newly developing processing method.

In Indonesia, the cyanidation techniques used by miners since the mid-2000s which introduced by Philippines miners. Since this time, the use of this techniques increasingly widespread across Indonesia. This technique is mimicking from industrial gold mining where the ASGM participants could adapt this techniques because of low tech and affordable by local investor with smaller and less intricate form. Estimated 90% of gold could be recovered by cyanidation and has dominated the gold industry due to its economic feasibility and technical simplicity as an easy to control process. This technique thereby suggesting a promising opportunity for reducing mercury use or the toxicological dangers of using cyanide in conjunction with mercury.

Among 6 project site, the use of cyanidation technique can be seen in 3 project site which are Minahasa Utara, Halmahera Selatan and Lombok Barat. Project has conducted assessing processing method in one of project site which is Minahasa Utara. The project intervention is assessing the factors that influence the leaching/processing of gold with cyanide, namely: processing pH, ore particle size, cyanide concentration (CN-), processing time, oxygen solubility (DO), solid percent of the slurry, temperature, and stirring. These factors are operating parameters as the key to success in the cyanidation process. Project has linked the intervention through scientific analysis. In addition, the project is also teaching the miners for waste management, particularly on reducing the CN concentration on the slurry after the processing is finished.

C. Involving women led enterprises.

It is important to note that gender issues also exist in the mining sector, which has so far been regarded as a masculine and gender neutral area. The important roles of women in the ASGM sector are not recognized as miners. In fact, the project identifies that the role of women is not only as a supporter, such as food and beverage sellers, providers of basic needs for miners, and cooks, but also as actors in activities in primary mining such as land owners, rock pounders, drum owners or cyanide barrels, sack washers, and involved in selling gold. Even women are the majority of secondary mining actors as gold panners.

Responding to the gender gap that occurs in the ASGM sector, project has isolated three strategies which are:

1. The gender gap in ASGM needs to be institutionalized in the stages of development, especially by the government related to ASGM management at various levels, through the Gender Mainstreaming (PUG/Pengarusutamaan Gender) strategy. The PUG strategy works by integrating the experiences, problems, aspirations and different needs of men and women into policy formulation, planning, budgeting, implementation, to monitoring and evaluation of development. This strategy is carried out by involving cross-sector considering the gap that occurs is a cross-cutting issue.
2. Recognition of women who are actively involved as actors in the gold mining process chain is an important upstream policy and affects the overall issue of gender gap in ASGM. Some women even carry out the processing around the house so that mercury exposure also affects family members. It is expected that the increased understanding of women in reducing mercury will decrease the exposure of community to mercury. Project is actively involving

women as an agent of transfer (champion) technology change from mercury to mercury-free used. The active role of women in technology and gold sales can expand and strengthen the technology transfer thus non-mercury gold sales chain.

3. Development of small-scale mining technology that is mercury-free and women friendly. Some miners already know that using cyanide is seen as safer than mercury, but poor waste treatment creates a bigger problem, especially in places where both mercury and cyanide are used together. Therefore, the development of non-mercury gold processing technology for ASGM needs is carried with technology that can be handled by both men and women. Developing micro-leaching tank is a great solution of women and technology where the size, the easy process and the ergonomic of the equipment is acceptable by the women miners.

D. Supporting the mining cooperative business.

The project has distributed a grant for 8 of Mining Cooperatives which already hold legality for mining and processing. The provision of this Low Value Grant (LVG) helps cooperatives in the procurement of mining support facilities for ASGM (Artisanal Small-Scale Gold Mining), to encourage mining cooperative to carry out mining activities in an environmentally friendly manner by reducing the use of mercury and to build their capacity to be better to be accessed to finance.

The Key Activities which had been conducted during the LVG period, are conducted as follows:

1. Strengthening the cooperative capacity for office and Mining Equipment Rental Premises. The fund allocation used to support the procurement office equipment and consumables office supplies thus the cooperative has fully operation in the new premises. This is including for training on the utility of using information technology and also training on office management system for increasing the capacity and capability of cooperative members.
2. Increasing the capacity Development for Cooperative Human Resources. The fund allocation used for the organizational development in order to comply with the professional standard of business entity. Some training have been conducted to achieve this target, such as : training on accounting and loan and savings reporting system; training on local corporate governance principles and Finance for members and managers; training on Computer's based for admin and office based on line reporting mechanism; training on Book keeping; and Training on management equipment using free mercury mining system.
3. Institutional Capacity Development. This fund used for increasing Institutional capacity, in terms of internal trainings for cooperative members and personnel to develop SOP, AD/ART good corporate governance principles, marketing strategic development and building networking, etc.
4. Strengthening the Cooperative capital. This fund used for capturing the opportunity in expanding the market segment in mining and potential local market and enhancing the micro credit for Cooperative members; Seed Capital to procure mercury-free processing plant.
5. Advocacy session / meeting with main stakeholders in mining and cooperative. The fund used for providing knowledge sharing on environmental friendly of mining to ASGM in their respective area.
6. Monitoring and Evaluation. The fund used for developing Guidelines for monitoring and evaluation of mining cooperative service standards to members and also developing Inventory list of equipment and its status through SOPs for management and cooperative members.

E. Replicating best practices.

Targeting the project objective which is increasing the capacity of mining communities for mercury-free ASGM through the provision of technical assistance and

technology transfer, the project must able to establish 1 mercury-free ore processing training plant and equipped 5 small mobile plant mercury-free gold ore processing plant. Ministry of Environment and Forestry and and National Agency for research and Innovation (BRIN previously know as BPPT - *Badan Pengkajian dan Penerapan Teknologi)* as our implementing partners have developed and established a mercury-free ore processing training plant in 7 provinces in Indonesia. It is expected that the project could adopt the Detail Engineering Detail (DED) of those gold processing plants for establishing project processing plant at project site. However, the IPs have not developed yet a prototype of the small-mobile plant. Thus, the project must be able to provide a prototype of small-mobile plant mercury-free gold processing equipment to be implemented to miners, particularly for the location like Hulawa Village where 100% of miners are still using the amalgamation system. This prototype is required to be designed in laboratory, built it and tested it directly to mining site, resulting a DED that can be adopted by miners in order to reduce mercury use.

The project has conducted a series of designing and re-designing a prototype of the small-mobile plant, building it and testing it directly to mining site with the final result of **micro-leaching tank**. This micro-leaching tank is scaling down the size of current cyanidation tank that used by miners, but using the same ingredient where most of the miners are familiar with: ore slurry, water, NaCN, active carbon and PbNO3. The introduction and testing of this micro-leaching tank have been conducted in 3 project sites with the results of the micro-leaching tank is can work to recover gold, affordable, equipment is easy to get locally, easy to assembly, can be replicated easily, and women miners also can operate it.

F. Modernizing equipment supply for increasing the gold recovery.

In 2 (two) project site, the project has increased the level of the mercury-free plant by modernizing equipment which is conducted for alluvial and primary ore. The selection of the equipment based on the request proposal from the miner cooperative which is supported by the local government and also local scientist for the technical and economical assessment of the selected equipment.

1. Shaking table then modernized with smelting technique for primary ore in Kulonprogo Regency.
   The mineralogical character of gold ore that can be processed using gravity technique also can be applied for the presence of very small grains. The presence of sulfides (pyrite, chalcopyrite, galena, and sparelyte) on ore in Kulonprogo will disrupt the gold extraction process if using cyanidation techniques. So miners choose to modernize the gravity method with smelting method. After the gold collected in concentrate form then the processing system is carried out using a scrubber which functions to capture the gas produced during the smelting process from the oxidation reaction of sulfide minerals in the form of SOx gas. Smelting technique can avoid the occurrence of gas pollution in the air. The gravity method followed by the smelting process do not use chemicals so that the waste produced is very safe for the environment. Thus its recommended that the gravity concentration followed by smelting (pyrometallurgy) has good potential to produce high gold recoveries in the management of gold processing in the Kulonprogo region.

2. Concentrate separation by traditional panning and modernized with shaking table for alluvial ore in Kuansing Regency.
   After collecting the concentrate through the sluice box, the miners use panning thus mercury for separating the gold grain. The design of the shaking table that must take into account the wishes and needs of the user/miners, in this case represented by the cooperative. The quality control and testing of equipment must using gold concentrate from the area. So the initial design and optimization of function and form of the shaking table design is truly in accordance with the characteristics of gold in Logas Village.

Designing and testing for the shaking table is conducted in workshop by using the miners concentrate which involving a series of testing to get confidence that the equipment can be accepted and can be used by miners thus sustainability:

1. Testing the shaking using 2,5K RPM machine, 5,0K RPM Machine and 7,5K RPM machine
2. Find the feedbox optimal design and avoid crack in the feedbox component
3. Testing material synthetic rubber (1st alternative)
4. Testing the shaking direction (1st alternative, using rail and wheel)
5. Testing the shaking direction (2nd alternative, using rail, wheel, and spring in the 6-vibration points)
6. Testing the shaking direction (3rd alternative, using rail, wheel, spring in the 6-vibration points capacity 2 Kg, 5 Kg pendulum in the 2 points)
7. Testing material synthetic rubber (2nd alternative: manual vulcanizing rubber)
8. Testing material synthetic rubber (3rd alternative: manual vulcanizing rubber carpet)
9. Design the sprayer (1st alternative: using micronozzle sprayer)
10. Testing water flowing film concentration (1st alternative)
11. Testing water flowing film concentration (2nd alternative)
12. Testing the table shaking using 1Kg ore concentrate to looking for the direction the water flow, sand and ore movement
13. Discuss the component change from synthetic rubber to PVC with epoxy coating or PVC engrave using a CNC Machine
14. The head of cooperative prefer PVC engrave using a CNC Machine than PVC with epoxy coating in the ripple and table
15. Approval drawing for the table and the ripple

G. Building the capacity mining communities in the use of mercury-free alternative technologies as well as the application of socially and environmentally sound ASGM practices.

The project developed guidance of Good Mining Practices for primary ore especially for ASGM sector while the current availability Good Mining Practices is refer to large scale mining activity which is can not be implemented for artisanal small scale activity. The content of this handbook is based on the condition of small-scale primary gold mining in Indonesia. This handbook focuses on the technical level of mining safety and environmental management. The benefits of this handbook should be seen as a complement to other national and international initiatives supporting small scale mining in Indonesia. There are several pilot projects underway in Indonesia, including aspects such as safe gold processing. The handbook content topic of:

- Good mining concepts and guidelines for small scale primary gold
- Concepts and guidelines for good processing for primary gold
- Details of the application of mining and processing techniques
- Reclamation and post mining

SUMMARY

During the project activity, its ensured that the trainings of the ASGM operators include practical demonstration of low efficiency of the whole ore amalgamation process and its consequences on profitability of the micro-miners' operations conducted based on the characteristic of each project site which their own habit on processing their ore, the differences on the ore characteristic, the access on the equipment and chemical purchase, the availability of chemical use, the capital availability. Considering the site and miners characteristic play a key role for sustainability of the equipment.

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