

Professionalizing ASGM processing in Mongolia

BACKGROUND

Mongolia's mining sector is dominated by the large-scale extraction of coal, copper, fluorite, gold, and iron ore. Gold is the main commodity mined on an artisanal and small-scale with 83% of the sector's workforce operating in 15 provinces out of 21 provinces in Mongolia making it an important livelihood activity across the country. (NSO 2021). An estimated 60,000 people directly engage in ASM in Mongolia, and approximately 240,000 are dependent on the sector for their livelihood.

The ASM was officially recognized by the State in 2010 with inclusions in the Minerals Law and approval of the ASM Regulation. Since then, there have been two revisions of the Regulation in 2017 and 2022 reflecting the ongoing needs and changes in the ASM sector. ASM gold processing is heavily regulated with more than 40 official documents required. The application and approval process for these documents is lengthy and costly, which exacerbates the informality of the sector. As of 2023, there are only two processing plants with proper operational permits in the whole country. Furthermore, this contributes to the lack of availability of processing facilities which drives the miners to use banned chemical substances such as mercury.

The planetGOLD project has estimated around 12 processing plants operating in the country with various levels of operations and equipment.

Then the project team chose a collaborative approach to partner with an existing processing plant which offers the opportunity to test another model for the implementation of mercury-free technologies in the ASGM sector.

Through a competitive selection process, the project selected the two ASGM processing facilities to introduce mercury-free processing systems (MFPS), with consideration of the criteria including availability of ore resources, existing infrastructure, production capacity, formalization, potential ASGM beneficiaries and willingness to work responsibly and sustainably with the project.

In addition to the MFPS, the project sees an opportunity to promote the formalization of plant operations by supporting the acquisition of missing permits, as well as to implement due diligence standards in extraction, processing and trading of the mineral.

TECHNOLOGY DEPLOYED

In order to identify environmentally friendly and clean technologies adapted to the local condition, the planetGOLD project conducted extensive research and laboratory tests on the ore reserves, ore grade, the existing technologies and equipment, and the latest gold recovery methods in the ASGM sector.

Common challenges faced by ASGM processing plants in Mongolia

-  Inefficient traditional gravimetric technologies for gold recovery
-  Outdated and handmade equipment
-  Heavy restrictions on leaching technology permit
-  Insufficient mineral processing and technical knowledge
-  Difficulties in obtaining operational permits

Flotation and gravimetric laboratory experiment were conducted with representative ore sampled from ASGM sites. Based on research the new processing system is designed as 100% gravimetric technology without using any chemicals and has the capacity to concentrate 3 (MFPS-1)-5 (MFPS-2) metric tons of hard rock gold deposit ore per day.

Based on the results and implementation viability within the project timeline, the planetGOLD project decided to introduce an enhanced gravity processing circuit that will increase the gold recovery rate and production. The new systems are designed as 100% gravimetric technology without using any chemicals with capacities to process a total of 8 metric tons of ore per day.

Table 1: Recovery rates of the experiment

Processing equipment	Recovery rate
Froth flotation	39.7%
Centrifugal concentrator	57.1%
Shaking table	64.4%

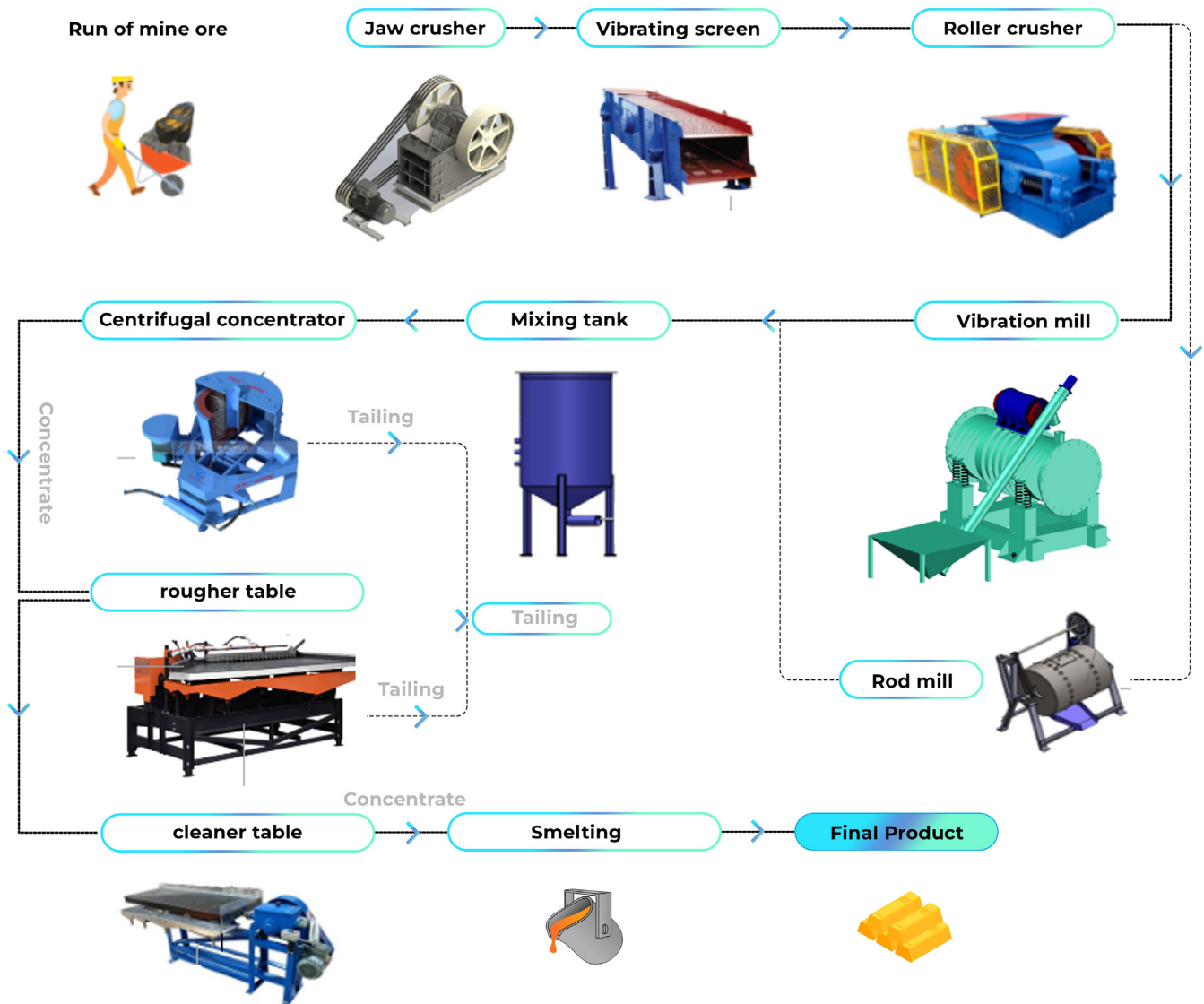


Figure 1: planetGOLD MFPS simplified diagram

The key equipment in determining the processing capacity is a grinding mill as it is the most time-consuming part in the processing cycle. Therefore, the planetGOLD project introduced a dry grinding vibration mill for the first MFPS and ball mill for the second MFPS to improve gold particle liberation rate by both of dry and wet grinding and to compare efficiency of the mills. Current recovery rate is 30-50% using wet pan mill and sluice. The planetGOLD circuit is projected to recover 60-70% of total gold.

Table 2: Key parameters for planetGOLD Mongolia MFPSs

Key parameters	MFPS-1	MFPS-2
Capacity	3 tonnes of gold ore per day	5 tonnes of gold ore per day
Raw ore gold grade	16.74 g/t	28.8 g/t
Expected recovery rate	60-70%	60-70%
Expected gold production	30-35 grams	86.4-100.8 grams

The tailings management facility will act as a holding cell for gravimetric tailings that will contain upwards of 30-40% of the total gold. This is because the gravimetric system is limited to only recovering free gold, so further gold recovery can only be achieved by using additional mineral processing technologies involving chemicals such as leaching or flotation. The “tailings” are therefore not final waste material and must be treated as a material of value. This low-medium grade material will be stockpiled until a suitable solution is arranged, such as an off-site processing at a third-party cyanidation facility.

The planetGOLD project estimates the total cost for both MFPSs to be USD 350,000. This includes manufacturing, import, taxation, as well as construction and infrastructure development. High logistics cost as a landlocked country and construction cost for the harsh winter climate are key factors behind the high cost. The onerous permitting process increases the cost further.

TECHNICAL TRAINING AND DISSEMINATION

The planetGOLD project conducted operations and maintenance trainings during the installation and commissioning of the MFPS to familiarize the participants with equipment assembly and functions. All staff of the processing plants who will operate and the miners who will be served by the MFPS took part in the training. The training was conducted in the form of on-the-job training where the participants learned to assemble and install the equipment in a proper and reliable way to ensure their own safety.



Figure 2. On-site training on rod mill and shaking table

The training imparted knowledge and skills on preventive maintenance schedule making, equipment maintenance and operation procedures, and the safety of the work environment whereas the online part delivered about the smelting system, fluxes, basic operating principles, and grinding efficiency as well. The importance of safety, operational procedures, and record keeping such as maintenance logs were reemphasized to the trainees who recognized and embraced the value of these principles. The project plans to conduct regular training as a refresher course every 3-6 months to ensure the safe operation of MFPS technologies. Furthermore, the project will develop a manual on operational procedures for the MFPSs, equipment inspection sheets, and a regular maintenance book.

PHOTO GALLERY



Figure 3. Progress of installation, testing, and on-site training

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