

**Research Article**

**Socio economic impacts and policy of artisanal small-scale gold mining in relation to sustainable agriculture: a case study at Sekotong of West Lombok**

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**Abstract:** Artisanal and small scale gold mining (ASGM) activities at Sekotong Sub District, West Lombok District, West Nusa Tenggara which use a traditional system have been operating since 2008. The objectives of this study were to analyze the socio-economic impacts of ASGM, to know the policy on ASGM in West Lombok Regency, and to formulate the policy recommendations of sustainable agricultural management which consider the ASGM activities. This study was conducted at Batu Putih and Pelangan villages of the Sekotong sub District which was chosen purposively. The research method was a case study with survey by interviewing 30 farmers with miners that were selected by a simple random sampling and field observation. A policy study was also used by interviewing key informants from many stakeholders. The results showed that ASGM activities at Sekotong improved the income of farmers/miners and created job opportunities. From the average, the ASGM mining contributed 76.01 % of farmers/miners income, while the farming incomes was 23.99 % of total income. In 2011, West Lombok local government issued a regional regulation through a decree number 1102A/480A/Distamben/2011 about The Determination of the Artisanal Mining Area. But, after the Law of Republic Indonesia Number 23/2014 on Regional Government, the authority to give the artisanal mining permit is the Provincial Government. In terms of economics, the ASGM activities supported the agricultural sustainability. However, the environmental impact of it activities needs to be addressed with technologies which are economically viable and environmentally sound such as phytoremediation.

**Keywords:** *artisanal gold mining policy, ASGM, Indonesia, pertambangan rakyat*

**Introduction**

In many developing countries, artisanal and small-scale mining (ASM) has been widely played an important role in reducing poverty and supporting economic sector also rural development. Based on the survey by ILO (International Labor Organization) and MMSD (Mining, Mineral and Sustainable Development), it was estimated that 13 million people around the world from 30 developing countries directly involved in the ASM. Almost 80 to 100 million people in developing countries depend on ASM (Hentschel et al., 2002). The increasing of global demand metals and other industrial raw material has increased mining activities throughout the world in recent years (Isahak et al., 2013). Artisanal

small-scale gold mining (ASGM) accounts for around 50 % of the world's artisanal and small scale mining (ASM) (Anderson, 2013). ASM included ASGM often have a negative impact on the environment and also often have serious consequences for the health and safety of workers and the community. One of the reasons is the lack of government laws and the government program against artisanal mining activities. ASGM has been a concern in many countries in the world.

The meaning of artisanal and small-scale mining is the mining by individuals, groups, families or cooperatives with minimal or no mechanisation, often in the informal sector (Hentschel et al., 2002). But, a common definition of ASM has yet to be established. In some

countries “artisanal mining” mean that is purely manual and on a very small scale, and “small-scale mining” that is more mechanised and on a larger scale (Hentschel et al., 2002). Artisanal mining describes an informal and unregulated system of small-scale mining (Utomo et al., 2014). It practiced in many developing countries of Africa, Asia also Central and South America. Artisanal miners do not make large profits, they struggle to make sufficient money to support their family (Anderson, 2013).

In Indonesia, artisanal small scale mining (*pertambangan rakyat*) is regulated in The Law of Mineral and Coal (UU Number 4/2009). As the implementation guidance for the law above, Indonesia Government is issued The Indonesian Government Regulation No. 22/2010 about the Mining Area. Refer to that regulation, artisanal mining has to get ASM area or *Wilayah Pertambangan Rakyat* (WPR). The authority for giving WPR is in the regional government on district (*kabupaten/kota*). However, the implementation of that regulation is still have many problems especially on ASGM. In fact, majority of artisanal gold mining in Indonesia is still not be regulated yet.

Indonesia is the largest archipelago in the world that is located between the Indian and the Pacific oceans. Indonesia has many mountains and rich in natural resources such as mineral resources. One of the valuable mineral resource discovered in Indonesia is a precious gold. Indonesia is known as one of the main gold producers in the world (Utomo et al., 2014). According to Lamare (2013), there are 90 countries currently digging for the precious gold metal. However, 75% of the total gold production is still produced by just 20 countries. Indonesia has rank to 8 in the worlds with the official gold holdings amounted to 73.1 tons. Indonesia's total gold reserves are estimated at 3,000 tons.

Indonesia is considered as one of main locations for artisanal and small gold mining activities (ASGM). Artisanal gold mining in Indonesia has begun since several hundred years ago in which most of the miners are farmers who wait for their agricultural harvest time by mining gold in river's stream nearby (Chamid et al., 2012). Nowadays, artisanal gold miners are driven by poverty then induce significant social and environmental issues (Chamid et al., 2012). In Indonesia, in the last 5 years the amount of artisanal gold mining spots increases doubled. In 2010, there were about 900 hotspots with 250,000 miners, including women and children, and more than 1 million people are dependent on this sector (Ismawati, 2010). Indonesia has a significant ASGM industry, defined as any informal and

unregulated system of gold mining (Anderson, 2013). One of ASGM sites is located in Sekotong Sub District, West Lombok District, West Nusa Tenggara Province.

Gold is a non-renewable resources, so that the continuous mining will lead this natural resources to be exhausted. Gold mining in Indonesia, especially in the large scale has done by many large companies which are commonly a foreign companies. Therefore, Indonesia only gets a little benefit from the mining activities, while the majority of benefit is taken over by the foreign company. However, beyond the abundant natural resources, poverty and unemployment are still problems in Indonesia.

Access of the poor towards land resources or other resources are very limited. The agricultural sector is still a major sector for working opportunity, that is amounted to 35,09 % for all people working (Indonesia Agricultural Census by BPS in 2013). However, the number of small farmers (less than 0,5 hectare of land ownership) by Indonesia agricultural census in 2013 was amounted to 14,25 million households or 55,33 % from total agricultural households with land. Many issues that include poverty, unemployment and limited access to resources are important issues that must be considered. That is one of the reasons why many people try to increase their income though artisanal mining activities.

In West Lombok regency, gold and silver artisanal mining activities have been operating since 2008. It started from Sekotong Sub District, then ASGM has been done in many places of Lombok and Sumbawa Islands (Krisnayanti et al., 2012). Based on preliminary studies it is known that artisanal gold mining in Sekotong is done by simple technologies, so it has a high risk for mining workers. ASGM at Sekotong is an informal and unregulated system on gold mining that doing by traditionally miners. Gold recovery is done through two processing steps i.e. amalgamation with mercury (Hg) and cyanidation.

Activity of artisanal gold mining at Sekotong is conducted traditionally, by digging up vertically about 30 meters and horizontally. Gold extracting is processed by using technology of amalgamation with Hg. This process is called as “*gelondong*”. Residual mud from this process is usually re-processed through cyanidation, which is called “*tong*”. Residual mud from this process is discharged into agricultural land around the site, thus it pollutes the land. The use of mercury can endanger miners health and pollute the environment.

The artisanal gold mining activities be expected can reduce poverty. However, ASGM

activities also have social and economic problems in the community. The arrival of migrants labour from many regions in Indonesia cause social consequences. The other problems on ASGM activities are the legality aspect, safety issues and environmental issues. Therefore, the socio-economics impact and policy of ASGM study are needed.

The objectives of the study were to analyze the socio-economic impacts of artisanal small-scale gold mining, to know the policy on ASGM in West Lombok Regency, and to formulate the policy recommendations of sustainable agricultural management which considers the artisanal gold mining activities.

## **Methods**

The research location was at Sekotong Sub-District, West Lombok District, West Nusa Tenggara Province, Indonesia which was determined purposively. From all the villages in the Sekotong Sub District, two villages were selected, i.e. Batu Putih and Pelangan Village which have the major of miners.

This research used primary and secondary data. The research method used for this study was a case study with survey. This method used in-depth interviews and field observation techniques. A policy study was also used in this study by interviewing key informants from many stakeholders that are “*Dinas Pertambangan Kabupaten Lombok Barat*” (The Mining Agency), “*Dinas Kehutanan Kabupaten Lombok Barat*” (Forestry Agency), “*Dinas Pertanian Kabupaten Lombok Barat*” (Agriculture Agency), “*BAPPEDA Kabupaten Lombok Barat*” (Regional Development Planning Agency) and “*Badan Pusat Statistik Kabupaten Lombok Barat*” (Statistical Agency).

For the purposes of the survey, 30 farmers with miners were randomly selected by a simple random sampling method as respondents. Most of the artisanal miners at the location were farmers. The interview was conducted using questionnaires. All of the survey was done in 2012, then the policy study doing again in 2016. Variables collected during this study were artisanal small-scale gold mining activity, cost and revenue from artisanal mining activities, cost and revenue from agricultural activities, constraints in their activities at artisanal gold mining and agricultural and their wishing also other socio-economic aspects. Descriptive analysis was used to describe the socio-economic impacts of artisanal small scale gold mining at the research area and the policy in West Lombok.

## **Results and Discussion**

### ***Socio-economic Impacts of Artisanal and Small-scale Gold Mining (ASGM)***

The positive social impact of ASGM at Sekotong was the creation of employment and job opportunities that could reduce poverty. The job opportunities in ASGM were on gold mining directly that was commonly in forest land, carrying rocks containing gold by sack to the processors who ground the rock with water in simple rocks grinders (*gelondong*) that were located at around the peoples house, crushing the gold stones, gold processing by amalgamation process (*gelondong*) and cyanidation process (*tong*), also in gold marketing. The ASGM also created business opportunities especially on “*gelondong*” and “*tong*” technologies that the miners paid to the rock grinders or gold processor. The other social impacts of ASGM were the limited knowledge and capital of miners and the incoming miners from other regions with various culture. The limited capital of miners made them to depend on the other persons having capital or money to operate ASGM. Many of miners like this just got a small benefit from their mining activities. The incoming miners from other regions with various culture often caused cultural changes. The economic impact of Artisanal Gold Mining practices at the Sekotong Sub-district was the increase of income. The ASGM also created economics multiplier effect on local community, as ASGM activities encouraged the local economic growth through the increase of people’s purchasing power because of their increased income from ASGM activities and related business. The people received an improvement on their welfare after this mining activity was implemented. This was indicated by improvement on housing quality, increasing number of motors and other assets owned by the people.

From the survey, it is known that the average farming income of farmer/miner respondents who cultivated 0.86 ha farm land was IDR 13,053,647/year, with the planting pattern of rice crop at the rainy season with rice farming income amount IDR 3,141,755/crop season and other food crops are maize amount IDR 3,837,682/crop season and peanut amount IDR 6,074,210/crop season) at the dry season (Table 1). Peanut had the highest farming income because it had the lowest farming cost.

From the artisanal gold mining activities they got income amount of IDR 4,136,667/month/person on average. They did gold mining by groups, with the total cost amount of IDR 22,080,000/month/group that covering labour cost, transport cost from mining site to the

“gelondong” processing sites, “gelondong” cost (amalgamation) and mercury cost. They got 20 sack (about 20 kg/sack) of rock per month per group on average. They used 0.5 kg of mercury per sack of rock, with the price of IDR 1,700,000/kg, so that mercury was the highest cost. The miners got 6.7 gram of gold per sack of rock on average, or 134 gram gold/month/group. The miners got revenue IDR 46,900,000/month/groups or gold mining income amount IDR 24,820,000/month/groups. With 6 members per group on average, so the income was IDR 4,136,667.month/person, or IDR 41,366,670 /person/year with 10 month working per year, or

per household/year (Table 2). It means that the farmers/miners got added income from artisanal gold mining. . So we can see that the income of farming activity contributed 23.99% of the total income of IDR 54.420.314 per year, while the income of artisanal mining contributed 76.01% of total income per year (Table 3). According to the review above, we can see that, from the economic aspect, the artisanal gold mining activity increased the household income. Economically, ASGM supported agriculture through the added income so that they had more capital for supporting agricultural cost of production.

Table 1. The average of ASGM revenue and cost at Sekotong, West Lombok

	Unit	Quantity (unit)	Price/ Unit	Total of money (IDR)
<b>Variable Cost</b>				
Labour	person	72	50,000	3,600,000
Transport	person	72	15,000	1,080,000
Mercury	Kg	10	1,700,000	17,000,000
Gelondong	sack	20	20,000	400,000
<b>Total Cost</b>				<b>22,080,000</b>
<b>Production</b>				
The amount of rock	sack	20		
Gold production/ sack	gram	6.7		
Total Gold revenue	gram	134	350,000	46,900,000
Gold income/ month (6 person)				24,820,000
Gold income/ month/ person				4,136,667
Income/miner/year (10 month working)				41,366,670

Table 2. The Average of Farming Income at Sekotong. West Lombok (land size= 0.86 hectare/household)

Commodity	Total Revenue (IDR)	Total Cost (IDR)	Farming Income (IDR/ household)
Rice	8,613,333	5,471,579	3,141,755
Maize	5,888,333	2,050,651	3,837,682
Peanut	6,996,667	922,457	6,074,210
Total Farming Income			13,053,647

Table 3. The average of farmers/miners income per year at Sekotong, West Lombok

Sources of Income	Income (IDR/year)	%
Agriculture (the average of agriculture land size= 0,86 ha/hh)	13,053,647	23.99
Artisanal Gold Mining (the income per farmer/miner)	41,366,667	76.01
Total Income/ household	54,420,314	100.00

**Policy on ASM in Indonesia and West Lombok Regency**

Legality aspect in Indonesia, which is UU Number 4 year 2009 (The Law of Republic Indonesia on Mineral and Coal) regulates mineral

and coal mining included artisanal small scale mining activity. Chapter 5 UU Number 4/2009 regulates about the mining area (section 1- 4). Section 1, article 9 states that mining area (*Wilayah Pertambangan*, WP) as part of a

national spatial planning is the basis for the determination of mining activities (paragraph 1). WP referred to in paragraph (1) should be determined by the Government after coordinating with regional governments and consulting with the House of Representatives of the Republic of Indonesia (DPR RI). Then, article 13 explains that the mining area (WP) consists of business mining area (*Wilayah Usaha Pertambangan* = WUP), artisanal small scale mining area (*Wilayah Pertambangan Rakyat* = WPR) and state mining area (*Wilayah Pertambangan Negara* = WPN).

The Artisanal small scale mining area (WPR) is declared in section 3 of UU Number 4/2009, on article 20-26. Article 20 states that the artisanal mining activity is held in an WPR. Then, article 21 explains that WPR is determined by regional government after consulting with Regional Representative Council (DPRD). The criteria to determine the WPR is stated on Article 22. The further clause regarding the guidelines, procedures, and WPR setting are regulated by government regulation (Article 25). Article 26 states that the criteria and mechanism for setting WPR is regulated by regional regulation.

Furthermore, UU Number 4/2009 regulates artisanal small scale mining license (*Ijin Pertambangan Rakyat* = IPR) on section 4. The Head of District (*Bupati/Walikota*) gives IPR primarily to local residents, both individual and community groups and/or cooperatives (Article 66). IPR holder has the rights and the obligations. The IPR holder has the rights to get guidance and supervision on health and safety working, the environment, technical mining, and management from regional government, and to get capital aid as applicable regulation (Article 69). The obligations of the IPR rights are to do mining activity at least 3 months after the IPR is issued, to meet the regulation on health and safety working, do environment management as environment standards, manage environment with the regional government, pay the contribution, and give the mining activity report to who gave the IPR (article 70).

Indonesian government also issued The Indonesian Government Regulation No. 22/2010 about the Mining Area, as the implementation guidance for The Law of Mineral and Coal. Referring to the regulation, the authority for giving WPR is in the regional government on district (*kabupaten/kota*). The districts set the WPR based on the criteria in the regulation, after coordinating with the provincial governments and consult to the Regional Representatives Council (*Dewan Perwakilan Rakyat Daerah*).

In the case in West Lombok District, the number of artisanal and small scale gold miners is

difficult to quantify because it was an informal mining activity. Based on information from the local government, in 2012 there were about 3,000 artisanal and small-scale gold miners who came from the local community as well as from outside the area. However, the number of miners was lower than in 2008 to 2010. In 2016 the number of miners in West Lombok regency including in Sekotong decreased.

Based on spatial plans or RTRW (*Rencana Tata Ruang Wilayah*) of West Lombok District, Sekotong Sub District has four priority areas, those are for fisheries and marine, mining, tourism, and agriculture, livestock and forestry. In relation to mining regulation, West Lombok District Government has issued The Mineral and Coal Mining Management (West Lombok District Government Regulation (*Peraturan Daerah*) Number 6 year 2010). Then, it is revised by The West Lombok District Regulation Number 6/2012 on "Changes in West Lombok District Regulation No. 6/2010 on Mineral and Coal Mining Management". In Chapter VI for the regulation number 6/2012 regulates about artisanal small scale mining. Section 1 regulates about artisanal small scale area (WPR), and section 2 regulates about artisanal small scale permit (*Ijin Pertambangan Rakyat* = IPR) giving. WPR is assigned by The Regional Government Leader (*Bupati*) after consulting to the Regional Representatives Council (DPRD), with some of criteria (Article 12). Article 13 states that ASM permit (IPR) giving from *Bupati* based on request from local people, either individually or community groups and/or cooperatives. The IPR is given after the WPR has determined by *Bupati*. Each ASM business can be carried out if they get the IPR, and the regulation about IPR giving further is regulated by *Bupati* Regulation (Article 13).

West Lombok District Government has given permission to two large companies to undertake the gold mining at Sekotong. The companies were PT Indotan Inc. Perkasa and PT Bintang Bulaeng. PT Indotan Inc. is a foreign capital company (*Penanaman modal asing* or PMA), which later changed to PT Indotan Lombok Barat Bangkit which the regional administration is given the opportunity to be part of the mining business with a given share of 10%. The permit to large company made community concerns, and often causes conflicts in society. After going through a long process, finally PT Indotan which at the time controlled mining licenses covering an area of 10,088 hectares for the Sekotong Sub District gave some areas of mining to artisanal and small-scale mining area. PT Indotan Lombok Barat Bangkit has mining

area of 56,670 hectare in West Lombok, Central Lombok and East Lombok.

In 2011, West Lombok Regional Government issued a regional regulation through a Decree number 1102A/480A/Distamben/2011 about The Determination of the Artisanal Small scale Mining Area. WPR assigned of 1,247 hectare consist of *Blok Simba* covering 705 hectare and *Blok Lemer* covering 542 hectare. Furthermore, the WPR determination must be coordinated with the Forestry Agency of West Lombok, to apply for a permit leasing of forest area. The Forest Agency will see whether the areas designated as the protected forest or not. Based on information from the Head of Forestry Agency of West Lombok, some WPR that set by the West Lombok District is at the protected forest. So that could be granted an area of WPR approximately 750 hectares. Based on Forestry Minister Regulation no. 18/2010 to issue permits leasing forest area should be a recommendation from the Governor. At the time of the study is awaiting a recommendation from the Governor of West Nusa Tenggara.

The very long and not an easy process and efforts, also the West Lombok Government regulation on ASM, determination for ASM area and ASM permit in West Lombok are highly appreciated. However, after the Law of Republic Indonesia Number 23/2014 on Regional Government, the authority to give the mining right permission is the Provincial Government. The West Nusa Tenggara Province has issued The Regional Regulation of West Nusa Tenggara Province Number 4/2012 about The Mineral and Coal Mining Management. This regulation regulate the mineral and coal mining in general, but is not especially section on ASM. Therefore, the ASGM activity in West Lombok are informal until now.

#### ***ASGM in relation to sustainable agriculture***

In the case of ASGM, one of the impacts of artisanal and small scale gold mining is the use of the hazardous chemicals which is mercury (Hg). The use of mercury as an ingredient for binding and separating ore from sand, mud and water which not managed well will cause disadvantages both for the miner and the environment. The residual sludge in the form of tailings containing Gold-Hg amalgam was discharged into agriculture land around the mining area (Sanchayaningsih et al., 2009, Utomo et al., 2014, Indraningsih et al., 2016). Generally, the sludge discharged along the rivers and contaminated the water with the hazardous and polluted material (Limbong et al., 2003) whereas farmers used the water for

irrigation. The use of mercury as amalgamation material is the most commonly method used by traditional gold miners. This technique is widely used because it is effective, easy, inexpensive and fairly availability of mercury in the market (Krisnayanti et al., 2012). Waste from the gold recovering process is discharged to the agricultural land around the site. Hg contamination on agriculture land can affect the growth of plants.

In the relation to sustainable agriculture, the environmental impact of ASGM must be addressed. According to the SEARCA (1995), the criteria of sustainable agriculture are agricultural system that are economically viable, ecologically sound and friendly, socially just and culturally appropriate also as a holistic approach. On the ASGM case, environmentally, a technology is needed to support the sustainable exploitation of gold in locations where ASGM is practiced. This technology is must be simple, cheap and easy to operate (Anderson, 2013). There is a technology as known as “phytoremediation” that in situ rehabilitation by means of vegetative growing, it is the most appropriate technology for rehabilitation of degraded land that is caused by ASGM activity (Utomo et al., 2014). This technology is relatively easy, low cost, low maintenance and reduced impact on the environment (Anderson, 2013; Utomo et al., 2014). As reported by Utomo et al., 2014, there were 6 indigeneous plant species which have a good prospect for Hg clearance of tailing contaminated soil at Sekotong, Lombok, i.e. *Cyperus kyllingia* Endl., *Dracontomelon dao* (Blanco) Merr., *Duabanga moluccana* Blum., *Erythrina orientalis* L., *Eugenia subglauca* Koord. & Valetton. *Lindernia crustacea* (L.) F., *Paraserianthes falcataria* (L.) Nielsen., and *Paspalum conjugatum* L.

Economically, ASGM can support agricultural sustainability. The farmers with miners have more income from mining activities, so they will have more money to cover the cost of agriculture production. But from the social aspect, especially in the case in labour, ASGM reduced labour availability for agriculture because they work on mining. Farmers at Sekotong are usually cultivate many crops such as rice, maize, and nuts, where rice is the dominant crop at the location. Based on reports of Adiputra et al. (2014), factors that affected labour usage in rice farming at Sekotong were the level of education, labour costs, and number of family. Considering that farmers often used family members in farming activities, so the job opportunity at gold mining could reduce the number of agricultural labour.

The number of labour which work in agriculture would then affect the crops production.

## **Conclusion**

Activity of artisanal and small-scale gold mining at Sekotong has been operating since 2008. It has increased the income and social welfare also created job opportunities. In 2011, The Regional Government of West Lombok issued a regulation which regulates the Artisanal Mining Area and set the ASM area, but it is still waiting for the permission letter from Department of Forestry for using forestry area. However, after the Law No. 23/2014 on Regional Government, the authority to give the mining right permission is the Provincial Government. The Regional Regulation of West Nusa Tenggara Province Number 4/2012 about The Mineral and Coal Mining Management is not especially section on ASM. So that, the ASGM activity in West Lombok are still informally. Gold processing that happened during this research used mercury to separate the gold from the mud that did not lead to a worst disaster on surrounded environment. Thus, agricultural activities are still sustainable to hold. ASGM supported agriculture sustainability from economic aspect. However, the impact on environment of this gold mining activity should be resolved by the new technologies that are friendly toward the nature such as phytoremediation with many indigeneous plants species.

## **Policy Recommendation**

The policy recommendations from this research are as follows:

1. The Regional Government (West Nusa Tenggara Province) should regulate the artisanal and small-scale gold mining by the regional regulation including artisanal and small-scale mining area (*Wilayah Pertambangan Rakyat*) regulation and Artisanal Mining Permit (*Ijin Pertambangan Rakyat*). The decision to issue a permission letter to the artisanal and small-scale miners, should be transparent and considering about artisanal interest, especially for people who live around the mining sites.
2. Remediation efforts on mercury-polluted land are recommended to implement for supporting the sustainability of agricultural activity, using a simple and cheap method, like phytoremediation (the use of plants as media for remediation).
3. In order to improve agriculture sector, it needs to diversify the business, such as

combining farming with animal husbandry. The important of this effort is regarding the fact that gold is an un-renewable resource and it will be exhausted someday. Thus, it needs a good management to develop businesses that use renewable resources, like agriculture, husbandry, fishery, and tourism.

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