

SUSTAINABLE TRADITIONAL GOLD-MINING MANAGEMENT IN BANYUMAS, CENTRAL JAVA, INDONESIA

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Abstract

Traditional gold mining in Banyumas is part of other traditional gold mining in Indonesia. They grow and develop without planning, calculation, evaluation even permission from the government. The purpose of this study is to create a program of sustainability mining management. So that it is not highly risks for people and the environment. The method used in this study is qualitative and quantitative. Analysis method was used SWOT analysis and Analytical Hierarchy Process. The results of the study that the condition of existing gold mining in Banyumas is not friendly to the environment and is not based on the principle of sustainability development. This research produces a program for traditional gold mining management. that stems from the principle of sustainability. It takes into account of social, ecological, economic aspects.

Keywords: Management; Sustainable; Traditional; Gold mining; Banyumas Indonesia

Introduction

People's gold mining in Indonesia in 2001 has reached 60,000 people. But for now it must have been much more than the data above. In the reform era, the growth of traditional gold mining rose very rapidly [1]. This can be seen from the number of hotspots of small scale miners (SSM). In 2011 *Y. Ismawati* [2] said that in Indonesia SSM has doubled in the last six years due to the high price of gold.

Illegal mining activities are destructive of nature [3, 4] because they do not pay attention to environmental impacts due to changes in the landscape and mercury wastes in the processing of gold ore which have a tremendous impact on public health. If mercury wastes contaminate springs then in the long term there will be many diseases and genetic quality declines that are permanent. The Kompas Daily News showed that signs of mercury poisoning have been found in three regions of Indonesia, including Bombana in Southeast Sulawesi, Sekotong in West Lombok, and Cisitu in Banten.

Now emerging miners are not only from local residents but also from outside the region. Currently gold mining in Banyumas is concentrated in Paningkaban Village 59 holes and Cihonje Village 35 holes with miner number around 1500 people [5]. The local government of Banyumas Regency has conducted a study that provides an overview of the potential of mining commodities in the region. Potentials that have been identified, among others, consist of many very valuable resources. Especially for the gold mining potential which is a soft and malleable metal, its hardness ranges from 2.5 to 3 (Mohs scale), as well as its specific gravity depending

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on the type and content of other metals combined with it. Gold can be obtained in District Gumelar and Lumbir with reserves of 9.47 tons [5].

Gold mining is one of the activities that clearly have the potential to influence the society and the environment both on biotic, abiotic and social components. It is generally known that mining activities are classified as activities that directly extract natural resources which are then processed in a process that is not simple, even using chemical components. It is very potential once will pollute and damage the environment so that the sustainability of environmental functions will be disrupted. On the other hand that Law No. 32 of 2009 [6] provides guidelines that activities should be oriented towards sustainable development.

Based on that condition, the community of gold mining needs to be systematically and coordinately handled seriously in an activity program undertaken in order to provide guidance to community miners through the Small Scale Mining Model. Besides, it is also needed a concept of management/exploitation of gold mine (mine of the people) and the concept of arrangement of mining area that can anticipate the development of mining industry in the future [7].

Research Methods

The method used in this study is a combined method of qualitative and quantitative method [8]. The informants of this research are gold mining stakeholders that include miners, community leaders, environmental academics, mining experts, local government institutions, NGOs and legislatures. Specific research methods are qualitative in nature such as interviews, sometimes quantitative dimensions and data obtained can be analyzed by various methods including quantitative methods [9]. Qualitative analysis by interactive method and strength [10], weakness, opportunity and threat (SWOT) analysis. The quantitative analysis was Analytical Hierarchy Process (AHP).

Result and Discussion

SWOT analysis is a qualitative analysis used to identify various factors systematically to create a model that takes into account the strategy of an activity. This analysis is based on logic that can maximize the strengths and opportunities of an activity, which simultaneously can minimize weaknesses and threats [11]. The impact of gold mining on local communities is analyzed by SWOT analysis, can be classified into external factors (opportunities and threats) or can be said to impact directly. On the other hand, the impact is indirectly classified into internal factors (strengths and weaknesses). Both of these factors have a positive impact that stems from opportunities and strengths and negative impacts that come from threats and weaknesses.

Identification of Internal and External Factors

Internal and external factors need to be described in advance the meaning contained in this research. Internal factors consisting of strengths and weaknesses are translated into several items. Similarly, external factors consisting of opportunities and threats also consist of each item.

a. Strengths

The description of each strategic factor as a component of strength is as follows:

1. **The content of gold.** Content of gold in the natural resources of Gumelar District, especially in the village of Paningkaban and Cihonje is the location where the land has a proven gold content with the number of existing mining. There are and know the gold content in the two villages since 1997. Started from the study of corporate

explorative obtained permission from the center it is known that in the area of the district Gumelar indeed contain gold estimated at 9.47 tons [12]. This gold content is specific natural resources, because not every region contains gold content. Therefore, the gold content can be a source of emergence of mining activities both traditionally and modernly.

2. **Availability of manpower.** Labor is one of the factors of production that is very important for the occurrence of a production activity. With the goods in the form of production materials (gold content) coupled with the workforce then it can become a production business even without the support of technology. Abundant local labor and added by entrants who are interested in becoming miners from other regions is a factor supporting the opening of gold mining activities, although done traditionally. Such conditions are gold mining in Gumelar sub-district [13].

3. **Simple technology in gold mining.** With relatively simple technology, gold mining in Gumelar sub-district can be done by miners and local communities. Local people who have no knowledge or experience mine mingle with miners from outside the region created mining cooperation. Without the need for a long time they can walk because the technology is simple [13].

4. **Community participation in mining.** Community participation in gold mining activities can be said to be quite high. Their participation is in direct form with the ongoing mining process, or indirect participation. Direct participation involves becoming part of many mining processes, both as landowners, owners of capital and miners. Indirect participation is those who engage themselves in activities linked to mining activities such as becoming a mine equipment trader, food stall, mining buyer, etc.

b. *Weaknesses*

The description of each factor that is strategic as a component of weakness is as follows:

1. **Mercury contamination.** An indication of mercury pollution resulting from gold mining is a recognized reality as a weakness of the activity. Various studies on mercury content in environmental components show that it has been exposed to river water, soil and sediment [14-16]. Theoretically, the tremendous danger of mercury is a serious threat to humans in the long term. The problem of understanding the dangers of mercury is not known and fully trusted by the community, especially miners. Thus, the existing gold mining process still used mercury for its amalgamation process. No matter the introduction of other technologies without mercury ever introduced, but less effective than mercury then the technology is not sold.

2. **Environmental destruction.** Symptoms of environmental destruction are seen in both abiotic and biotic components. Abiotic components that experience symptoms of damage are artificial infrastructure such as homes and roads. As a consequence of unlimited excavation or zonation, it has an effect on the stability of the soil above which sometimes landslides or shifts. The affected biotic component is the reduction of vegetation on the surface of the mine field. This is because the rock tailing that covers the fertile soil makes it not grow as usual before the mining.

3. **Illegal mining status.** The status of illegal gold mining activities is an obstacle for these activities. This reality was common in traditional gold mining in Indonesia. Perhaps on the basis of that also, the government also did not try hard to close the mining activities. Even in reality diligent conduct supervision, control and even coaching.

4. **Consumptive lifestyle.** Consumptive attitude is actually a common thing in people who have increased welfare. But if it's excessive and income spending is out of place, that's where it gets into trouble. For example, the lifestyle that leads to hedonism

because it is not to meet the basic needs of life but to dissipate. This kind of phenomenon is present in mining even though it is not massive and has been prevented by the authorized components.

c. *Opportunities*

The description of each factor that is strategic as a component of opportunity is as follows:

1. **Value and price of gold are high.** The value of gold in society can be in two different areas of social and economic. The value of gold socially is gold as a symbol of one's social status in society. The value of gold is economically valuable gold is relatively high, so gold becomes the standard of economic measurement. Even it is recognized that gold as a very good material for investment because the price will not be devalued by the turmoil even the economic crisis.

2. **Increased income.** The existence of gold mining in Gumelar Banyumas is recognized as a vehicle to increase people's income. Society and government recognize that. Prior to mining, many local people were dependent only on agriculture. Agriculture is also more only on plantations because rice fields are very limited as a consequence of a relatively high plains area. Increasing public income is one of the positive impacts of traditional gold mining which is a strong argument that miners do not want to stop its activities even though it is actually prohibited by the government. Instead the government did not necessarily close their activities.

3. **Community economic drivers.** In addition to gold mining as an economic activity, but the alliance also serves as a driver of the emergence of other economic activities. This happens because the quantity of mining is relatively large and involves many residents so that the effect on the demands of other activities needed to support the mining. Thus, become more reinforcing each other and mutual living between activities with each other.

4. **Decrease in unemployment rate.** With the gold mining activities make the unemployment of the population is reduced. This is also felt by the local community and local village officials. Prior to gold mining, Paningkaban Village and Cihonje Village are well-known for exporting labor abroad. After the mining of the title it is no longer bears. Young people prefer to be miners rather than to become migrant workers. The decline in unemployment is not only due to the acquisition of new jobs or occupation of occupation, but also the occurrence of charging time. So residents who have worked but have a long spare time, then the spare time was used in mining activities. Thus there are times when they are involved in gold mining as a sideline of the basic work that they still have [17].

d. *Threats*

The description of each strategic factor as a threat component is as follows:

1. **Government bans the illegal mining.** The illegal status of gold mining in Gumelar, actually does not become a barrier for their activities. In reality, the government does not forcibly shut down its activities. At least the illegal status becomes a kind of warning that serves to be more careful in maintaining the safety of miners. Due to the status or threat of closure will be stronger when an accident occurred causing the death of miners. In addition, this illegal status becomes an obstacle when the government itself is seeking to find environmentally friendly technology required that gold mining activities are legal.

2. **Accidents and work safety.** Accident and occupational safety aspect is quite a concern for many parties because gold mining has a high enough risk for K3. It is no secret that gold mining in case of work sensitivity is the miners who died at the wells. That sort of thing happened in traditional gold mining in Gumelar. Such a case if it

happens is not preached let alone to the media. Miners who die from accidents will not sue anywhere because since they started to become miners they already know the risks. There were even informants who argued that the miners were contractually dead. This means that if a work accident to death it will not sue to anyone [18].

3. **Limited environmental carrying capacity.** One of the functions of the environment is to live the living and human beings in it. The carrying capacity of this environment is not infinite. Therefore, the use of natural resources should consider its sustainability. In order to future generation, human and sentient were being to continue their life as previous generation.

4. **People's dissatisfaction.** In a heterogeneous society there are always members of society who are not satisfied or happy with the conditions, included in the case of the existence of gold mining in Gumelar. But for people who enjoy it, of course, be positive, otherwise community members who do not enjoy the existence of a gold mine may be negative.

Internal and External Matrices

The management of gold mining requires management, among others, developed various strategies obtained from the results of the study with the gold mining management priority obtained from SWOT and AHP. SWOT analysis is used to determine the gold mining management strategy by looking at a combination of internal factors and external factors. Both of these factors have a positive impact that comes from strength and opportunity, while the negative impact comes from threats and weaknesses. These components are very important to be studied in determining strategic steps. Weighting is done to see priorities between components. The result of weighting in formulating the gold mining management strategy is shown in the table 1.

Table 1. The Result of SWOT and Analytical Hierarchy Process

Level 1	Level 2	Ecology	Economy	Social	Grand Total
Strength _h	Content of Gold	0.083	0.048	0.031	0.162
	Public Participation	0.029	0.039	0.091	0.159
	Teknology	0.018	0.02	0.035	0.073
	Labor	0.013	0.034	0.043	0.09
Strength		0.143	0.141	0.2	0.483
Weaknesses	Illegal	0.005	0.003	0.009	0.017
	Consumerism	0.001	0.002	0.005	0.008
	Mercury	0.043	0.008	0.015	0.066
	Contamination				
	Environmental Destruction	0.028	0.006	0.009	0.043
Weaknesses		0.077	0.019	0.038	0.135
Opportunitie _s	Gold Value	0.006	0.018	0.006	0.03
	Revenue Increase	0.007	0.034	0.015	0.056
	Unemployment	0.007	0.016	0.03	0.053
	Decrease				
	Economic Driver	0.007	0.026	0.012	0.045
Opportunities		0.027	0.094	0.063	0.186
Threats	Supporting Capacity	0.03	0.008	0.008	0.046
	Accidents	0.013	0.009	0.039	0.061
	Community	0.009	0.009	0.024	0.042
	Dissatisfaction				
	Government Prohibition	0.013	0.007	0.027	0.047
Threats		0.065	0.033	0.098	0.196
Grand Total		0.313	0.287	0.400	1.000

Source: Primary data, 2017.

Based on the data above, it can be seen that the internal factor consisting of the strength factor that has the highest weight is the gold content in some areas of Gumelar sub-district, especially in Paningkaban and Cihonje villages (0.162) and community participation in the gold mining (0.159). On the weakness factor side, it is seen that the highest score component is the presence of mercury contamination in gold mining (0.066) and followed by the component of the occurrence of environmental damage phenomenon in mining area (0,043).

External factors consisting of the opportunity and challenge components show that the opportunity with the highest analysis is the increased public income (0.056) and the decreasing unemployment rate (0.053). While the external factor component of the threat (thread) in the first position is the existence of work accidents in gold mining that can be up to the death of miners (0.061) and gold mining is still illegal or prohibited by the government (0.047). From the results of analytical hierachi the process can then be formulated strategic issues in the management of traditional gold mining in Gumelar District Banyumas District.

The linkage of AHP values to social, ecological and economic aspects with SWOT factors including strengths, weaknesses, opportunities and challenges of data in table 1 can be seen in Figure 1 below.

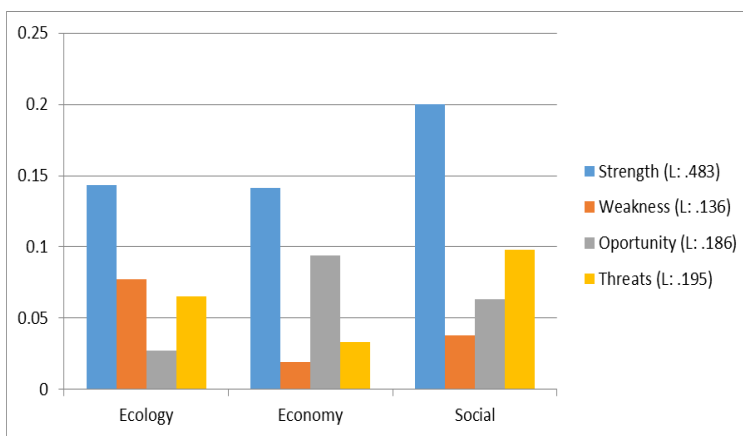


Fig. 1. Graph of the three aspects of the sustainability pillars

The graph, which is the result of two analytical methods, is the SWOT analysis and AHP analysis presented in one picture, showing that the strength factor of all aspects occupies the highest portion. On the other hand, the weakness factor is seen as the lowest factor. This means that the presence of gold mining in Gumelar Banyumas basically has more advantages rather than disadvantages. It's just that it needs to be managed well so that the weaknesses are getting smaller.

The picture and table above show that social aspect is the highest aspect (0.40) compared to ecology aspect (0.313) and economy (0,287). It is similar with the study of [19], that social ecology aspect had the highst attention. Therefore, the social field must be considered first from the ecological and economic aspects. Similarly, ecological aspects should be more attention than economic aspects, and so on. In fact, these three aspects must be considered all because they are a unity in the principle of sustainable management.

Strategic Management of Traditional Gold Mining in Gumelar Banyumas

The results of the analysis of the strategic factors affecting the traditional gold mining management condition are summarized in the SWOT matrix which can be seen in Table 2.

Table 2. SWOT Matrix of Traditional Gold Mining Management

IFAS (Internal Factor Analysis Summary)		Strength (S)		Weaknesses (W)	
		S1	The presence of areas that have 9.47 tons of gold content.	W1	The exposure of mercury contamination in the mining area in among sediment, soil and river water.
		S2	The high community participation in gold mining activities.	W2	The occurrence of environmental destruction symptoms such as infrastructure, vegetation and social.
EFAS (Eksternal Factor Analysis Summary)		Strategy (SO) “Competitif Strength”		Strategy (WO) “Weaknesses Mobilisation”	
O1	Income of the community is increasing as result of gold mining.	1.	Arrangement of zones and zones for mining is more effective and efficient (S1 and O1)	1.	Socialization about the dangers of mercury and seek alternative technologies that are eco-friendly (W1 and O1). Socialization of the importance of environmental conservation to ensure the continuity of mining (W2, O1 and O2).
O2	Unemployment is declining because it is absorbed into the gold mining activity.	2.	Prioritize unemployed or underemployed local workers (S2 and O2).	2.	Increased awareness and community participation in sustainable mining management (W1, W2, O1 and O2).
Threat (T)		Strategy (ST) “Comparatif Strength”		Strategy (WT) “Weaknesses Demobilisation”	
T1	Work accidents that occur quite apprehensive because until the death of miners.	1.	Conducting socialization and education about K3/Occupational Health Safety to miners (S1, S2 and T1)	1.	Improving the institutional and technological management of gold mining which minimizes the risk both to the environment and miners (W1, W2 and T1)
T2	Gold mining activity is still illegal/ prohibited by government.	2.	Supervision and control of existing mining in accordance with the applicable regulations (S1 and T1)	2.	Involving communities and NGOs in traditional gold mining management (W2 and T2.).

Source: Primary data, 2017

Thus, there are four alternative strategies to develop the traditional gold mining management program in Gumelar district of Banyumas regency:

- a. Strategy (SO): use strength (S) to exploit opportunities (O). This strategy can be pursued by alternative programs, namely:
 - 1) Arrangement of zones and zones for mining is more effective and efficient.
 - 2) Prioritize unemployed or underemployed local workers
- b. Strategy (ST): use strength (S) to overcome obstacles / threat (T). This strategy can be pursued by alternative programs, namely:
 - 1) Conducting socialization and education about K3 / Occupational Health Safety to miners.
 - 2) Supervision and control of existing mining in accordance with the applicable regulations.
- c. Strategy (WO): overcoming weakness (W) to exploit opportunities (O). This strategy can be pursued by alternative programs, namely:
 - 1) Socialization about the dangers of mercury and seek alternative technologies that are environmentally friendly.
 - 2) Socialization of the importance of environmental conservation to ensure the continuity of mining.

- 3) Increased awareness and community participation in sustainable mining management.
- d. Strategy (WT): Minimize weakness (W) and avoid threat (T). This strategy can be pursued by alternative programs, namely:
 - 1) Improving the institutional and technological management of gold mining which minimizes the risk both to the environment and miners.
 - 2) Involving communities and NGOs in traditional gold mining management.

Conclusion

Traditional gold mining in Gumelar Banyumas requires management that can have as much positive impact as possible. To achieve such mining, environmentally sound management should be implemented. This research produces a recommendation of mining management that stems from the principle of sustainability, which takes into account social, ecological, economic and institutional aspects

The gold mining management recommendation is principled on strategies derived from SWOT and AHP analysis. The result recommends that there are program that must be done. There are 9 (nine) existing programs that is:

- Conduct socialization and education about OHS/Occupational Health Safety for the miners;
- Increasing public awareness and participation in an environmentally sound gold mining business;
- Arrangement of area and zonation for mining more effective and efficient so localized. The three main programs are in the social and ecological aspect;
- The local unemployed or underemployed workforce priority program to be absorbed in gold mining;
- Supervision and control of existing mining in accordance with the applicable regulations;
- Improving institutional and management technologies that minimize the risks to both the environment and miners;
- Socialization of the importance of environmental conservation to ensure the continuity of mining;
- Socialize about the dangers of mercury and seek alternative technologies that are environmentally friendly;
- Involving communities and NGOs in traditional gold mining management.

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