The Existing Socio-techno-economic Paradoxes in the Indonesia Mining Development Program

Ukar Wijaya Soelistijo¹,²,³,⁴, Sri Widayati¹

¹University of Islam Bandung (UNISBA), Department of Mining Engineering, Faculty of Engineering, Bandung, Indonesia
²Institute of Technology Bandung (ITB), Department of Mining Engineering, Faculty of Mining and Oil Engineering, Bandung, Indonesia
³Center for Education and Training of Mineral and Coal, Ministry of Energy and Mineral Resources, Bandung, Indonesia
⁴Center for R&D of Mineral and Coal Technology, Bandung, Indonesia

Email address
ukar@tekmira.esdm.go.id (U. W. Soelistijo), ukarws@gmail.com (U. W. Soelistijo), widayati_teknik@yahoo.com (S. Widayati)

To cite this article

Abstract
The existing paradoxes faced by the Indonesia mining development could be inventoried that it may include around ten parameters among others between interests of centralized and decentralized purposes, quick and slow yielding, low and high risks and so on. Since 1970s, these phenomena should have been overcome by the government of Indonesia (GOI) to accommodate the national interest at one side and the investors on the other sides, and then the mining development progress has been achieved as the significant existing condition successfully. The progress could be claimed that the role of mining sector have supported the Indonesian economic growth significantly up to the present, including the progress of mineral policy development in utilizing the large mineral resources available in the country. Methodology applied in this study is based on historical descriptive analysis observed by the writer as government official, researcher and lecturer within the last 45 years of job, besides combined with usage of economic, management and engineering models.

Keywords
Mineral Resources, Development, Paradoxes, Indonesia

1. Introduction
Indonesia as located in the Pacific ring of fire [6] is the mineral resourceful endowment such as energy mineral (oil, gas and coal), metallic minerals, non-metallic minerals and rocks. These resources require comprehensive treatment in the forms of management, economics and policy in line with the application of good mining practices facing global trend and paradoxes (Figures 1 and 2).

The problems of the mineral resources development faced by the government may include the management supervision the economic transformation from the resources into economic capital toward social capital in the purpose of improving the capability and viability of the Indonesian human resources facing their future in their self reliance brightly in terms of intellectual, welfare and peace in line with the constitutional guideline. At the other side, this process will face the global trend as well as paradoxes. Global trend may include free investment and trade, democratization, environmental protection, intellectual property right (IPR) and human right.

Furthermore, down to earth of the mineral policy aim is to strengthen economic as well as non-economic support of the nation. Economic purposes may include such as national income, community development, local content, added value of minerals, supply of raw materials and energy sources, and as prime mover of other sectors. Non-economic purposes may cover environmental protection and regional development of facilities and infrastructure.

Methodology applied in this study is based on description analysis of historical observation of the mining industry development in the country since 1970s up to the present.

2. Materials and Methods
Methodology: Macroeconomic model applied in this study may cover the Gross Domestic Product (GDP) from the expenditure side(Ye) (Soelistijo et al, 2003 [18]; Soelistijo et al, 2013 [26]):
Ye = C + I + G + X – M

where C = consumption, I = investment, G = government spending, X = exports and M = imports. In this case (X-M) is also called Balance of Trade (BOT). In general, it could be formulated as Ye = f(I, C, G, BOT).

**Figure 1.** Indonesia Mineral and Energy Resources Distribution Map (Sources: Ministry of Energy and Mineral Resources, Indonesia, 2011, reprocessed).

**Figure 2.** The transformation process of natural resources into economic capital toward social capital.
From the income side PDB (Yi):

\[ Yi = f(K, L, R, I, E, Z, T) \]

Where \( f = \) function of; \( K = \) capital, \( L = \) labor, \( R = \) natural resources, \( I = \) information, \( E = \) environmental cost, \( T = \) technology, \( Z = \) other variables. In this study mining sector may be included in the sector of natural resources. [17-32].

Management model is applied based on management function as the followings

\[ M = f(P, O, A, C, E, T) \]

where \( M = \) management, \( f = \) function of, \( P = \) planning, \( O = \) organizing, \( A = \) actuating, \( C = \) controlling, \( E = \) evaluating, \( T = \) Technology.[1-5; 15;16; 33-51].

Engineering model is related to the circle from the downstream up to upstream engineering process in the mineral development such as general investigation, exploration (including feasibility study), exploitation, marketing and mine closing to gain mineral added value.

**Data.** The input data used in this study coming from the Ministry of Energy and Mineral Resources, Statistics Central Agency and the related institutions, [7; 8; 9-14; 17; 18-32].

The main items of paradoxes could be seen on Figure 3, where it is consisted of high/advanced technology versus traditional technology, high risk versus low risk, quick yielding versus slow yielding, high tax versus low tax, Gross Domestic Product versus Gross National Pollution, upstream industry versus downstream industry, the enclave community versus local community, environmental protection versus mining in the protected forest, the sunset industry versus new investment development, national development versus regional development, and consumption oriented national income versus investment oriented national income.

Moreover, the process of study is based on the input-conversion-output (ICO) approach then using feedback control as the principle of spiral management for the purpose of further output improvement qualitative and quantitatively. (Figure 4)

### 3. Results and Discussion

Based on the above-mentioned steps and procedures of the study then the results could be clarified as the followings.

**Clarification of the paradoxes**

**Centralized versus decentralized interest.** Actually, following the global trend of democratization the GOI has launched the principle of decentralization since 1975 by releasing Law Number 4 year of 1975 what so called “regional autonomy” (Figure 5) which regulate the process of decentralization including the field of mining sector. At that time the mineral resources what so called “c grouped minerals”
was decentralized to the Regency or the second level of governmental authority from the central government, then in 1999 by Law number 22 further decentralization on all metallic minerals, coal, non-metallic minerals and rocks were also decentralized to the Regency/City Government (Figure 6). Then it has been improved in the year of 2004 by Law Number 32 and in the year of 2014 by Law Number 23. Even though the process of decentralization in the field of mineral resources is not very smooth, many things of what so called “autonomy euphoria” happened in the forms of many frictions between Regency/City, Provincial and Central. The main point is the division of income coming from mineral resource development, even though it has been clearly regulated by the existing law, governmental regulation (central and regional), however, it still requires further translation from time to time. For instance, the division of general mining income is that 20% for the central government, 16% for the province, 32% for the regency where the mining activity located, and the remainder of 32% for the rest of regencies/cities within the related province.

**High/advanced technology versus traditional technology.**

Mining sector in Indonesia has applied many dimensions of technology from traditional technology up to modern or advanced technology as well. For example, mining technology of alluvial mineral is traditional mining based on massive employment, but the mining for the underground and open pit at up the hill or mountain as well as under the sea water so that advanced technology is applied for instance PT Freeport in Papua (underground and open pit mining on between 2000-4000 meters above sea level), PT Newmont in West Nusa Tenggara, also for oil and gas mining exploitation of PT Chevron and the other oil and gas companies) on shore and off-shore mining), etc. In Indonesia the most favorable country in the world where the most advanced mining technology is applied, then they could gain the most efficient mining production cost, for example, PT Freeport Indonesia (copper mine), PT Newmont (copper mine), PT Kaltim Prima Coal, PT Adaro (coal mine), PT Chevron (oil and gas mining). However, also in Indonesia the traditional mining technology is applied including illegal mining to respond mass employment creation. In principle, the function of technology application is how to obtain productivity jump. All in all, the mining sector should respond the problem of increasing and existing unemployment in the country.

**High risk versus low risk.** Two sides of the existing mining activity facing low risk and high one, where high risk is on line with the proverb “mining is gambling”. It is expected that the massive employment base is expected to be working with low risk. Both types of risk should be applied in the country, because it should answer the solution of the unemployment as well. In fact, that the massive employment mining activity is also containing high risk, because too many disasters happened.

---

Figure 4. Input-conversion-output approach of the process of the study.

Figure 5. The principles of regional autonomy (decentralization).
Figure 6. Hierarchical level of governmental authority in the Indonesian Government system: Central – Provincial - Regency/City levels.

Figure 7. Mineral potential versus policy potential in several countries.
Quick yielding versus slow yielding. Slow yielding is the character of the mining business, because it takes time at least 10 years for activity duration, 1-2 years for general reconnaissance and exploration, 1 year for feasibility study, 1-2 years for mining development, and several years up to 30 years for production depending the available mineral reserves. However, for small mining or last but not least especially illegal mining, it operates 1-2 years directly for production because they find out the bonanza outcrop or deposits accidentally. The second one is called as the quick yielding which resulting tremendous disordered environmental condition at the end of mining closure. In the management side, there is a weakness of controlling so that besides in the mining side, there are what so called illegal logging, illegal fishing, illegal trading that it inflicts a financial loss of billion dollars per annum from the national income. Indonesia has famous tropical forest, has 2/3 area of countries sea water of the archipelago which is rich of sea fish.

High tax versus low tax. National income comes from tax and non-tax revenue. National income tax is originated from non-tax coming from dead rent (land rent) and royalty and also 11 kinds of taxes. Taxes are consisted of among others corporate tax, personnel income tax, land and building tax, export and import taxes, value added tax, income tax of interest, rent, leasing, dividend, customs duty, stamp, seal, regional government retribution/tax, general administration, tax of motorized vehicle, and others. Information from the investors stated that mining taxes in Indonesia may categorized as the high tax or even the highest tax in the world, including royalty. Several countries do not burden royalty in the mining sector such as Australia, Brazil and so on. Indonesia still chooses the high tax regime in the purpose of supporting her economic development program. Of course, the investors prefer low tax regime. Indonesia should develop her policy on mineral to attract the investors especially foreign ones, where they will take any risk of the mining investment. These two sides of interest should be solved in a wise way of business.

If might have a look at the condition in the several mineral resourceful countries, where Indonesia is one the mineral resourceful one but poor in the mineral policy, then Indonesia should be working hard to improve her mineral policy to polish and to meet between national interest versus the investors willingness to invest. (Figure 7).

In fact, through contract of work implementation, coal could contribute around 60% of the mining companies' revenue and hard minerals of 55% of the mining companies' revenue to the Indonesian income as sources of the economic development budget since 1970s. (Soelistijo, UW, [18-32]).

Gross Domestic Product versus Gross National Pollution. Indonesia mining sector has resulted revenue that is contributed to the Gross Domestic (National) Product (GNP or GDP)around 18.7% including oil and gas, but only 5.2% from the general mining.(2011; [18-32]). It should be understood that Indonesia following the "polluter pay principle", then the input-output formula would be
\[ Y = f(K,L,R,E,I,...)T, \]

where E in the environmental cost that has to be included in the mining production cost. And usually the increasing mining revenue that also would increase the GDP then will be followed by the increasing cost of Gross National Pollution. In Indonesia, the environmental cost of the mining activity has been allocated ranging of around 2-5% of the corporate revenue. At the national level, for example, the States allocated around 70% of GDP for the national pollution control. It looks likely that the richer the states the more environmental cost allocation will be.

In this context, to save the increasing GDP as well as the aim of environmental protection it is important to control the indicators of the mining business successfulness in terms of the mining company’s financial management and its business management as well, in the way how far they follow the related laws, regulations, and decrees.

The current condition it is most likely that the nature carrying capacity is lower than the population pressure due to the rapid economic development and the un-control population growth, toward the future better carrying capacity of the nature that greater than the population pressure through the firm control in the environmental protection similar with the condition at the beginning condition of the nature (Figure 8).

**Upstream industry versus downstream industry.** Within the years of 1970-2000, Indonesia required a lot of national budget to run the national living cost, then in that period she export mostly the mineral products as export commodity as the product of upstream industry such as bauxite, iron ore, tin concentrate, nickel ore, gold and copper concentrates etc. Consequently, she only received low value from the mining sector. Later on, beyond the year of 2000 it is tried to increase the mineral added value through prohibition of exporting mineral as raw material, then the mining companies has to develop mineral processing technology to produce semi-finished and finished products to capture its added value in the country through releasing laws and government regulation down to ministerial decree. For instance PT Freeport has to build the extension refining plant of copper concentrate to extract metals of gold, copper and silver to supply domestic downstream industries. This regulation is also valid for every mining companies in the country such as metallic, non-metallic minerals and coal.

![Figure 9. Graph between Mining Company’s Revenue versus Net Gain Coefficient.](image)

**The enclave community versus local community.** The other consequences are among others the frontier development program in line with the progress of the contract of work in mining., and this also valid every mining companies operates in Indonesia. It may include program of regional development that may cover physical and non-physical development. Physical development program may include development of facilities and infrastructure, spatial order, and physical environment; and non-physical development program may cover social-economic activity including corporate social responsibility (CSR) and community development (CD) especially for the development of local people who live within the surrounding the mine sites. Usually, the mining enterprise community is in the “fence” of enclave or developed community who live in the remote areas and then they should live to gather harmoniously with the “underdeveloped” local people. Then in 2002 the Ministry of
Energy and Mineral Resources composed such a guideline of developing community development for the local people within the mining sites. In fact, this eagerness of the government has been gradually actuating to realize the harmonious living condition between the community of mining enterprise companies and the local people toward realizing the regional as well as national resilience. It is found out that net gain coefficient obtained from the mining companies is favorable contribution in creating welfare for the local people in the form of CSR and CD. However it is also found out that the greater the mining company’s revenue the less percentage of social contribution will be (Figure 9) (Soelistijo UW, 2014 [31]).

Environmental protection versus mining in the protected forest. By the year of 2000, Indonesia had launched policy of protecting the protected forest. However, in fact that under the protected forest too many available valuable mineral resources such as gold, silver and copper. Then, to meet the national demand of increasing national revenue then the GOI created such new policy of how to permit the mining investors to explore mineral resources within the protected forest, but under certain strict circumstances of regulation. Say, the mining companies should carry out underground mining exploitation equipped with the certain tunnel or shaft of ventilation, then it does not destroy the surface of the forest. Or, they has to exchange twice large areas of land in the other areas instead of the mined land if it is worked by using open pit mining method. Shortly speaking, there is no excuse to destroy the protected forest, and furthermore it must be protected as well.

The sunset industry versus new investment development. In fact, the mining industry in Indonesia has been facing what so called “the sunset industry”, because several mineral resources have been well depleted or exhausted such as bauxite, iron ore, tin ors, and may be gold ores for another 30-40 years to come (Soelistijo, UW, 2003; 2014, [24, 28]). Of course, if it is not followed by the intensive exploration as has happened within the last 30 years. It is believed that mining operation in Indonesia still could be extended if the mining stakeholders intend to do serious exploration from now and on, because Indonesia archipelago is located in the Pacific ring of fire, then Indonesia has chances as mineralized region.

Consumption oriented national income versus investment oriented national income. Indonesian economy within the last few years is highly dependent on consumption side, and not very much on investment sector. Indonesia is as a populated region with almost 250 million people, of course she is as good consumer. But, the deficit balance of payment indicates that imports is greater than export, and it means that Indonesia people are a good consumer for the imported goods and services. She has to be serious working hard to improve the economy into investment oriented development toward producing exported materials in terms of goods and services where added value of the available natural resources domestically could be gained forever.

Future notifications

Mineral resource development cycle. Indonesia should follow the management of the mineral development cycle from upstream to the downstream up to mining closure of how the way to utilize the mineral resources as part of the natural ones available in this country towards supporting national development in terms of geo-politics, economy, social, culture and security guaranteed by national resilience (Figure 10) through the process of prosperity, security and global environment concept approaches. (Figure 2).
Mineral development system. To achieve the national aim of development a system of mineral resource development is required and there are several subsystem such as governmental subsystem, industrial (production-consumption) subsystem, regional subsystem, science and technology subsystem and international subsystem. The governmental subsystem formulates policy in the forms of such as law, regulation, various level of decree. Industrial subsystem executes supply and demand side including transportation and trading business. Regional subsystem establishes and controls mineral resources management. Science and technology subsystem does research and development activities to support other subsystems. International subsystem carries out trading and marketing of commodities and services transaction. In the industrial subsystem should notice an interaction between mineral resources as part of the natural resources – economics – and environmental protection phenomena towards achieving the national as well as regional aim of development.

4. Conclusions and Recommendations

To save and secure the national interest of economic development on natural resource based development concept as applied in Indonesia as the natural resourceful country, various socio-techno-economic paradoxes should be overcome since 1970s when the economic development has been launched up to the present. This effort should also be in line with the global trend especially on environmental and economic phenomena, among others global warming, global economic trend such as free trade and investment, intellectual property right and human right. Consequently, Indonesia should follow the concept of good mining practices toward what so called green economic development process. Moreover, Indonesia has to gain her natural resources added value through applying appropriate technology where it could also create employment as high as possible.

It is recommended that Indonesia should follow the management of the mineral development cycle from upstream to the downstream of how the way to utilize the mineral resources as part of the natural ones available in this country towards supporting national development in terms of geo-politics, economy, social, culture and security guaranteed by national resilience. Any further input of improving the content of this article is welcome and it is expected that the results of this observation would be beneficial for the global mining development.

References
