Outstanding Issues in Mineral Resource Economics: The Case of Indonesia

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***Abstract*—** *Mining industry in Indonesia has proven to give good results as a source of state revenue. However, the development of the mining sector in order to create people welfare is facing various problems. Critical issues as reviewed in this article related to mineral and energy resources economics are divided into eight sections, namely economic modeling, regional and sub-regional development, regional autonomy, contract of work, management of resources and modern management, mineral added value, policies, and outlooks. Problems associated with those issues should be solved immediately so that Indonesia can determine the direction of development of mineral and energy resources in the future. In order to solve these problems, there must be management and supervision as well as good cooperation between stakeholders those are government, mining companies, and the society so that mining sector could perform its function toward Indonesia incorporated in achieving sustainable development. Methodology applied in this study is based on description and analysis related to the author's experiences and professionals.*

***Keywords*— Outstanding issues, mineral resource economics, mining**

I. INTRODUCTION

Indonesia is blessed with abundant natural resource including minerals such natural oil and gas, coal, metallic-, non-metallic-, radioactive-minerals, and rocks. Since 1970s, Indonesia has produced several varieties of metallic minerals for instance iron sand, bauxite, tin, copper, gold, silver and nickel. However, Indonesia faces many problems since the first exploitation of mineral resources. 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. Problems associated with those issues should be solved immediately so that Indonesia can determine the direction of development of mineral resources and energy because it plays an important role as one of the key supporting sectors for the industrialization process growth.

At first glance, mining and minerals would seem to be quintessential unsustainable activities. Individual mines have finite reserve that once mined are gone. The earth's crust contains only a limited quantity of any mineral. So, the purpose of the article is to explore how exponential growth of mineral demands interacts with finite resources especially in Indonesia case. Because the size of resources is not known, only the general behavior can be explored [Figures 1a and 1b [39,41,42,65].

This study aims to review the outstanding issues in mining sector into eight main sections, namely economic modeling, regional and sub-regional development, regional autonomy, contract of work, resources and modern management, mineral added value, policies, and outlooks. These issues are expected to be considerations for the government in determining the direction of Indonesia policy in the development of mineral and energy resource to achieve sustainable development in the near future.

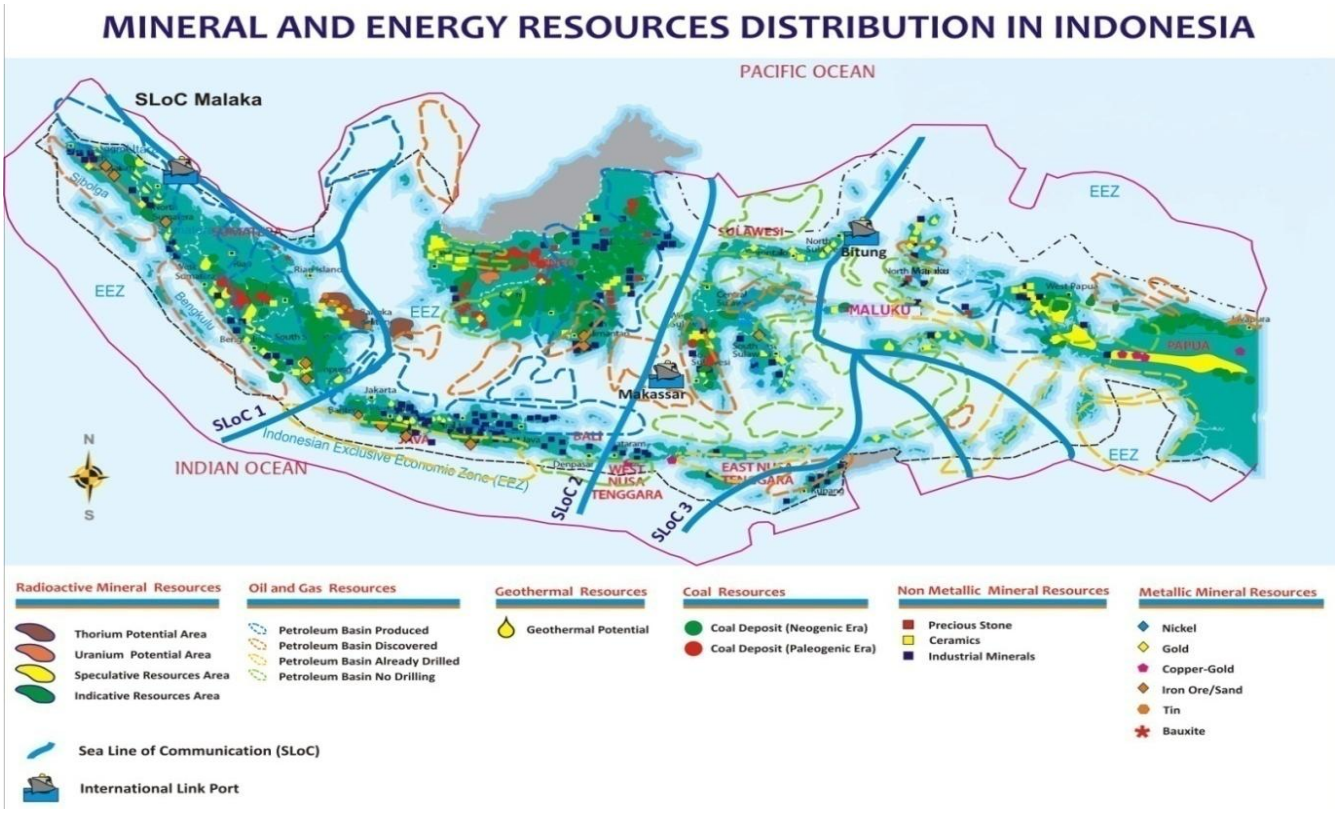


FIGURE 1A. INDONESIA MINERAL AND ENERGY RESOURCES DISTRIBUTION MAP

Sources: Soelistijo, 2014 [42]

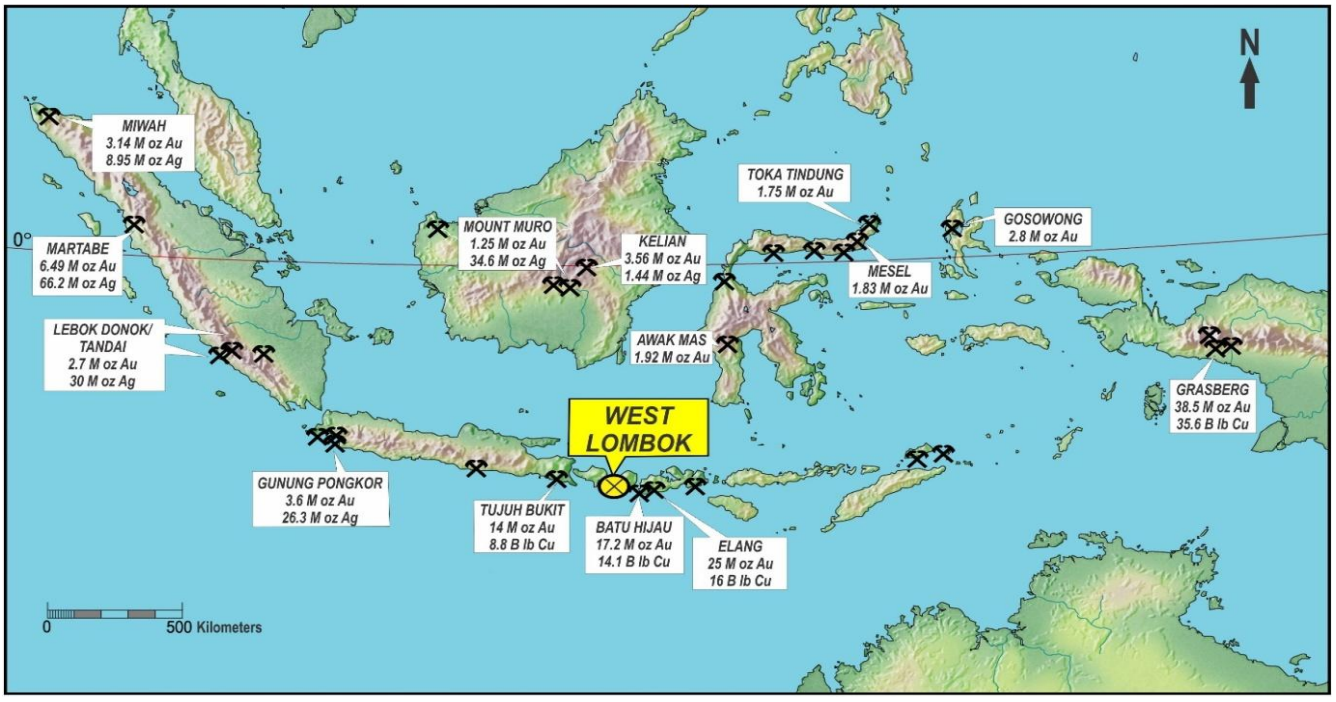


FIGURE 1B. LOCATIONS OF INDONESIAN GENERAL MINING

Source: http://www.southernarcminerals.com/section.asp?pageid=22155 [65]

II. METHODS AND MATERIALS

2.1 Methods

The method used in this observation is accompanied by a descriptive analytical method on historical data and

information relating to issues of mineral economy both domestically and in foreign countries. In addition, the writer conducted literature study on matters which related to exploitation of minerals and energy to deepen the analysis of development of mineral resources in Indonesia. This study is also related to the author's experiences and professionals and concerned about the experiences of similar events in the past which may be repeated in the future ([24] up to [64]).

2.2 Materials

Data and information used in this study is a compilation of data from the internet and the author's published journals related to issues in mineral and energy resource economics.

III. RESULTS AND DISCUSSIONS

The current outstanding issues in mineral resources economics in Indonesia may include several important matters namely in the fields of implementation of economic modeling, regional and sub-regional development, regional autonomy, contract of work, management, mineral added value, policies, and its outlooks.

3.1 Economic modeling

3.1.1 Dynamic commodity model.

Dynamic commodity models are quantitative formulations for solving problems concerning amount of demand, supply, prices, and commodity stocks. The main points of the dynamic commodity model may include:

1) Calculation of the amount required to reserve.
   - Approach through the quantity of the commodity.
   - Approach through commodity prices.
2) Calculation of benefit and loss.
   - Data input.
   - Output each year.

Formula to model the dynamic commodity among others (Labys, 1973; Schaeffer, 2008):

- Demand for commodity : D = d (D-1, PW, PS, A, TF);
- Supply for commodity : Q = q(Q-1, PW-1, U, NR, Z);
- Commodity prices : P = p(P-1, D, I);
- Stock commodity : IC = IC-1 + Q-D;
- Supply-Demand : C = Q + M – X + (-)S.

This relationship can be explained that the requirement (D)depends on endogenous variables changed, needs of the past (D-1), the international price (PW), the level or the level of economic activity (A), prices of one or more commodities direction substitute (PS), and the possibility technical effect (TF) as well as the growth of synthetic substitutes. Supply (Q) will depend on the prices of the past (PW-1), the amount of reserves (U), natural resources (NR), and the possibility of change of policy (Z). Future price changes past included because the supply of goods usually depend on past factors which is generally translated as price. Price (P) will depend on price changes of the past (P-1), needs (D), and stock (IC). While the amount of stock is the stock of the past (IC-1) plus the provision of demand and present stock of commodity (IC).Besides gained added relationship supply demand: Relationship of supply-demand: C = Q + M - X + (-) S Where the stock as the use of (C) is the provision plus imports (M) reduced export (E).([Labys,1973 [14]; Soelistijo, 2003 [33]).

This model could also be unified with bufferstock stabilization scheme that is very important to manage the price of any kind of commodity including minerals and energy.

3.1.2 Implementation of optimization programming

Linear programming is usually used for optimization of various problems as objective function in mineral economics with certain limitations in the form of resources constraint. LP is often used in transportation problems and Input-Output models which important in evaluation of regional economic development. As evaluation of the Indonesia output of GDP has it been efficient or not by using LP it is found out that the effect of coal liquefaction to the national economy in the year of 2025 the projected Indonesia final demand of IDR 11,896 trillion billion was equal to the maximized one and the projected Indonesia output of IDR 32,727 trillion was greater than the projected actual one of IDR 19,813 trillion. It means that the projected final demand would have been not efficient yet, however, the projected output has been efficient (Soelistijo, 2013, 2014 [50,61]).

The linear programming model is formulated as follows: Maximize: $Z=\Sigma\Delta Yi= \Sigma j\ I1\text{-}A)^{-1}\ \Delta Xj$; and $Z= \Sigma\Delta Xi= \Sigma\ (I\text{-}A)^{-1}\ \Delta Yi$; Subject to constraints: Capital: $\Sigma\ kj\ Xj \leq \underline{Kj;}$ Labor: $\Sigma ljXj \leq Lh$; Operating surplus:$\Sigma sjXj \leq Sh$; Indirect tax: $\Sigma tjXj \leq Th$; Subsidy: $\Sigma sujXj \leq SUh$; Imports: $\Sigma mjXj\text{-}h \leq Mh$; Non-negativity: $X1\geq 0$, $X2\geq 0,\ldots Xn\geq 0$; where: Z = objective function; X = total gross ouput; Y = final demand; A = techncal ciefficient; kj= capital coefficients; bj= subsidy coefficients; Kh= available capital; Bh= available subsidy; lj= labor coefficients; tj= indirect tax coefficients; Lh= available labor; Th=available indirect tax; sj= operating surplus coefficients.; mh=import coefficients; Sh= available surplus;SU = subsidy; Mh=available imports; Dh, Eh, Rh, Fh, Ph, Ih= disposal activities.

3.1.3 Electrical power generating

The cost of electricity generation produced by using fossil fuels includes (1) capital cost: the cost of acquiring the site and building the station; (2) fuel cost: cost of buying fuel throughout its life; and (3) operation and maintenance cost: other operational and maintenance costs, the cost of storing and disposing wastes, as well as the eventual decommissioning of the station. The energy source that can be used as fuel for power plants are economical, among others, coal, petroleum, natural gas, geothermal, and nuclear. Power plants used in electrical power generating have a long term life time so that the planner must develop a long range strategy for about 15 to 30 years. It is not only represent a capital investment but also a commitment of fuel cost for the full operation over the whole life time of the plants. It is found out that coal fired power plant is the least cost of electrical power generating of 30.54 mills/kwh and the highest is nuclear power plant of about 71.96 mills/kwh (Soelistijo, 2010 [25]).

3.1.4 Buffer-stock stabilization scheme

The main points of buffer-stock model are (1) calculation of required amount of reserve , with the approach of the number and price of the commodity, and (2) calculation of benefit and loss with the data input and output each year (Figure 2).(Soelistijo, 2010 [25]).

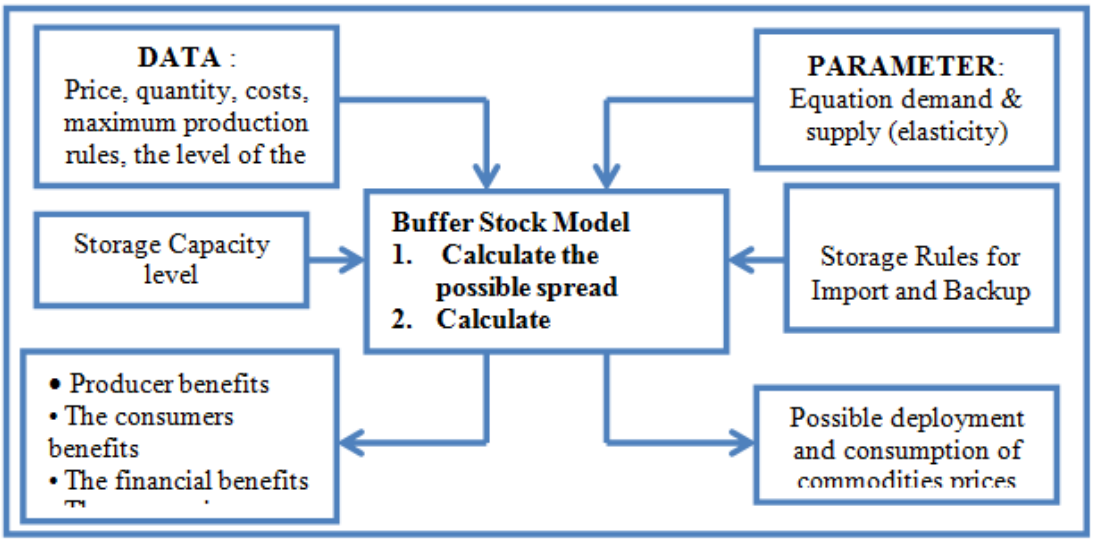


FIGURE 2. BUFFERSTOCK STABILIZATION SCHEME

This study aim is how to stabilize mineral price dynamically of mineral and energy commodity over time so beneficial for the state economy. The model is also applicable for stimulating agricultural commodity in Indonesia.

3.1.5 Net Social Gain

Quantitatively the social-economic benefits of CSR for the local development could be identified among others by using the net social gains (NSG) model. In principle, NSG is the difference between the company revenue and the cost of production. While, the profit or loss is called net external effects (NEE). The positive NEE means that the impact of the existence of mining companies is beneficial to the lives of the local people. The negative NEE means that the mining companies create social unrest. NEE consists of backward and forward linkages, technological, final demand and fiscal linkages of the company as well. The formula for calculating NSG is as followed (Pearson and Cownie, 1974):

$$\textbf{A.}\quad NSG = (uj - mj - rj)\, vj - f\, sj\, vj + Ej$$

$$\textbf{B.}\quad DRC = f\, sj\, vj + Ej / (uj - mj - rj)\, vjss$$

$$\textbf{C.}\quad NGC = NSG / Total\ Output$$

where: DRC = Domestic Resource Cost; NGC = Net Gain Coefficient; uj = export revenue of sector j; mj = intermediate goods imported; rj = repatriation; v = shadow price; f = commodity price; E = external effects.

It is found out that the richer or bigger revenue the mining company the less percentage contribution of CSR to the local community would be. It is necessary to proceed regulations that arrange the ultimate magnitude of the mining company CSR contribution to measure the improvement of the local people welfare ()Pearson et al, 1974 [20]; Soelistijo, 2010 [25]; Amrullah, 2007 [6]).

3.1.6 Terms of trade

Terms of trade (TOT) is the assessment of a country's trade performance. TOT < 1 means country's trade is poor (declining), whereas TOT > 1 means trade is considered good.

$$\text{TOT} = \frac{PX1\ /\ PX0}{PM1\ /\ PM0}$$

Balance of Trade (BOT) is the difference between exports and imports. If X > M means BOT surplus. In contrary, X < M means the BOT is deficit. It is found out that following the trend of the mineral commodity prices the TOT was greater than 1 except industrial mineral commodities and the BOT would increasing significantly in the coming years (Soelistijo et al, 2015 [56]).

3.1.7 Trend and projection of mineral prices

In 2000s there was a phenomenon of 2000's commodity boom in which prices of various commodities surge due to increasing economic growth and high demand from China. However, since 2011 commodity prices weakens because of there is abundant supply of mineral and coal in market, low demand, and US dollar strengthen.

Based on forecasting result, by 2025 all mineral commodity prices are expected to increase as follows: petroleum ($ 289.45/TOE), LPG ($ 5.37/MMBtu), LNG ($ 5.94/MMBtu), high-grade coal ($ 297.84/ton), low-grade coal ($ 97.08/t), gold ($ 6769.00/troy ounce), silver ($ 115.25/troy ounce), aluminum ($ 5,434.59/ton), tin ($ 96,422.50/ton), lead ($ 10,165.42/ton), zinc ($ 2,738.49/ton), copper ($ 11,506.12/ton), nickel ($ 25,344.56/ton). The mining sector contributes of around 10-14% to GDP, while in the years of 2014 and 2015 declined down to 9.87% and 7.62%, because of the declining price of mineral commodity and the prohibition of exporting raw minerals since 2014. Within 1984-2011 the Indonesia BOT was positive, however, it became negative. It is due to the increasing oil and gas import and also to the declining value of the export because of the declining price of mineral commodity. The Indonesia BOT deficit in 2012-2014 reached between USD 1-4 billions, but in 2015 reached surplus of USD 7.5 billion and it is expected could reach USD 20.1 billion based on the regression projection with the average growth rate of 7% per annum (Soelistijo et al, 2015 [56].

3.1.8 International trade

Some international trade organizations, among others, GATT, WTO, and UNCTAD, while organizations with a regional scale include ASEAN, APEC, EU, NAFTA, OECD, and so forth. Associations focusing in commodity formed to handle particular mineral, among others, IBA (Bauxite), ATPC (Tin), ASCOPE (Petroleum), INSG (Nickel), as well as ICSG and

CIPEC (Copper). These international mineral commodity organizations look likely as cartel rather than free market taker. UNCTAD as well as WTO should direct them toward free market action (Soelistijo, 2010 [25]).

3.2 Regional and Sub-regional Development

3.2.1 Asean

ASEAN is an organization that is essentially based in economics cooperation. However, most countries in ASEAN region has mineral and energy resources, so it would be best to establish cooperation of three things, namely mineral and energy information exchanges, cooperation in energy and minerals, as well as the establishment of specific institutions. These institutions consist of ASEAN Council for Petroleum (ASCOPE) which focus on oil and gas, Committee on Minerals and Energy (COME) which focus on energy such as geothermal, coal, gas and uranium, COST which focus on research and development of solar energy, biomass and wind, as well as ATPC, SEATRAD Centre, and ITRI which focused on tin commodity.

\ASEAN Vision in 2003 is the creation of ASEAN Free Trade Area (AFTA). AFTA program is implemented through tariff reductions both in the fast track (2000) and normal track (2003) in order to actualize the ASEAN Community in 2015.

3.2.2 Apec

Asia-Pacific Economic Cooperation (APEC) is a regional economic forum established in 1989 to leverage the growing interdependence of the Asia-Pacific. APEC's 21 members aim to create greater prosperity for the people of the region by promoting balanced, inclusive, sustainable, innovative and secure growth and by accelerating regional economic integration.

APEC Vision (2010/2020) is creating trade and investment liberalization. The implementation of APEC's vision are divided into two, 2010 for developed countries and 2020 for developing countries

3.2.3 ASEAN-Indonesia-Australia growth triangles

Encouragement of development in the region in cross-sector has to be followed by territorial cross-sector namely inter-region. Both inter-regions in the country and among inter-regions with the neighboring country territories through sub-regional economic cooperation such as Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT), Indonesia-Malaysia-Singapore Growth Triangle (IMS-GT), Brunei Darussalam-Indonesia-Malaysia-Philippines- East ASEAN Growth Area (BIMP-EAGA) and Australia-Indonesia Development Area (AIDA) are complementary (mutually supportive).

Actually, both regional as well as sub-regional economic development cooperation program could be beneficial for creating welfare and prosperity of the regional and national altogether simultaneously and synergistically (Soelistijo, 2010 [25]).

3.3 Regional Autonomy

3.3.1 Delegation of regional authority

Regional autonomy was launched to create equitable distribution of development over the regions in the country. Regional autonomy has actually been launched since 1975 by law that is called as regional autonomy period I (RAP I), then renewed in 1999 and re-enforced in 2004 as regional autonomy period II (RAP II). In RAP II most of the sectors are decentralized, except six sectors. Those are foreign affairs, finance, defense and security, justice, religion and certain sectors that will be determined by government regulation (Anonymous (a), 2009; Anonymous (b), 2009; Anonymous (c), 2004) [1], [2], [3], [4]; Mangiri, 2000 [15]).

The principle of regional autonomy, among others:

- Decentralization, de-concentration, and assisting task.
- All authorities handed over to local government, except the field of defense and security, foreign affairs, finance, religion, justice, and other areas of government (Government Regulation/PP).
- Submission of authority accompanied by finance, human resources, facilities and infrastructure.
- Implementation of authority based on the norms, standards and procedures.

Regional autonomy is just following the global trend of democratization, so that it is just likely as a must (Naisbitt and Burdene, 1990) (Freres, 1995 [9]; Hill, 1997 [10], Isard, 1975 [11]) , Soelistijo, 2012 [37]).

3.3.2 Natural resources revenue sharing

Financial balance between the central and regional governments based on Law No. 33 of 2004 (Article 1, paragraph 3), with the principle of local authorities freely organize their regional, the benefit of local communities and the potency of each area, convergence between regions, as well as to create stabilization, distribution and allocation to enhance the creativity of society and economic growth in the region. The following are the sources of local revenue (Table 1).

TABLE 1
SOURCES OF LOCAL REVENUE

Sources of Local Revenue				
Local Revenue	Locally-generated Revenue	Local Tax		
		Regional Retribution		
		Result of Regional Wealth Management Separated		
		Other legitimate Locally-generated Revenue		
	Equalization Funds	Sharing Fund	Sharing Fund from Tax	Property Tax
				Fees for acquisition of land and buildings
				Income tax
			Sharing Fund from Natural Resources	Forestry
				Mining
				Fishery
				Petroleum mining
				Natural gas mining
				Geothermal
		General Allocation Fund (GAF)		
		Special Allocation Fund (SAF)		
	Other Income			
Financing	Remaining balance of local budgets			
	Acceptance of local loans			
	Regional reserve fund			
	Proceeds from sales of regional assets separated			

The convergence of the economy across provinces shows that there are several “surplus” provinces and still many “poor” ones. This condition indicates that the running of autonomy program in the poor provinces still does not work fluently or facing many obstacles. The arrangement of convergence to the national income per capita index could be carried out by “cross fertilization” from the “surplus” to the “minus” regions through the management of autonomy budget allocation toward convergence economy between regions (Soelistijo, 2010 [25]; Bulmer, 1982 [7]).

3.4 Contract of Work

3.4.1 Mineral Contract of Work (MCOW).

At the end of 1960s Indonesia faced several political, security and economy issues as well as relations with neighboring countries. Economic problems include sovereign debt, poverty, hunger, inflation, and low investment. In order to overcome these problems, the government invited foreign direct investment (FDI) by releasing Law No. 1 Year 1967 about FDI in line with Law No. 11 of 1967 about Principles of Mining. Until now there have been eight generations of MCOW in Indonesia (Figure 3).

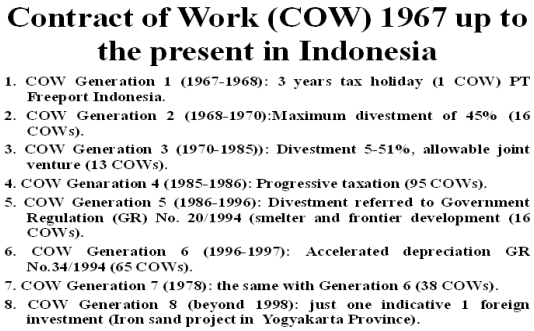


FIGURE 3. CHRONOLOGY OF MINERAL CONTRACT OF WORK (MCOW) SINCE 1967

Various taxes and financial obligations that must be paid by MCOW companies to the state include dead rent, royalty, income tax of company (PPh Badan), income tax of employee (PPh karyawan), tax of interest, dividend, leasing and services (PPH bunga, dividen, sewa, jasa), value added tax (PPN), excise and stamp (bea materai), import duties, land and building tax (PBB), local government tax, general administration, vehicles tax, fulfillment of other tax obligations

Conditions of Indonesia mineral potency is still promising (Figure 4). Therefore, it is necessary to improve mining policy to address various problems faced by Indonesia. Those problems include legal and business certainty, Contract of Work (COW), local people, illegal mining, security, overlap between the mining and forestry area (Law Number 41/1999), spatial, human rights and democratization, inventory, utilization, conservation, environment, sub-marine tailings disposal, regional autonomy, map of sea area of regional autonomy, fiscal conditions in mining business, the provisions of new royalty tariff (Government Regulation (PP) Number 45/2003 as a replacement for PP Number 13/2000), change in paradigm about Community Development (CD) (Soelistijo, 2010 [25]).

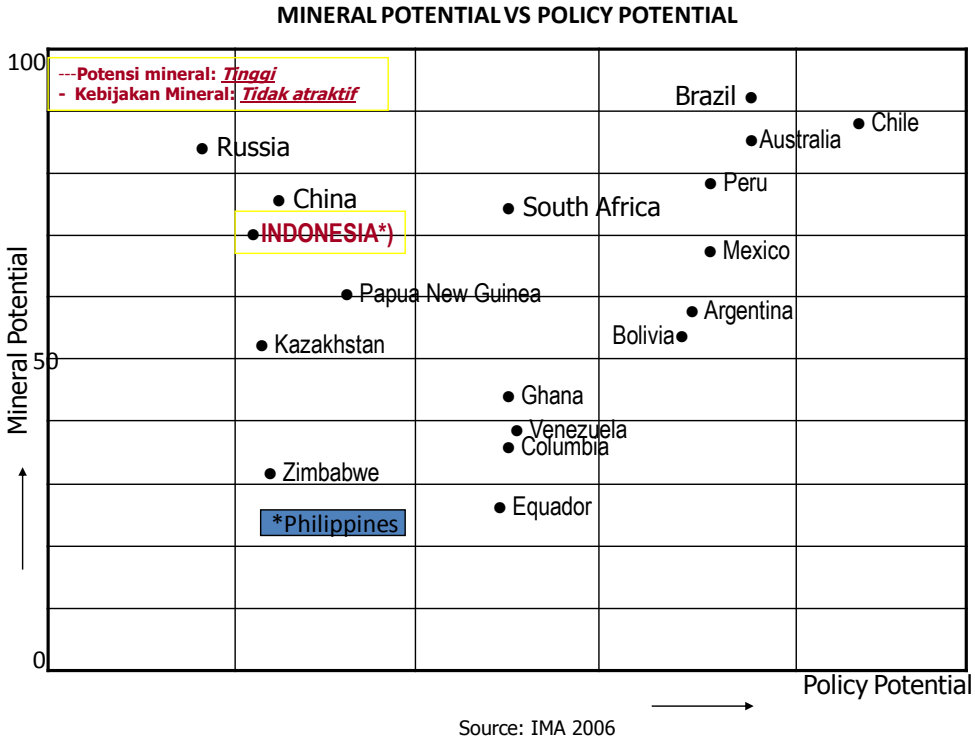
3.4.2 Coal contract of work

Coal Contract of Work (CCOW) consists of 3 major parts, they are technical aspects, legal aspects and economic aspects of the implementation of the contract. The technical aspects contain regulations about areas, periods of activity, activity reports, provision of mapmaking, as well as implementation of mining activities. Legal aspects governing the settlement of disputes, termination of contracts, transfer of ownership, and so on. While the economic aspects governing the royalty (13.5% of production/year), security deposits, minimum expenditure, export rights, and the company's financial obligations.

The implementation of COW and CCOW (coal enterprising cooperation agreement) in Indonesia. Actually, it has created national gains of about 55% and 60% of their revenue to the country respectively, Soelistijo, 2011a [26]).

3.4.3 Flow of mineral and coal commodity trade

In coal and mineral commodities trading, there are contracts or agreements that must be met. The contracts (smelter schedule) is a list of the requirements of the elements that must be contained in a product so that it is ready to sell. The contract consists of number of products, price, place of exchange, quality, penalty / bonus, procedure of payment, insurance, and term (Soelistijo, 2010 [25]).



Source: IMA 2006

FIGURE 4. INDONESIA'S POSITION IN CONTEXT OF ITS MINERAL POTENCY AND MINERAL POLICY STATUS

3.4.4 Indicators of mining business success.

The accredited mining enterprise includes the successfulness indicator both in the fields of financial management and mining enterprise. Moreover, a more specific indicators of financial management include several matters, such as (1) an enterprise characterized by good governance and clean management, that is supported by systematic/professional, accountable and transparent/auditable financial management system; (2) the system of fund raising (debt equity, loan rescheduling, diversification of enterprising, and services development; (3) the system of book-keeping; and (4) the system of audit. The indicators of mining enterprise management may include the activities from upstream (resource/reserve management), management of production activities, up to downstream activities (marketing management) and problems relating to regional development (Herfindahls, 1974; Isard, 1975; Richardson, 1979) and including CSR (Corporate Social Responsibility) (Anonymous (d), 2004).

The indicators of successfulness in the mining enterprise either in the financial management or in the business management is indicated by internal capability in relation to the least cost and the optimal profit obtained as well as by external capability in relation to optimal benefit for the nation where the enterprise operate. For instance, in the case of accountable tax payment and optimal benefit for the regional development including local community development as a corporate social responsibility.

3.5 Management

3.5.1 Resources management

Management means to get things done through and with other people. A process of management functions which consists of planning, organizing, actuating, controlling, evaluating, and technology is applied on resource production functions (human, capital, natural resource, information, technology, environment, and market) in order to obtain the optimum, efficient, effective and economical output. Mathematically, production function can be formulated as follows:

$$Y = f\,(K, L, R, E, I, Z)T$$

where: Y = output (goods/services), F = function, K = capital resources, L = human resources, R = natural resources, E = environment, I = information resources, Z = other resources (ex: market), T = technology.

Management process performed on each resource has a different purpose. The following is the goal of management applied on each resources:

- capital management: fundraising and perform network planning to create a project that can produce products that are useful to national interest,
- human management: creates man of works, virtuous, independent, competitive, and competent,
- natural management: increasing the value added through the interaction between economy, natural resources and environment,
- environment management: a conscious effort to maintain and preserve the functions of environment through arrangement, utilization, development, maintenance, restoration, monitoring, and controlling in order to create a healthy environment,
- information management: a supporting tool in decision making to achieve a goal,
- technology management: creates possibility of stepping productivity,
- market management: bring sellers and buyers to the transaction of goods and services at a certain price,

toward achieving efficient, effective, economic mining business and optimally in terms of minimizing cost and maximizing profit. This achievement has been gained by the mineral resource management in Indonesia (Soelistijo, 2010 [25]).

3.5.2 Modern management

Modern management means to do the right things (standard, norm, and procedure) and do the things right (clean management: good government, accountable, transparent, participative, human rights). Modern management can be applied both in corporate and government environments. Modern management pattern in corporate environment are transnational, service oriented management, restructuring-downsizing-specializing, cross fertilizing and enrichment management,

incorporated. Modern management is necessary to be implemented in the mining industry development toward supporting and achieving efficient, effective, economic as well as optimal business supporting sustainable mining development (Soelistijo, 2010, [25]; Soelistijo et al, 2015 [58]).

3.6 Mineral Added Value

The simple meaning of added value is the result of techno-economic transformation from the initial condition of mineral resources and commodity toward the condition with the greater value of economic, utilization and usefulness than before. Then, this new condition would contribute positive impact upon the economic, social and culture at the level of global, regional, national and local.

A broader meaning of added value may include sector and regional added. Sector added value is consisted of from downstream to upstream industry products or end use commodity, while regional added value may cover benefits that be useful for the regional as well as community development. Within the coming years natural resource added value may also cover the competent of geopolitical (economy) interest such as world trade, transportation, global logistics of economic inputs resources, goods and services and so on to achieve national sustainability and people welfare (Soelistijo, 2013 [34]; 2013, [28]; Anonymous (e), 1999 [5])

3.7 Policies

3.7.1 Political economy

Political economy is the social science of the interrelations of economic processes and political and social organization. In principle, political economy of resources constitutes interaction between processes of economy, social institution, and political one to aim a sustainability of nation life and community wealth (Figure5).

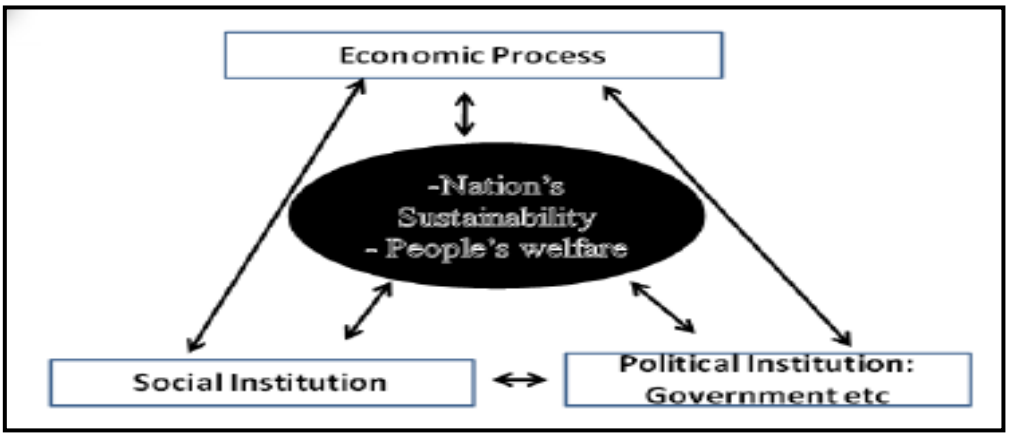


FIGURE 5. GENERAL MINDSET OF POLITICAL ECONOMY
Source: Mas'oed, 2003 [16]; Soelistijo, 2013 [40]).

Referred to the mindset of political economy for Indonesia where instrumental input and considering the strategic environmental condition, toward achieving the goal of political economy of people welfare and nation life sustainability, so that process and method of political economy especially its development in Indonesia (Figure 6), in principle paying attention on the aspects of the existing science of economics such as liberal economics, the developing Indonesian knowledge of economy of "Pancasila" (the Indonesian ideology) (Redaksi Ekonomi Harian Kompas, 1982; Departemen Koperasi, 1992, [21] [8]), centrally planned economy, law in order and enforcement including several fundamental factors in the science of economy such as economic entropy. In management, entropy could be translated as a theory of limitation. Entropy is an alert method of calculation used as indicator of inability of a system to carry out a certain kind of work. Entropy of an organization means that a very comprehensive computation should be conducted about matter that is it possible or impossible to carry out based on the various determinant factors that may exist or possibly exist (Kuntjoro, 2013 [12]; Freres, 1995 [9]; Mas'oed, 2003 [16]; Miernyk, 1982) [18].

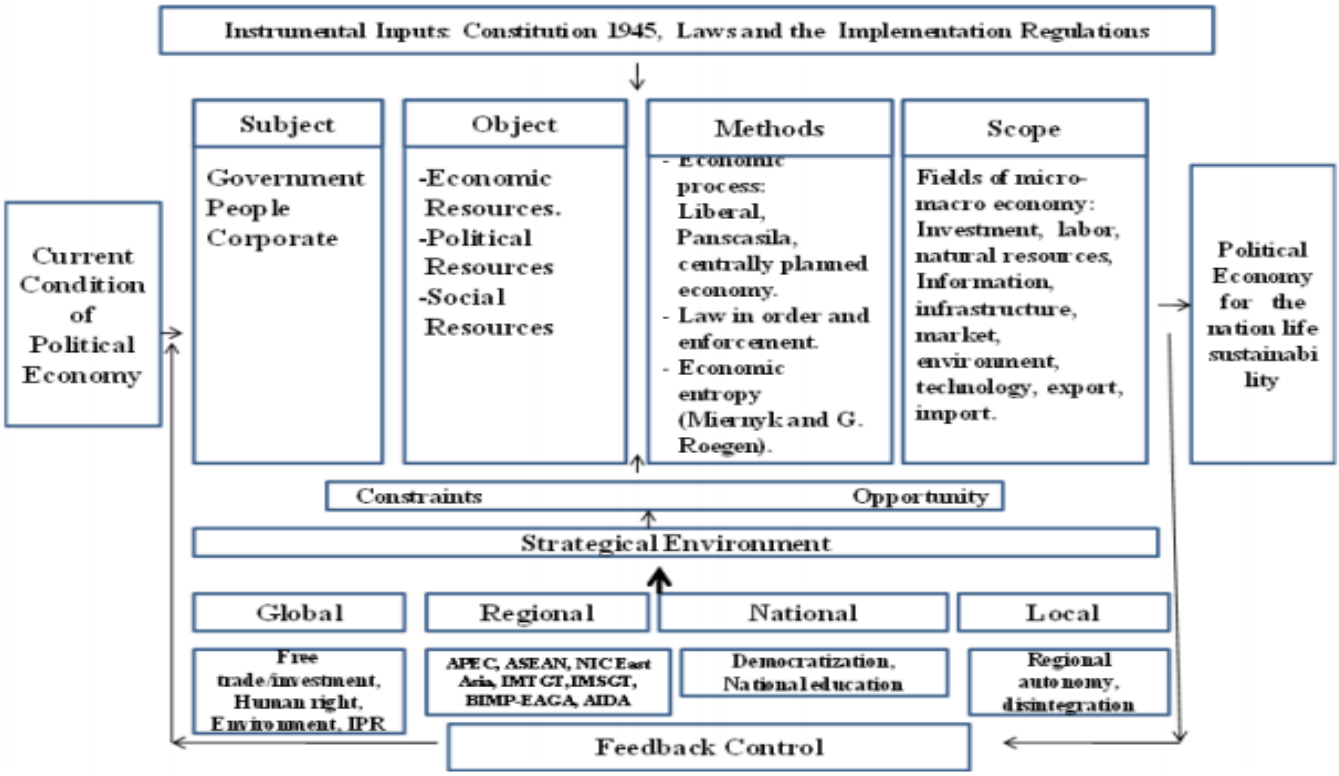


FIGURE 6. MINDSET OF POLITICAL ECONOMY FOR INDONESIA

3.7.2 Intensification, conservation, diversification, expansion.

In mineral resources management, it is necessary to apply the concept of (1) intensification: the effort to intensify exploration activities in order to increase the amount of reserves as one of the national wealth for support to development, (2) diversification: the effort to diversify vertically (increasing value added by processing the primary commodities into end-use commodity) and horizontally (diversification of similar commodity yet with different quality, quantity, and price or economic role), (3) conservation: the use of natural resources of the greatest goods, for the greatest number and for the longest time, and (4) expansion: efforts to produce efficiently, effectively, and economically in order to obtain output with the least cost and good quality which accompanied increased added value (Soelistijo, 2010 [25]).

3.7.3 Illegal mining

Illegal mining or PETI (the mining activity without license) is the mining enterprise which is carried out by individual, group of people, or legal enterprise, where in its operation does not own permit from the government institution in lieu of the prevailing regulation or law. Various problems emerge caused by PETI, for instance by the condition of disharmonized enclave between the legal mine and the local community and PETI, mine safety and health, loss of the state revenue, environmental disruption, un-conducive investment climate and wasting (extravagance) of mineral resources (Soelistijo, 2011b [27]; [63, 64]).

Referred to the policy formulated by The Central Integrated Team of PETI tackling, (Tim Terpadu Pusat Penanggulangan Masalah Pertambangan Tanpa Izin (PETI), 2000 [63]; Tim Koordinasi Penanggulangan PETI, Penyalahgunaan Bahan Bakar Minyak, serta Perusakan Instalasi Listrik dan Pencurian Aliran Listrik, 2003[64]) systematic effort of PETI prevention and tackling principally could be seen in Figure 7 in the framework of law in order and law enforcement based on the several steps of program, they are (1) PETI disclosure and structural transformation f PETI toward other sector enterprise and employment creation, (2) formalizing PETI into small scale mining business or formal artisan (traditional) mining based on Law of Mineral and Coal Mining Number 4/2009 and (3) partnership between ex-PETI and the Mining Enterprise Permit Holder. PETI could be formalized as formal business entity such as cooperative unit or other type of corporation by the authoritative government institution.

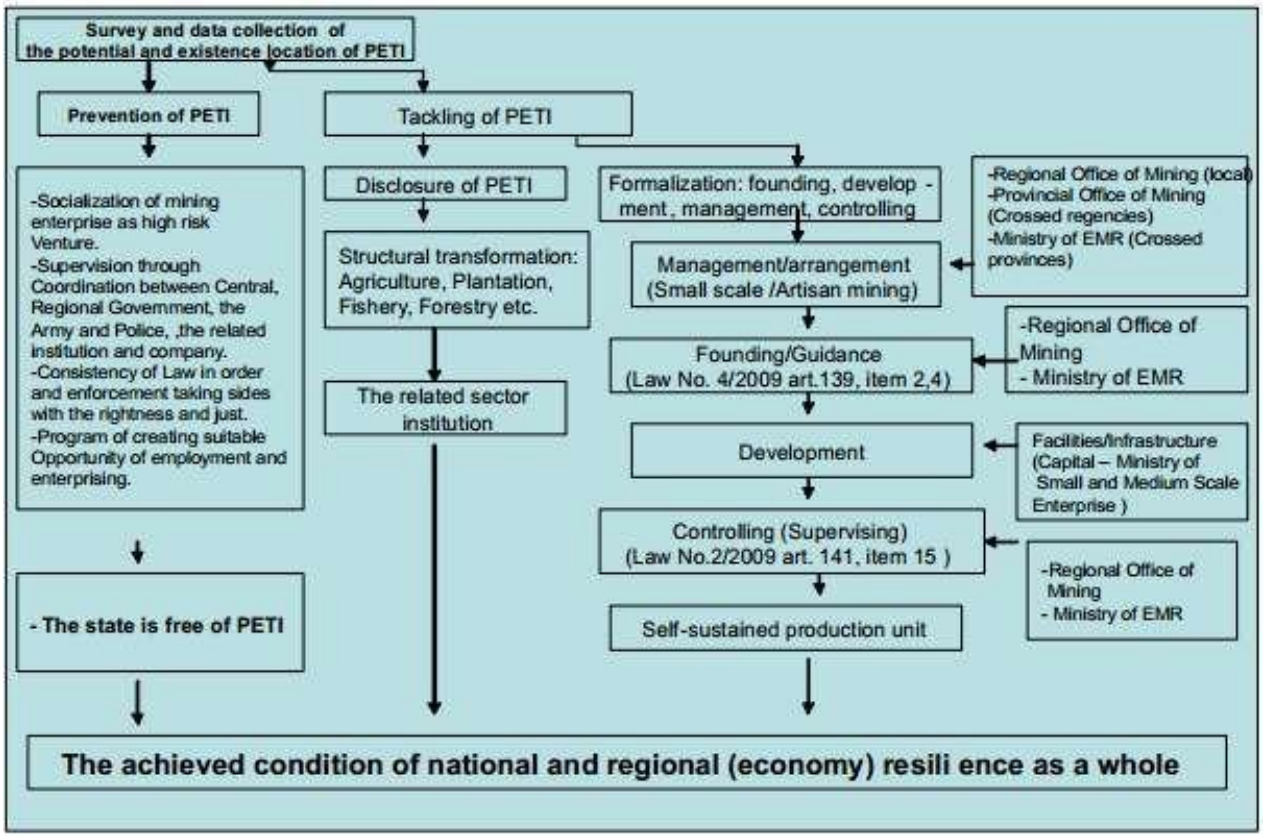


FIGURE7. SYSTEMATIZATION OF THE EFFORT OF PETI PREVENTION AND TACKLING

3.7.4 Policy of mineral and coal mining (Law no. 4/2009).

Formerly, mining was regulated with Law No. 11 of 1967 on Basic Regulation on Mining ("Law No. 11 of 1967"). But with the highly development of mining, nationally and internationally, Law No. 11 of 1967 is no longer suitable with the conditions nowadays. In January 2009 the government stipulated a new regulation on mining. It is Law No. 4 of 2009 on Mineral and Coal Mining ("Law No. 4 of 2009"). This Law is changing the use of Mining Authority (Kuasa Pertambangan) into Mining Enterprise License/Permit (Izin Usaha Pertambangan/IUP). The law is expected to create conditions for mineral and coal which able to give added value for national economic growth, create wealth, prosperity, and justice for people sustainable development, , as well as reliable, competitive, and efficient management of mineral and coal [1].

3.7.5 Master Plan of Acceleration and Expansion of the Indonesian Economy/MP3EI (Economy Corridors).

Indonesia has launched the master plan for MP3EI (***Master Plan of Acceleration and Expansion of the Indonesian Economy***, 2011- 2025). The projection of GDP is figured out from around US$ 500 billion in the year of 2011 up to US$ 2,000-3,000 billion in 2025 or increasing 4 to 5 times greater. In the master plan Indonesia is divided into six corridors. Those are the corridors of Sumatera, Kalimantan, Sulawesi, Papua-Maluku, Nusa Tenggara, and Java in line with the concept of regional development and location theory and with the different seeded sectors respectively (Figure 8) (Soelistijo, 2010 [25]).

Five of the 22 main economic activities in the framework MP3EI is of the six activities of energy and mineral resources sector, i.e., oil and gas, coal, bauxite, nickel, and copper. With the release of the Minister of Energy and Mineral Resources (MEMR) Regulation No.7 of 2012 on Improving Mineral Added Value, thus the mineral and coal are still expected as the prime mover and the leading sectors to boost economic activity in the sixth Indonesian economy corridors.

The present government improves the vision or policy of the national development what is called "NAWACITA" which contains nine points of desires (aspirations) namely national security (safety), clean government, periphery development, law enforcement, human skill resource development, national productivity, economic reliance, national character building, and diversity but unity.

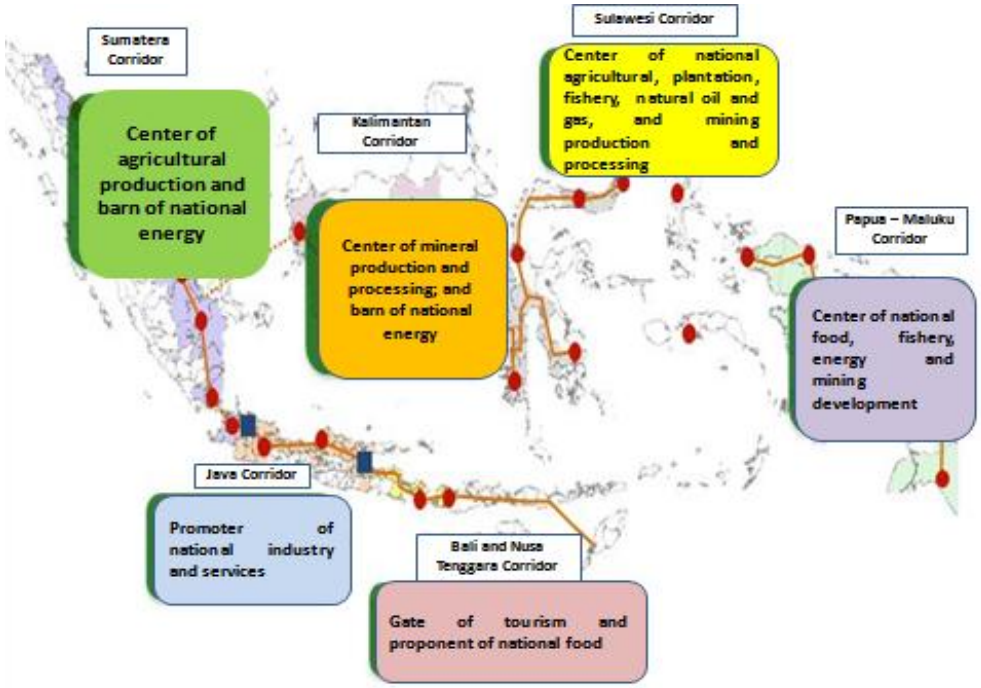


FIGURE 8. SIX ECONOMIC CORRIDORS OF INDONESIA

3.7.6 Paradoxes in the Mining Business

There are some conflicts that opposed the implementation of the mining business which include centralization vs. decentralization, upstream vs. downstream industries, exclusive society vs. local, advanced technology vs. traditional technology, high risk vs low risk, quick yielding vs slow yielding, high taxes vs. low taxes gross domestic product gross national vs. pollution, environmental protection vs mining in protected forests, the sun sets industry vs. developing new investments, as well as the orientation of consumption vs. investment orientation (Figure 9) [5]. Paradoxes can act as an input to determine the policy and management of natural resources in order to create the sustainable development of mineral resources and for the benefit of community.

FIGURE 9. PARADOXES IN THE MINING ENTERPRISE DEVELOPMENT

Source: Soelistijo et al, 2015 [46]

3.8 Outlooks

3.8.1 Globalism versus regionalism

The era of globalization is the global era of human life and civilization with the dynamics of modern norms. The era of globalization has several characteristics, among others:

- the whole competitiveness, both in terms of quantity, quality, "price" in broad meaning and "just-in-time services";
- tendency to neglect the various limits (3B's: barrier, boundary, border) in the economy, the state, and geography toward multi-network (2N's: network of networks).
- free trade and free investment;
- the rise of the global environment which brings disorder to the existing conditions of life of the nation (Figure 10).

In contrast to globalization, regionalization only covers a certain area consisting of several countries. The purpose of regionalization is to encourage free trade at certain regions, such as AFTA, NAFTA and SAFTA as well as to create instruments, such as CEPT and PTA. to reduce trade barriers (Soelistijo, 2010 [25]).

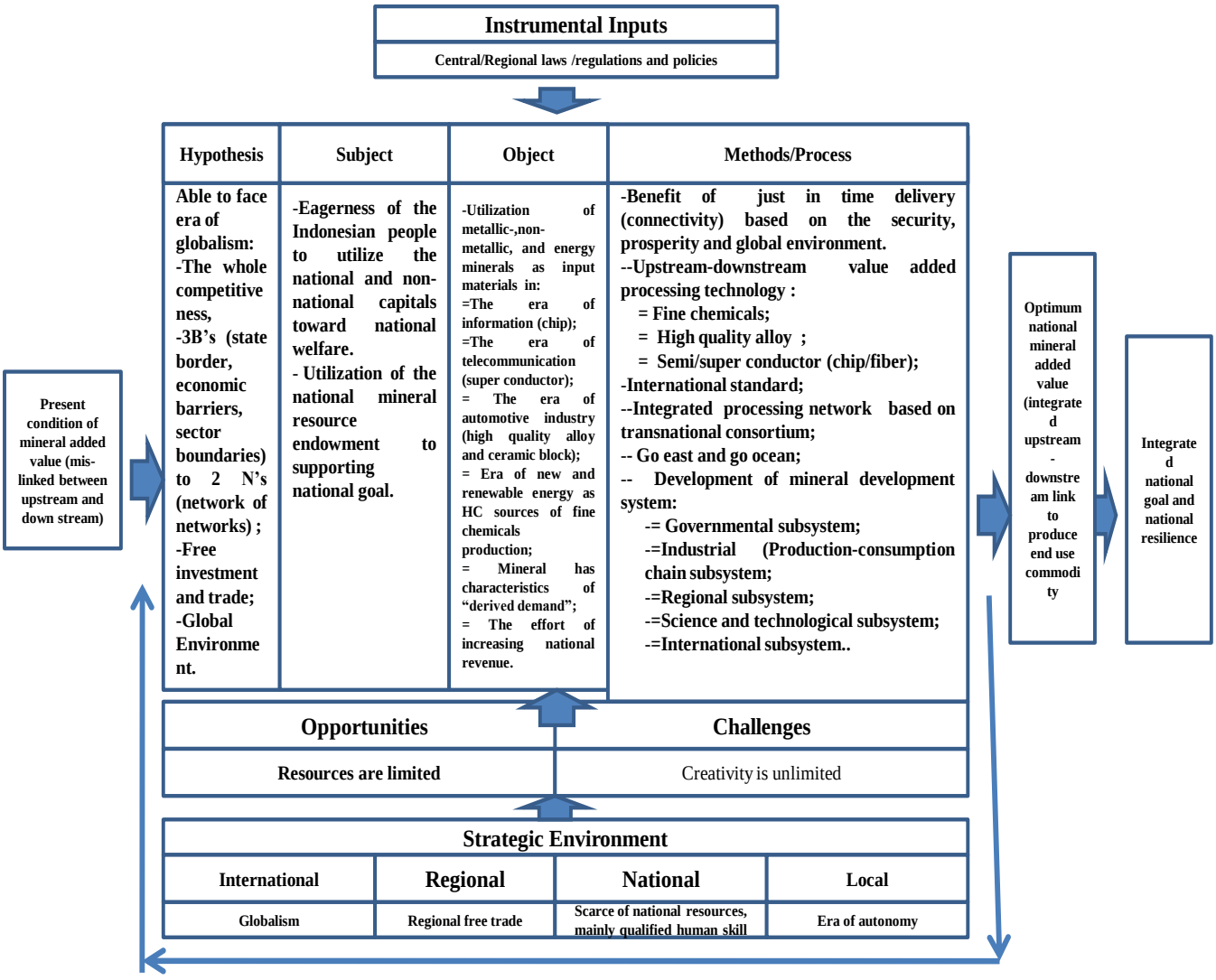


FIGURE 10. MINDSET OF MINERAL COMMODITY IN GLOBALIZATION ERA

3.8.2 21st century megatrends

Megatrend in the era of globalization according to J. Naisbitt is the creation of the information society, advanced technology, global economy, decentralization, self help, network, South nations (developing countries), participatory democracy, and multi alternative as well as openness, freedom, and responsibility. On the other hand, according to Aburdene megatrends of 21st century is the formation of society of information and services, skillful labor, strong involvement of women, workfare state (creation of employment), biotechnology, companies and human resources (human is the center of concern) , the global role of English, the role of Pacific and free trade and the importance of local knowledge (arts and culture, spiritual and religious) (Table 2) (Soelistijo, 2010 [25]).

TABLE 2
MEGATREND OF THE 21ST CENTURY

No	J. Naisbitt	Aburdene
A	• Information society • Advanced technology • Global economy • Long-term • Decentralized • Self help • Network • Southern (developing countries) • Participatory democracy • Multi alternative	• Information and services society • Skilled workforce • Strong involvement of women workers • Workfare state • Biology • Corporate and human resources • Role of global English • Role of Pacific • Free trade • Arts and culture, spiritual and religious
B	Openness, freedom, and responsibility	

Source: http://wahyuchaem.mywapblog.com/, 2015 [66].

3.8.3 The limits to growth

There are some complex problems known as (WP) which faced by all nations. Those problems are poverty, environment, loss of faith in institutions, uncontrolled urban spread, alienation of youth, rejection of traditional values, inflation and other economic disruptions. WP has 3 characteristics: (1) occur in all societies, (2) contain technical, social, economic and political elements and (3) they interact.

Population, rate of growth, and level of pollution seem to be increasing exponentially. If the present growth trends continued unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. However, it is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far in the future through technology and policy.

It looks likely that the 1970s outlook of several eminent Club of Rome thinkers is valid for the reality in the 21st century views.

3.8.4 Global warming

Global warming has implications for climate change on Earth. To minimize the climate change, efforts are needed to reduce greenhouse gas (GHG) that is caused by emissions mainly by CO_2 (carbon dioxide) and other gases (CH_4 (methane), CFC (Chlorine Fluor Carbon), NO_x (nitrogen oxides group), SO_x (sulfur oxides group), etc.) by the result of human activity.

However, the efforts to reduce emissions of these gases, especially CO_2, will affect logging and industry that will directly affect the rate of development in each country, both developed and developing countries. The implications will be felt particularly by developing countries to develop their related countries in order to reduce and alleviate poverty. It requires a specific mechanism in the presence of some sort of international fund to compensate developing countries that need to be led by the developed countries.

Global efforts needs to be implemented through joint action programs in order to achieve that goal of climate change mitigation, among others, the level of CO_2 levels aligned to produce a temperature rise in the Earth's atmosphere no more than 2^{o}C year 2030. Those various efforts were discussed in the various international meetings either at the level of UN (UNFCCC) or in the other international bodies within the last two decades since in the UNFCCC COP-3 in

1997 with the Kyoto Protocol up to COP-19 in Warsaw. Indonesia has taken into action in the forms of developing Central Climate Change Team under the Ministry of Finance in cooperation with international bodies such as World Bank to perform down-to-earth sector action program in the fields of low carbon study, REDD plus and transportation study (Figure 11) (Soelistijo, 2010 [25], 2014 [60]).

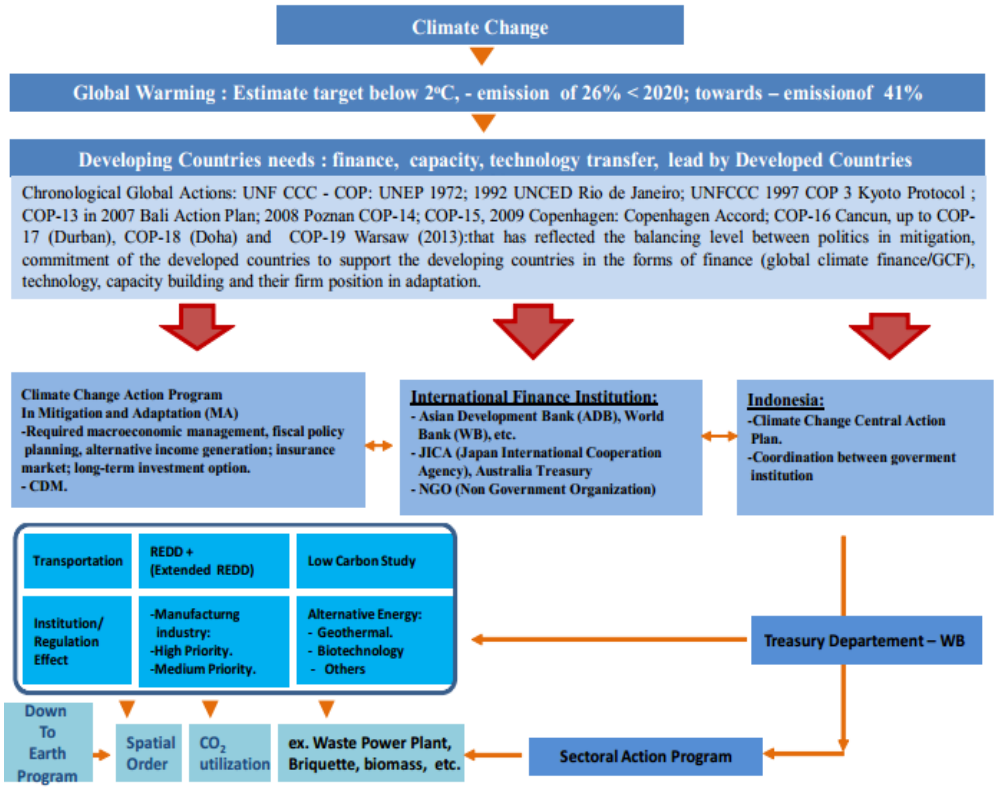
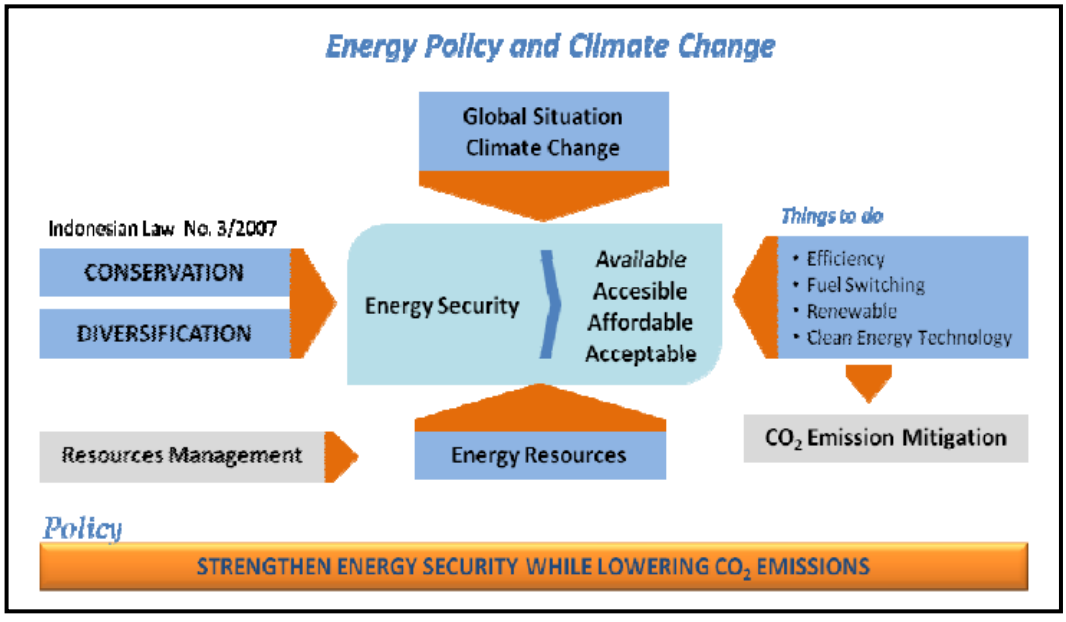


FIGURE 11. INDONESIA DOWN-TO-EARTH PROGRAMS FOLLOWING THE INTERNATIONAL CLIMATE CHANGE GUIDELINES

In order to overcome this issue, it is needed energy policy to govern conservation and diversification efforts to achieve energy security. Management of energy resources take part in order to aim for strengthening energy security while reducing CO2 emissions [11]. In addition, mitigation efforts of CO2 emissions through energy efficiency, fuel switching, the use of renewable energy, and clean energy technology are necessary (Figure 12) (Soelistijo, 2010 [25]), 2014 [60]).



V. CONCLUSIONS & RECOMMENDATIONS

As a country that relies on mineral resources and energy as one of the main economic sectors, in order to save and secure the national interest of economic development, the issues explained above should be overcome since 1970s when the economic development has been launched up to the present. This effort should also be in lieu with the global trend especially on environmental and economic phenomena, among others global warming and global economic trend, such as free trade and investment, intellectual property right and human right.

Regional and global cooperation and regional autonomy is an opportunity to develop the potency of mineral resources and energy. Through regional and global cooperation, Indonesia may reach a wider market on mineral and energy resource. In addition, with the regional autonomy the licensing process of minerals will become easier. However, in practice regional autonomy even cause new problems, i.e. overlapping mining permits which issued by Minister, Governor, or the Regent/Mayor related to the euphoria of democracy. In order to overcome this problem, there must be a good controlling system.

Resource management and modern management is supporting tools for processing inputs into economical, efficient, effective and optimum outputs. Similarly, the increase in value-added minerals used in transforming mineral resources into a more valuable product. Both of these tools should be used to obtain optimum and sustainable benefits of mineral resources.

The outstanding issues in the field of mineral and energy exploitation as explained above could be a basis for decision-making and policy-making for Indonesia government. Minerals and energy policy is a part side in achieving national goals. However, too many changes in the mining regulatory framework may cause uncertain investment climate in Indonesia and as the result Indonesia less attractive to foreign investors.

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