



Mercury Problems In Gold Mining In Indonesia: Political Ecology Review

**Mutia Izzati^{1*},
Soeryo Adiwibowo²,
Etty Riani³**

¹*Natural Resource and Environmental Management Study Program, SPs IPB,
E-mail: mutiaizz21998izzati@apps.ipb.ac.id

²Departement of Communication Science and Community Development, FEMA IPB,
E-mail: adibowo3006@gmail.com

³Departement of Aquatic Resources Management, FPIK IPB, E-mail: etty_riani@apps.ipb.ac.id

***Corresponding Author:-** Mutia Izzati

*Natural Resource and Environmental Management Study Program, SPs IPB,
E-mail: mutiaizz21998izzati@apps.ipb.ac.id

Abstract

In Indonesia, the phenomenon of gold processing using mercury is a complex phenomenon. This phenomenon links inter-sectoral relationships (environmental, social, economic, and even legal) as well as inter-stakeholder linkages (government institutions, non-governmental institutions and the people). In an effort to overcome this phenomenon and achieve Mercury-free Indonesia, the Government of Indonesia has issued PERPRES NO 21 of 2019 concerning the National Action Plan for Mercury Reduction and Elimination (RAN-PPM). In the field of Small-Scale Gold Mining (PESK), it is targeted to eliminate 100% of mercury by the end of 2025. This study uses an evaluative qualitative approach using primary data obtained through Focus Group Discussions (FGD) and in-depth interviews from relevant stakeholders and then processed. using the MICMAC analysis tool, then analyzed by perception analysis. This study examines why the existence of mercury in Indonesia, especially in the gold mining sector, is still high. Furthermore, this research can gradually identify factors and even key actors in the problem of eradicating mercury in Indonesia. The results showed that of the 5 (five) existing factors, namely: law enforcement, interest relations, structural, social (perception), and economic. The relationship between one factor and another all has a close relationship and is united in a frame called political ecology. The political ecology narrative carried in this study states that the impact of local business on the environment is greater than that of universal business because the nature of this local business is often more difficult to classify and interpret.

Keywords: political ecology; mercury; gold mining; Indonesia

Introduction

Small-scale Gold Mining (PESK) is also commonly referred to as community mining, this is because most of the mining managers are the people themselves. Small-scale Gold Mining (PESK) in Indonesia is inevitable with the case of Unlicensed Mining (PETI). As of August 2021, according to the Directorate General of Mineral and Coal, MEMR (2021), unlicensed mining locations in Indonesia have reached 2,741 locations with 2,645 PETI Mineral locations which include gold mining without a permit. (Picture X).

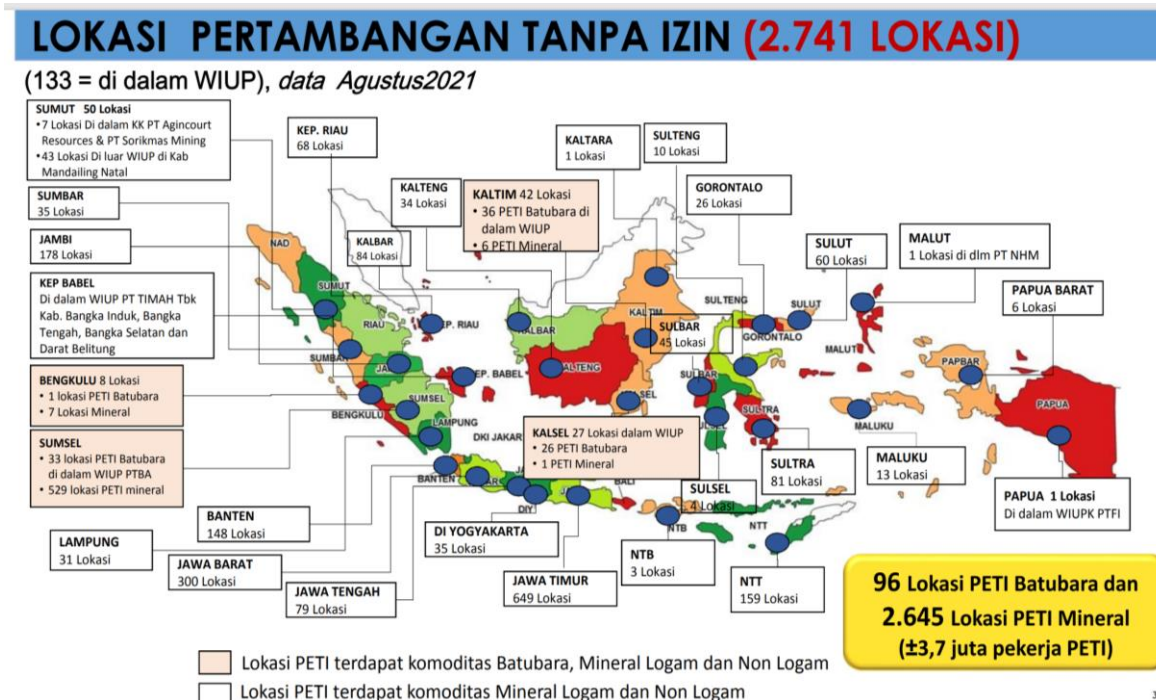


Figure X. Map of the Distribution of PETI Locations Directorate General of Mineral and Coal Ministry of Energy and Mineral Resources (2021)

In essence, gold mining has an impact on state losses in a multidimensional manner such as economic losses, environmental losses and socio-cultural losses (Minerba, 2013). This gold mining phenomenon can be categorized as a local business which in fact indirectly affects the politics of the third world environment. The concept in the third world of environmental politics is to understand the sources of politics and political conditions that become an integral part of environmental change, because gold mining brings environmental changes. The perspectives and theories used in viewing and responding to the ecological crisis as a result of mercury emissions in Small-Scale Gold Mining use the perspectives of critical theories of social change which include ecologism, social justice, radical and revolutionary. This ecological crisis is seen as one of the political, social and economic products that have been going on and become a culture attached to miners in Indonesia. Departing from this, it is necessary to apply ecological principles and not just a linear approach (Dobson, 2007).

Since the development of the global industrialization era, the amount of mercury in the atmosphere, soil and waters has increased by two to four times than before (Network., 2017). The issue of mercury pollution has become a concern for the global community because of its contamination which has a negative impact on the environment and human health. Departing from these concerns, under the United Nations (UN) followed by world countries through the United Nations Environment Program (UNEP) finally in 2013 an International Agreement was made to regulate the use and management of mercury substances in a convention known as the Convention. Minamata on Mercury. The Minamata Convention requires countries that ratify it to make strategic action plans related to the management and elimination of mercury use in their respective countries.

In Indonesia, Law Number 11 of 2017 concerning Ratification of the Minamata Convention on Mercury has become a signal that Indonesia is already in a mercury emergency. The ratification of the Minamata convention can be seen as evidence of the Indonesian government's efforts to play an active role in protecting citizens and participating in carrying out world order in accordance with the mandate in the Preamble to the 1945 Constitution.

In following up on the mercury emergency in Indonesia, in April 2019 the President of the Republic of Indonesia issued Presidential Regulation Number 21 of 2019 concerning the National

Action Plan for Mercury Reduction and Elimination (RANPPM). This Presidential Regulation Number 21 of 2019 contains the government's target for reducing mercury which includes limits on the circulation and use of mercury in stages, controlling the emission of mercury released into the surrounding environment and also contains the government's target in efforts to eliminate mercury which includes a prohibition on producing and using mercury, as well as replacing mercury with other materials that are friendly to human health and the environment. The target for reducing and eliminating mercury in the priority areas of Small-Scale Gold Mining (PESK) in 2025 is 100%. However, based on the fact that until 2021, Small-Scale Gold Mining still uses a lot of mercury in its processing because it is considered more affordable, both in terms of easy access to it and the price. It is proven that there are still 2,645 mining locations without permits, including illegal gold mining (Minerba, 2021), as well as other important aspects such as the prosecution and control of illegal ASGMs that use mercury in their processing, only achieving around 50% of the target made in 2019 ago. (LHK, 2018). What are the inhibiting factors that cause mercury to still circulate in Small-Scale Gold Mining Areas in Indonesia?

Literature Review

Mercury is a metal that comes from the source rock of mercury sulphide (HgS) which is heated at a temperature of 800 oC using oxygen (O₂). Mercury has a greater tendency to vaporize and easily mixes with other metals to become mixed metals (Amalgams/Alloys) (Barkay & Wagner-Döbler, 2005). In the periodic table, mercury is a metal with serial number 80, isotopes 193 to 205 and a relative atomic mass of 200.9 atomic mass units (amu) and a density of 13.59 grams/cm³. Other physical properties of mercury are that if at room temperature it has a liquid form with a melting point of -38.88 oC and a boiling point of 356.7 oC, silvery white in color, toxic with a mirror-like appearance, easy to form alloys, good electrical conductivity but poor thermal conductivity, mercury insoluble in water, ether, alcohol, hydrochloric acid, hydrogen iodide, and hydrogen bromide, mercury is soluble in lipids, sulfuric acid, and nitric acid (Davis et al., 1994). All forms of mercury have toxic properties, the only difference being the level of toxicity, mercury is less toxic, namely inorganic mercury. But in truth, mercury gas is still the most dangerous gas (Duffus, 1980).

The Minamata Convention is a global convention that discusses international agreements related to global mercury release control (Programme., 2013). The use of mercury in Small-Scale Gold Mining to produce mercury waste is a bad practice in gold processing techniques. Mercury which is classified as B3 waste (Hazardous and Toxic Materials) has been regulated in the laws and regulations in Indonesia through Law Number 32 of 2009 concerning Environmental Protection and Management and its amendments in Law Number 11 of 2020 concerning Job Creation. The Government Regulation Number 74 of 2001 concerning the Management of Hazardous and Toxic Materials in which there is a list of Hazardous and Toxic Materials (B3) which is limited to use is one of the types of mercury. B3 limited to use is B3 restricted to use, import and/or production. In Article 7 and Article 8 it is stated that B3 export-import activities that are limited to use must follow the notification procedure to the state authority. Mercury compounds that are included in the restrictions for use are: Inorganic mercury, Alkyl mercury, Alkyloxyalkyl mercury and Aryl mercury.

Methods

This study uses a descriptive qualitative writing method in the form of an evaluative study. The qualitative method according to (Gunawan, 2013) is a method that has the aim of developing the concept of sensitivity to the problems that are currently or have been faced, explaining the reality that is closely related to grounded theory and deepening understanding of one or more phenomena. This study aims to identify obstacles and barriers in achieving the targets of the National Action Plan for Mercury Reduction and Elimination with a stakeholder evaluation model through the opinions and views of stakeholders involved with the National Action Plan for Mercury Reduction and Elimination. The Stakeholder Model is an evaluation model that involves actors to obtain narratives, stories, and observational data on a policy that will later influence the next policy step (Vedung, 2009). This study uses primary data and secondary data. The obstacles found in the achievement of the National Action Plan for Mercury Reduction and Elimination in the priority areas of Small-Scale Gold Mining use primary data obtained from the Focus Group Discussion (FGD) process and in-depth interviews, while secondary data is obtained from official reports and related supporting documents.

Analysis Data

The data is then analyzed by prospective analysis. Prospective analysis is an analysis that is used to analyze problems in expert systems and can combine decision makers in order to rearrange plans with different approaches but still with the same goal. The resulting solutions come from different approaches, not from the formulation of each case (Munchen, 1991) (Bourgeois, 2002)

The initial stage in factor analysis using MICMAC is to determine Table X Variables and Matrix of Direct Influences (MDI) Table Y. Matrix of Direct Influences (MDI) describes the relationship of direct influence between variables that define the system. Through this MICMAC software, the relationship between the variables found is then given a weighting for these variables based on the degree of mobility and the level of dependence between the variables. In principle, MICMAC software can help (Fauzi, 2019): 1) identify the main variables that influence and are influenced by the system essentially; 2) solve the relationship and relevance between these variables in the system; and 3) help reveal cause-and-effect relationships in the system

The working principle in MICMAC of a cross-matrix to filter the influences and dependent variables is done by the Lefebvre method (Figure X). For example, 3 (three) interacting variables A, B, and C. This relationship is described by the relationship structure of the Boolean Matrix (Fauzi, 2019)

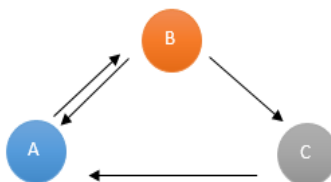


Figure X. Illustration of the interaction of three variables

| | | | | |
|--------|---|---|---|---------|
| | A | B | C | Σ baris |
| A | 0 | 1 | 0 | 1 |
| B | 1 | 0 | 1 | 2 |
| C | 1 | 0 | 0 | 1 |
| Σkolom | 2 | 1 | 1 | |

From the matrix above, if there is a relationship from A to B, then the writing will be represented by a matrix element 1. It can be seen that the zero diagonal element means that the influence on the variable itself is not taken into account. The matrix is MDI (Matrix of Direct Influence). Then consider the effect of the follow-up by squaring the matrix above and will produce the following matrix (Fauzi, 2019):

| | | | | |
|--------|---|---|---|---------|
| | A | B | C | Σ baris |
| A | 1 | 0 | 1 | 2 |
| B | 1 | 1 | 0 | 2 |
| C | 0 | 1 | 0 | 1 |
| Σkolom | 2 | 2 | 1 | |

The matrix that has been squared shows the result that the diagonal element which was originally zero turns into 1. This value can be interpreted that there is an influence that can be illustrated in Figure Y. The key variables in this study are described in Table X

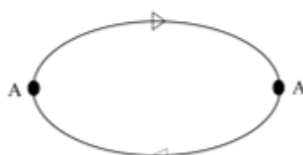


Figure Y. Illustration of the rotation of the influence matrix

According to Godet, Meunier & Roubelat 1999, quadrant I (driven) is a variable that has a very high influence with low dependence, this variable is a crucial variable because it acts as a variable key. Quadrant II (relay) is a variable that has a high influence with a high dependency and an unstable relationship. Quadrant III (dependent) is a variable that has a low influence with high dependence, while Quadrant IV (independent) is a variable that has a low influence with low dependence. Variables in quadra IV are also called excluded variables because their effects are small and will not stop a system from working (Fauzi, 2019).

| | |
|--|--|
| I Driven (Influences Variables) | II Relay (Relay Variables) |
| IV Independent (Excluded Variables) | III Dependent (Depending Variables) |

Figure X Variable Quadrant Mapping in MICMAC

The combination of primary data and secondary data that has been obtained is then summarized into a table of key variables as follows:

Table X. Key Variables: Barriers to Achievement of RAN-PPM in ASGM Priority Areas

| KEY VARIABLE | | | |
|--------------|--|-------------|---------------------|
| N° | Long Label | Short Label | Theme |
| 1 | Lack of seriousness of the government in socializing, educating, and assisting policy implementation | SE | Law Enforcement |
| 2 | Lack of prioritizing the allocation of funds in policy implementation | DANA | Economy |
| 3 | Lack of seriousness in patrols to monitor illegal mining conditions | PATROL | Law Enforcement |
| 4 | It is difficult for illegal miners to switch to other livelihoods | MPL-MPB | Social (Perception) |
| 5 | Miners find it difficult to convert illegal mining status to legal ones | IL-L | Social (Perception) |
| 6 | Lack of awareness of illegal miners about the health impacts of mercury use | KES | Social (Perception) |
| 7 | Lack of awareness of illegal miners regarding occupational health and safety while mining | K3 | Social (Perception) |
| 8 | Strong cooperation between illegal miners and the authorities | RA | Interest Relations |
| 9 | Strong cooperation between illegal miners and local government authorities | RP | Interest Relations |
| 10 | Good relationship between illegal miners and financiers affiliated with local government authorities | RPP | Interest Relations |
| 11 | Access to affordable mining land | AL | Structural |
| 12 | Lack of government transparency in following up illegal mining to legal channels | HUKUM | Law Enforcement |
| 13 | The existence of illegal miners who are rotative and difficult to detect | ROTATIF | Structural |
| 14 | Lack of precise targets in implementing policies | SASARAN | Structural |
| 15 | There is no clear solution from the government in diverting livelihoods | SOL-MP | Structural |
| 16 | The high economic valuation of mining products compared to other livelihoods | VAL-EKO1 | Economy |
| 17 | Lack of awareness of illegal miners about the environmental impact of mercury use | LING | Social (Perception) |
| 18 | State revenues and expenditures for policy implementation are not comparable | VAL-EKO2 | Economy |
| 19 | Easy access to mercury (spread in the market) | AM | Structural |

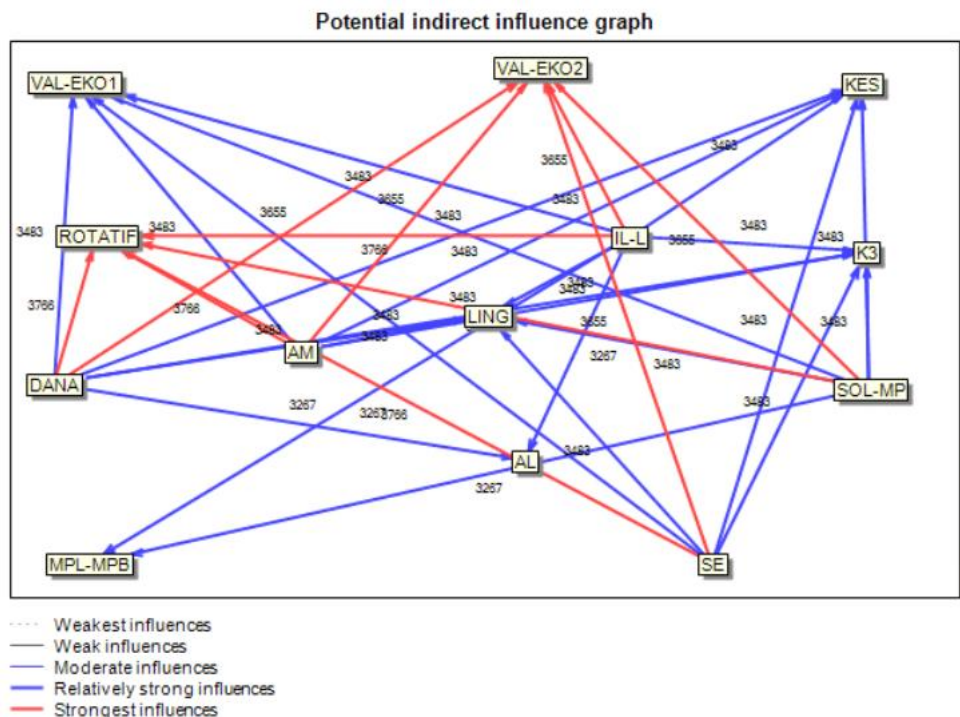
After obtaining the mapping of the key variables, in-depth interviews and Focus Group Discussions (FGD) were carried out together with the Ministry of Environment and Forestry,

MEMR, NGOs, academic leaders, and related miners to fill out the Matrix of Direct Influences (MDI). Then the results occupy a certain quadrant plot, the variable quadrant in MICMAC, describing a map of the direct influence relationship between strategic variables. This map is marked by various types of connecting lines, namely the thick red line which can be interpreted as having the strongest influence relationship, the blue thick line can be interpreted as having a relatively strong influence relationship, the blue thin line can be interpreted as having a moderate influence relationship, and the black thin line. can be interpreted as having a weak influence relationship, and the dotted line can be interpreted as having the weakest influence. . MICMAC provides various ways to represent the variables that have been obtained through a displacement map consisting of a direct/indirect map, potential indirect influence graph, potential indirect influence/dependence map, indirect influence graph, indirect influence/dependence map, potential direct influence graph, and potential direct influence/dependency map.

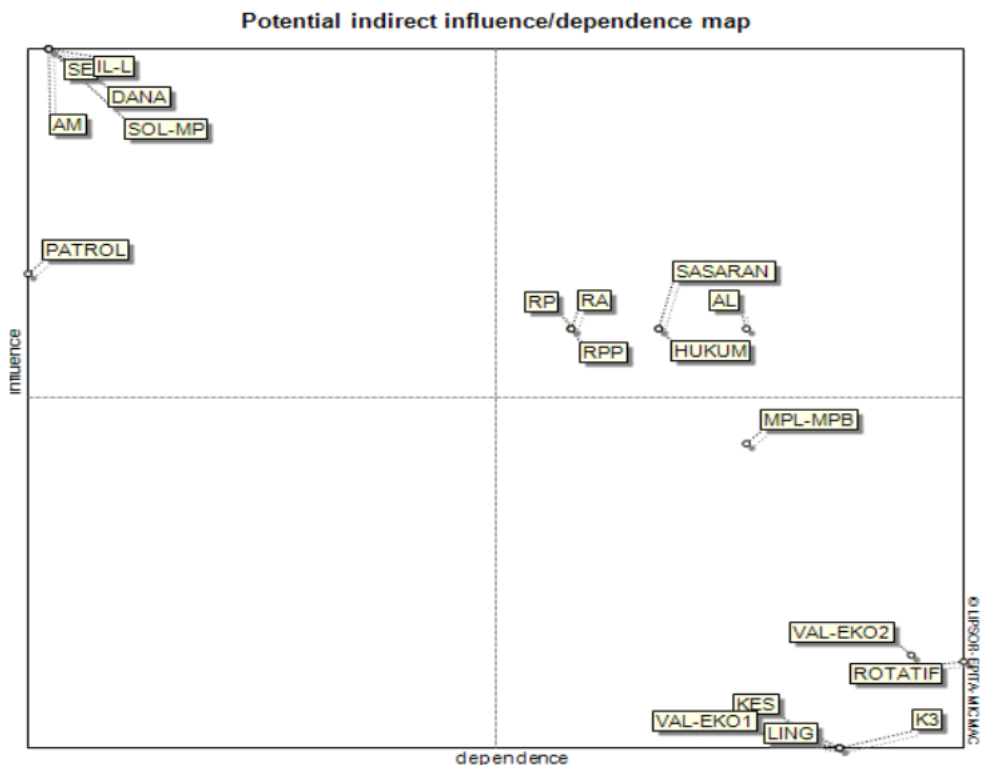
Results

Barriers to Achieving National Action Plan for Mercury Reduction and Elimination

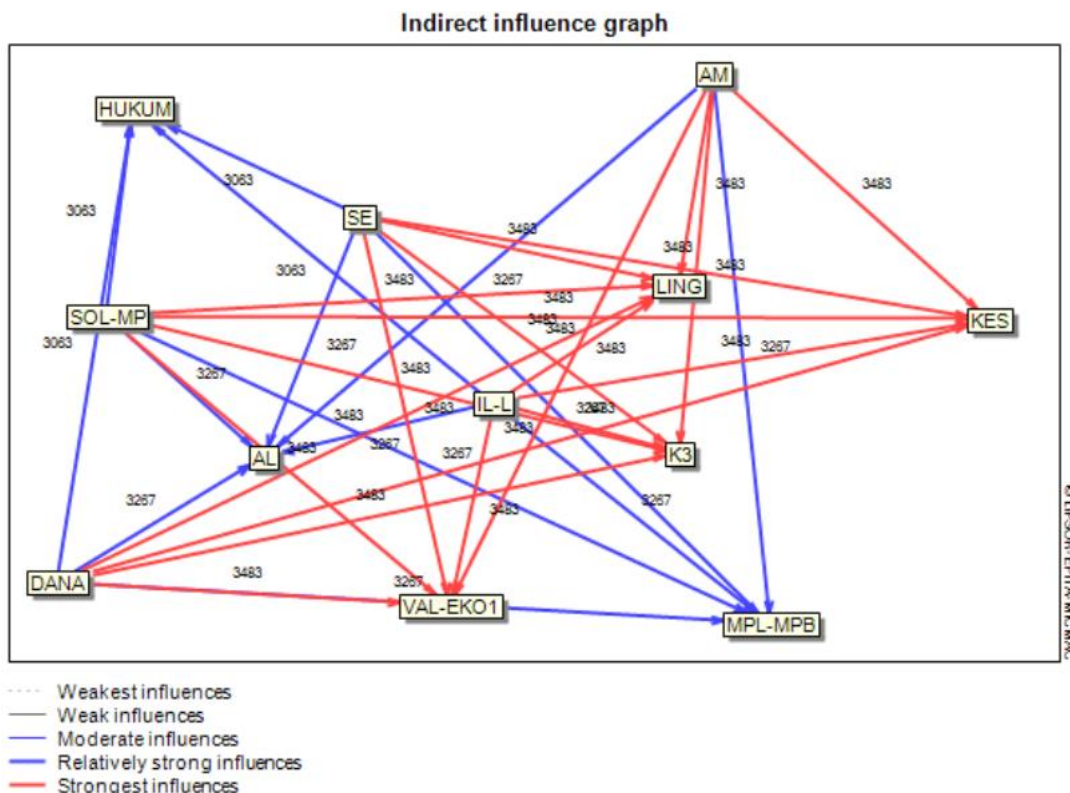
One of the objectives of this research is to identify and analyze the obstacle factors in the implementation of the National Action Plan for the Reduction and Elimination of Mercury in the priority areas of Small-Scale Gold Mining. After the data was processed using the MICMAC analysis tool (LIPSOR software), the results obtained in the form of potential indirect influence graph, potential indirect influence/dependence map, indirect influence graph, indirect influence/dependence map, potential direct influence graph, and potential direct influence/dependence map with description as follows:



Dana, AM, LING, SOL-MP, IL-L, have a very strong effect on the rotative variable, then the variable funds, AM, SE, and SOL-MP have a very strong influence on the VAL-EKO variable 2. Then the variables that have a Relatively relationship Strong Influences, namely the DANA, AM, SE, SOL-MP, K3 variables affect VAL-EKO1 and the fund variable, AM, LING, IL-L affects the KES variable, the variable that has the Relatively Strong Influences on K3 is the VAL-EKO1 variable. , Dana, SE, and SOL-MP.

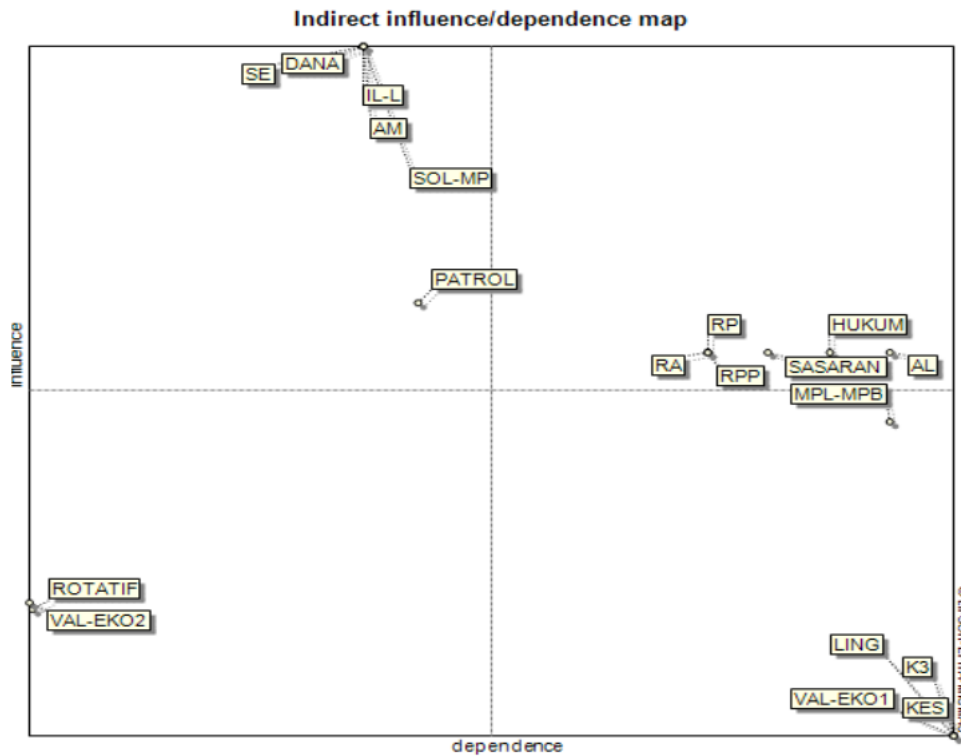


Variables in quadrant I (Influence) are DANA, PATROL, SOL-MP, AM, SE, and IL-L variables, while the variables in quadrant II (Relay) are RP, RA, RPP, Law, AL, and TARTAR variables. , There is no quadrant III variable, and quadrant IV variable there are KES, K3, VAL-EKO1, VAL-EKO2, LING, and Rotative variables.

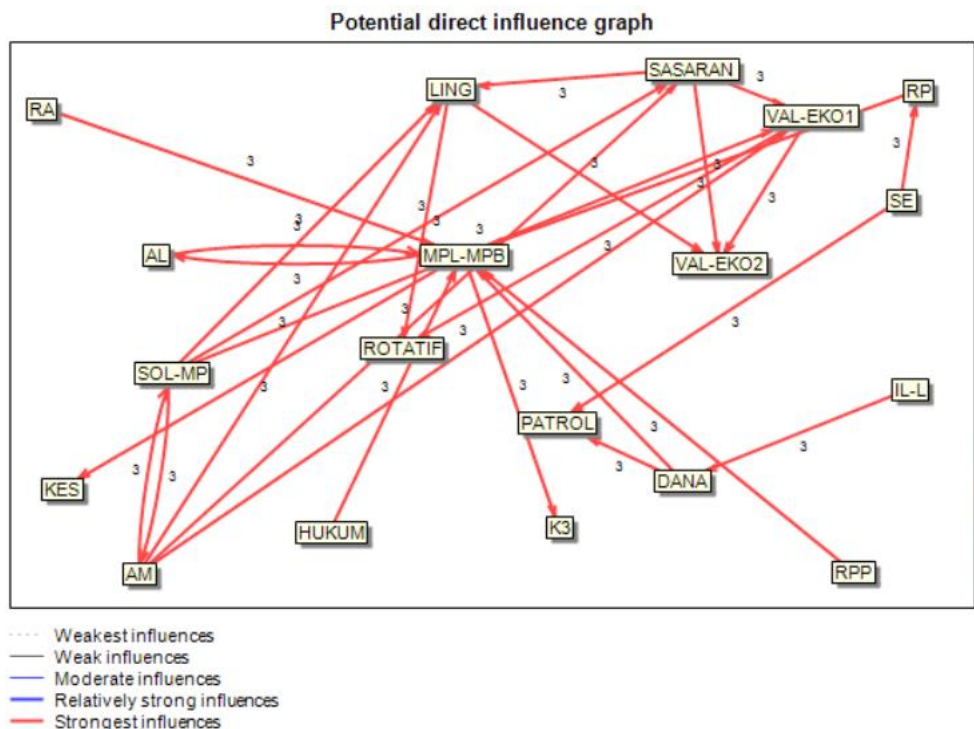


SOL-MP, DANA, IL-AL, MPL, MPB affect the legal variables showing relatively strong influences, then VAL-eko1 SOL-MP, SE, LAW, and AM affect the MPL-MPB variables. Strong Influences relationship, namely the DANA, AM, SE, SOL-MP, K3 variables affect VAL-EKO1 and the funds

variable, AM, LING, IL-L affects the KES variable, the variable that has the Relatively Strong Influences on K3 is the VAL- EKO1, Dana, SE, and SOL-MP.

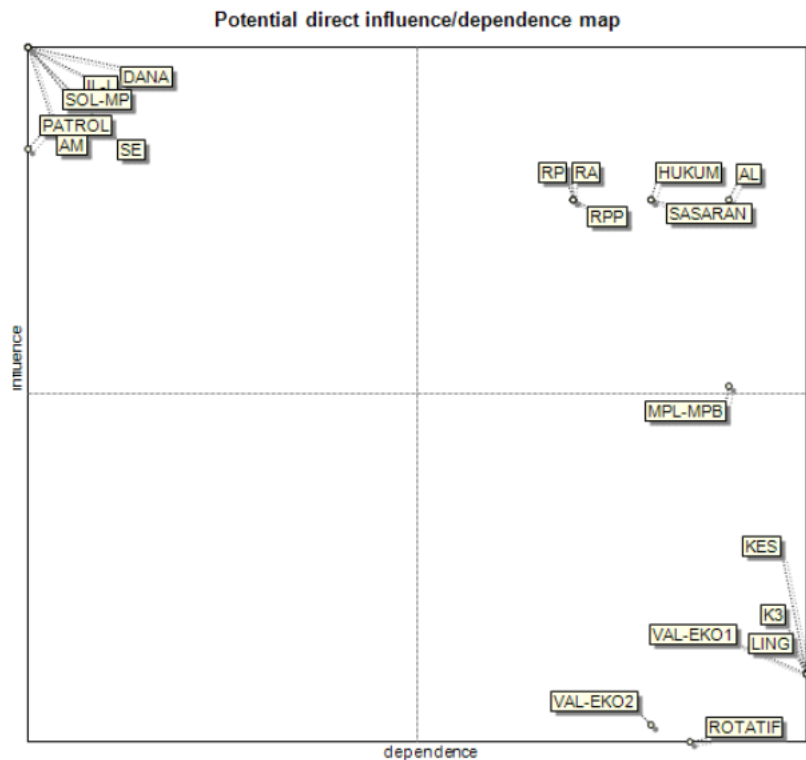


In the indirect influence/dependent map, it is known that the variables in quadrant I (Influence) are SE, DANA,, IL-L, AM, SOL-MP, PATROL variables. The variables in quadrant II (Relay) are RP, RA variables , RPP, Law, target, MPL-MPB, and AL, it is known that Quadrant III variable has no variables and Quadrant IV variable has LING, K3, KES, VAL-EKO1 variables.



In the potential direct influence, it is found that the dependent, independent, and moderating variables have a very strong relationship, namely the variables RA, LING, TARSAR, VAL-EKO1,

VAL-EKO2 RP, SE, AL, MPL-MPB, SOL-MP, ROTATIF, PATROL, FUND, RPP, K3, LAW, AM, KES, IL-L



Variables in quadrant I (Influence) are DANA, PATROL, SOL-MP, AM, SE, and IL-L variables, while the variables in quadrant II (Relay) are RP, RA, RPP, Law, AL, and TARTAR variables. , There is no quadrant III variable, and quadrant IV variable contains MPL-MPB, KES, K3, VAL-EKO1, VAL-EKO2, LING, and Rotative variables.

The first obstacle factor is law enforcement, which includes the government's lack of seriousness in education dissemination and policy implementation assistance, lack of seriousness in patrols to monitor illegal mining conditions and lack of government openness in following up illegal mining to legal channels. local government agencies that are given the authority in the environmental sector state that the threat of criminal sanctions in the circulation and misuse of mercury is very necessary to suppress the circulation and use of mercury that is not in accordance with various laws and regulations which in the end can endanger human health and the environment, but it still really depends on the law enforcement process. Furthermore, the factor of law enforcement on local businesses that is difficult to track is environmental damage due to weak laws. Local businesses can have an impact on the environment. Of course, this argument does not hold true in the case of larger and more capital-intensive local businesses (Marchak, 1995) Local businesses may also adopt relatively restrained environmental practices as a result of their local political, economic and cultural 'engagement', and the accompanying fear of adverse public and state reactions to environmentally destructive practices.

The second obstacle factor is the interest relationship factor. The relationship between the miners and the authorities and the miners and the government creates a good relationship between the authorities and the government against illegal miners for individual interests so that mining activities are given permits. Mercury control is to save the life of animate creatures on earth. Therefore, problems in the use and circulation of mercury are systemic problems that must receive special attention from the central government and local governments. Based on this, it is necessary to study the government's efforts to reduce and eliminate mercury in Indonesia in order to identify the potential for maladministration that occurs. If the government is dominant, then the government is able to suppress the rate of movement of society in an authoritarian manner, and if the community is dominant, the community can control the government so that it results in excessive exploitation of natural resources and can lead to an attitude of stateless

society which can be interpreted as an anarchic society (indifference).) against the state's rules of the game. The balance of duties and functions of the actors that play a role will also determine the existence of mercury emissions in the future.

The next obstacle factors are structural, social (perception), and economic factors. The fourth barrier factor is social (perception) which includes the difficulty of illegal miners to switch to other livelihoods, the difficulty of miners to convert the status of illegal mining to legal, the lack of awareness of illegal miners regarding the health impacts of using mercury, the lack of awareness of illegal miners regarding occupational health and safety at work. mining, and the lack of awareness of illegal miners regarding the environmental impacts of mercury use. These five things are a mindset of illegal miners as a result of economic demands to fulfill their daily needs and even consumptive desires. Despite the shortcomings of some historical materialist research, materialist theory supports providing a good explanation during the cold war period, and begins to uncover many of the more glaring sources of global inequality. Of particular interest is the concept of dependency, first pushed onto the world stage by Latin American economists in the 1960s. For dependency theorists, the marginal conditions of the world's poorest countries are a direct result of the terms of trade established during the colonial period, when most of the colonized countries were forced to produce primary products, rather than more valuable industrial goods and crafts. This was especially the case in India, where the tradition of textile production was pushed aside by the colonial authorities, who wanted cheap cotton from the Indian fields, but there was no competition in finished goods for the textile mills in Manchester. This relationship hardens into a perpetual economic order of underdevelopment in which, as (Peet, R., Robbins, P., & Watts, 2010) explains, "real power is exercised from external command centers in dominant ('metropolitan') states. Dependency continues today through international ownership of the region's most dynamic sector, multinational corporations control over technology, and payments of royalties, interest and profits" (p. 107). Even years after colonialism, and even where these poor countries are sovereign and control them.

Political ecologists have devoted relatively little attention to understanding how local business affects the Third World political environment. Perhaps reflecting the structural roots of the research field, they tend to emphasize the impact of the First World on environmental change and Third World conflicts as part of a broader argument about the place of the Third World in a world-dominated global capitalist system (Franke & Chasin, 1980) Dinham and Hines , 1983). To the extent that local businesses have played a role in Third World political ecology, they have done so usually in the context of discussions about state-sponsored economic activities that damage the environment.

Discussion

In following up on the mercury emergency in Indonesia, in April 2019 the President of the Republic of Indonesia issued Presidential Regulation Number 21 of 2019 concerning the National Action Plan for Mercury Reduction and Elimination (RANPPM) referring to Law Number 11 of 2017 concerning Ratification of the Minamata Convention on Mercury. The government's target in reducing and eliminating mercury is focused on 4 (four) priority areas of Small-Scale Gold Mining (PESK) with a target of achieving a 100% reduction by 2025, the health sector with a target of achieving a 100% reduction in 2020, the manufacturing sector with a target of achieving a reduction 50% by 2030, and the energy sector with a target of achieving a reduction of 32.2% by 2030.). The agency responsible for the reduction and elimination of mercury is the Ministry of Environment and Forestry (KLHK) as the National Focal Point, Ministry of Industry (KEMENPERIN), Ministry of Health (KEMENKES), Ministry of Energy and Mineral Resources (KESDM), Ministry of Home Affairs (MOHA), Ministry of Trade, Ministry of Research and Technology (KEMENRISTEK), Agency for the Assessment and Application of Technology (BPPT), and the Central Statistics Agency as well as assistance to all ministry in the Republic of Indonesia.

Conclusion

The target for the implementation of the National Action Plan for Mercury Reduction and Elimination (In accordance with the mandate of Law NO 11 OF 2017) regarding the mercury convention regarding small-scale gold mining activities (PESK). environment, both at the regional and national levels, in the implementation of RAN PPM, this step is still considered

ineffective and has not received significant results because in Indonesia there are still many ASGM activities that still use mercury.

The lack of coordination between the Ministry of Energy and Mineral Resources and local governments regarding small-scale gold mining permits is still not optimal, therefore it causes obstacles in implementing the National Action Plan for Mercury Reduction and Elimination in priority areas of Small-Scale Gold Mining, namely law enforcement factors, interest relations factors, structural factors, social factors, and economic factors.

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