Implementation Effectiveness of Mercury Elimination Policies in Artisanal Small-Scale Gold Mining

M R Sapulete 1,2,*, H Effendi 3,4, E Riani 4 and Machfud 5

1 Natural Resources and Environmental Management Science Study Program, Graduate School of IPB University, West Java, Indonesia
2 Department of Community Medicine, Faculty of Medicine, Sam Ratulangi University, North Sulawesi, Indonesia
3 Environmental Research Center, IPB University, West Java, Indonesia
4 Department of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, IPB University, West Java, Indonesia
5 Department of Agriculture Industrial Technology, Faculty of Agricultural Technology, IPB University, West Java, Indonesia

E-mail: margarethsapulete@yahoo.com

Abstract. This study evaluated the implementation effectiveness of mercury elimination policies in the Artisanal Small-Scale Gold Mining (ASGM) at Bolaang Mongondow District. A qualitative method used as an explanatory design through interviews and questionnaires. The data collected were analyzed using the Regulatory Gap Analysis method. Based on the data obtained, only 33% of respondents (community representatives) were aware of the mercury elimination policy. 75% of respondents (relevant agencies) have been aware of UU No. 11/2017 about the ratification of the Minamata Convention and the national action plan of the mercury elimination in gold processing in 2014-2018 ESDM (RAN-PPM PE 2014-2018 ESDM). 63% of respondents were aware of PP No. 21/2019 about the national action plan for reduction and elimination of mercury (PP 21/2019 RAN-PPM), and only 50% of respondents who were aware of PMK No. 57/2016 about the national action plan for controlling health impacts due to mercury exposure in 2016-2020 (PMK 57/2016 RAN-PDKAM). The average gap value based on the evaluation result of each policy was: -0.4 in RAN-PPM PE 2014-2018 ESDM, -0.24 in PP 21/2019 RAN-PPM, and -0.21 in PMK 57/2016 RAN-PDKAM. Therefore, the implementation of these policies is unsuccessful in overcoming mercury usage in the ASGM.

1. Introduction
On October 10, 2013, in Kumamoto, Japan, all countries around the world, including the Indonesian Government have signed the Minamata Convention on Mercury. At the same time, Gibb and O’Leary reviewed the mercury impact on health in the ASGM and urged them to immediately apply to the Minamata Convention on Mercury that had just been signed [1]. The seventh article of the convention requires a national action plan that includes a public health strategy on mercury exposure in the ASGM. As mentioned in the first article, this convention aims to protect human health and environmental safety from mercury emission and release, and the mercury compounds due to anthropogenic (human) activity [2].
The Indonesian government have ratified the Minamata Convention on Mercury, followed by the application of Constitution No. 11 in 2017 (UU No.11/2017) about the ratification of Minamata Convention on Mercury. Several regulations and policies have been published as a derivation and commitment of the Indonesian government on the Minamata Convention. In 2013, the Ministry of Energy and Mineral Resources released a National Action Plan (NAP) about the mercury elimination in gold processing in 2014-2018 (RAN-PPM PE 2014-2018 ESDM). However, until the periodical management of this NAP ends, the mercury elimination target in the ASGM is unreachable. In 2016, the Indonesian Ministry of Health released a regulation of Minister of Health No.57/2016 about the National Action Plan for Health Impact Control due to Mercury Exposure 2016-2020 (PMK 57/2016 RAN-PDKAM). This NAP period has ended but the goal remains unfulfilled.

On April 26, 2019, a Presidential Regulation No. 21/2019 about the National Action Plan for Mercury Declination and Elimination (PP 21/2019 RAN-PPM) with the goal to decline and eliminate mercury in national and regional level through the integrated and sustainable system.

Although government has released several policies, the miners still use mercury in the ASGM and views that mercury is an effective chemical element for gold processing compared to other methods. The miners in Bolaang Mongondow have long been used mercury for gold ore extraction. The waste disposed by the gold miners after the amalgamation process to the river without any treatments will cause water source, river, and seawater pollutions. The ecological impact of Hg in Toraut watershed, Bolaang Mongondow District reported that Hg was found in river water (< 0.00005 mg/ L), river sediment (<0.05-1.45 mg/kg), and water plant tissue (<0.001-0.013 mg/kg) [3]. The water in mining area such as Lanut Village had a Hg content at 0.0004-0.0012 mg/ L. Moreover, this study also found that the Hg content in the community (hair) was 0.171 – 2.08 µg/g [4].

The main problem is on the implementation of mercury elimination policy that remains unacted effectively, which creates a gap between policy released and reality in the field. A policy is failed when it does not achieve the objectives and the components set to achieve the objectives as the policy do not get a support from the policy recipients [5].

The aim of this study was to evaluate the implementation effectiveness of mercury elimination policy in ASGM at Bolaang Mongondow District level.

2. **Method**

A qualitative method with an explanatory design through interviews and questionnaires was used in this study. The policies evaluated in this study were RAN-PPM PE 2014-2018 ESDM, PMK 57/2016 RAN-PDKAM, and PP 21/2019 RAN-PPM.

2.1. **Data Collection**

There were two groups of respondents. First, the community representatives who are in direct contact with and interact with the mining community consisting of: leading figure of community, village apparatus, and subdistrict head. Second, the regional government stakeholders namely the relevant technical offices/agencies consisting of Health Office, Trade and Energy Mineral Resources Office, Environmental Office, and Regional Development Planning Agency (Bapedda) in the Bolaang Mongondow District.

2.2. **Data analysis**

The Regulatory Gap Analysis (RGA) is an analysis tool used to assess the government performance in terms of public policy by comparing the planning inputs and factual implementations. This method is derived from the Gap Analysis, where Gap Analysis is more likely to be used to measure gaps in the field of management and is one of the tools used to measure service quality so that it is often found in economic policies [6].

In general, the word “gap” is defined as an available disparity of one condition to another. The Gap model was firstly developed by Parasuraman, Zeithamet, and Barry [7] or known as SERVQUAL Model.
service quality). Gap analysis compares the current situation with future conditions to be achieved. By doing a gap analysis, we can identify what we need to bridge the gap [8].

Procedures to perform the RGA are identifying the public policy which will be evaluated its implementation, identifying the following program or policy indicators, distributing the questionnaire to the relevant stakeholders, and analyzing the policy formula.

\[ \text{Gap} (G) = \text{Average Ideal Score for Policy} - \text{Average Score of Policy Implementation} \]

Average gap \(=\) Amount of Criteria weight \(\times\) Average of Gap Score [9]. In this identification, a hypothesis can be developed into: If the average gap was more than or similar to zero, then the implementation of the following policy is success based on the planning strategy and can overcome the community problems. Meanwhile, if the average gap is less than zero, then the implementation of the following policy is failed to overcome the community problems.

3. Result

3.1. Mining community perspective on the danger of mercury usage and policy implementation

3.1.1. Mining community awareness on the danger of mercury. The mining community awareness percentage on the danger of mercury can be seen on the following figure 1.

![Figure 1. The mining community awareness percentage on the danger of mercury.](image)

Based on the figure above, all respondents (100%) stated that the mining community was aware of other methods (non-mercury usage) to extract gold. However, related to the dangers of mercury to the environment, the dangers of mercury to human health, socialization on the dangers of mercury, and policies to eliminate the use of mercury, respondents stated that the mining community was not fully aware (less than 100%).

3.1.2. Respondent perception on the mercury usage elimination policy.

- Interview quotations of respondent perception on the reason using mercury: “Because mercury is a chemical substance used to capture gold particles.” “Because we are used to processing the gold with mercury with efficient cost as mercury can be used for several times, while cyanide can only be used once following the proper dose.” “Because we have been processing the gold with mercury since the beginning period.”
- Interview quotations of response on the implementation of mercury elimination policy: “Mining community is going to object the mercury that has to be eliminated as there is a socialization for the community.” “We surely object this policy and if this policy is underway, another solution has to be provided, therefore our job will not be inhibited.” “We are very supportive as long as there is a solution in mercury processing system with an income guarantee.”
Interview quotations of response on the non-mercury method: “As long as the method offered is profitable, the mining community will definitely accept it.” “We agree with it and we expect to be provided with a socialization on how to use the method.” “We agree with it, but the system needs to be tested, socialized, and guaranteed to produce a maximum product.”

Interview quotations of win-win solution: “For ASGM in protected forest, there has to be a solution for alternative job as it is an illegal job, while for ASGM in the plantation area, there has to be created a community mining area (Wilayah Pertambangan Rakyat/WPR).” “Socialization should be provided on how to mine safely and environmentally friendly without damaging the environment by cut tree rejuvenation.” “Socialization should be performed on the danger of mercury, official mining company should be established regulated by an environmentally friendly mining system, followed by surveillance and control.”

Interview quotations on the most accurate way to eliminate mercury: “Mercury distribution should be stopped.” “Socializing the danger of mercury for health and mercury selling prevention on the consumer. If the mercury can no longer be obtained freely, the mining activity will never use mercury anymore.” “Regional, village, and sub-district government roles should be maximized. The role of law enforcement officers should be aimed for to obey on the available rules.”

3.2. Bolaang Mongondow Government Stakeholders perspective on the mercury elimination policy

3.2.1. Technical offices awareness on mercury elimination policy. The percentage of technical offices associated with the mercury elimination can be shown in the following figure 2.

![Figure 2](image)

**Figure 2.** Technical offices awareness on the associated policies.

Based on the figure above, none of the technical offices in Bolaang Mongondow are fully aware (less than 100%) of the four mercury elimination policies.

3.2.2. Technical offices awareness description on each policy.

![Figure 3](image)

**Figure 3.** Awareness percentage of technical offices on UU No. 11/2017.
Based on the figure 3 above, the highest awareness percentage of technical offices on UU No. 11/2017 was obtained from the Health Office (100%) and Trade and Energy Mineral Resources Office (100%), followed by Environmental Office at 75%, and BAPPEDA at 0% which obtained the lowest awareness percentage as nobody was aware of UU No. 11/2017 policy.

The National Action Plan about Mercury Elimination in Gold Processing in 2014-2018 by the Indonesian Ministry of Energy and Mineral Resources (RAN-PPM 2014-2018 ESDM)

Based on the figure 4 above, the highest awareness percentage of technical offices on RAN-PPM PE 2014-2018 ESDM was obtained from the Environmental Office (100%) and BAPPEDA (100%). An interesting and ironical condition was found in the Trade and Energy Mineral Resources Office as the regional responsible actor which obtained the lowest awareness percentage of 0% or not aware of RAN-PPM PE 2014-2018 ESDM policy.

Indonesian Ministry of Health Regulation No. 57/2016 about the National Action Plan for Health Impact Control due to Mercury Exposure in 2016-2020 (PMK 57/2016 RAN-PDKAM)

Based on the figure 5 above, there were no technical offices with 100% awareness percentage on PMK 57/2016 RAN-PDKAM. Even the Trade and Energy Mineral Resources Office and BAPPEDA do not know and aware at all this policy.

Presidential Regulation No. 21/2019 about the National Action Plan for Mercury Declination and Elimination (PP 21/2019 RAN-PPM)

Based on the figure 6 above, there were no technical offices with 100% awareness percentage on PP No. 21/2019. Even the Trade and Energy Mineral Resources Office and BAPPEDA do not know and aware at all this policy.
Based on the figure 6 above, the highest awareness percentage of technical offices on PP No. 21/2019 was obtained from the Environmental Office (100%), followed by the Health Office at 50%. Meanwhile, the Trade and Energy Mineral Resources Office and BAPPEDA which obtained the lowest awareness percentage of 0% or not aware of PP No. 21/2019.

3.3. Implementation effectiveness of mercury elimination

3.3.1. Effectiveness of ESDM RAN-PE 2014-2018 policy. The gap analysis result of ESDM RAN-PE 2014-2018 can be seen in the following table 1:

| Component                                        | Average difference |
|--------------------------------------------------|---------------------|
| Legal Framework and Institutional Strengthening  | 0                   |
| Research and Development                         | -0.31               |
| Awareness and Communication Improvement          | -0.92               |
| Total Average                                    | -0.41               |

In table 1, the average gap (difference) obtained was less than 0 (-0.41), which means that the implementation of RAN-PPM PE 2014-2018 ESDM policy is still not following the action plan and does not succeed to overcome the mercury usage in the ASGM. The gap occurs because some programs are not fully implemented, causing some unachieved indicators in the legal framework and institutional strengthening component.

3.3.2. Effectiveness of PMK 57/2016 RAN-PDKAM. The gap analysis result of PMK 57/2016 RAN-PDKAM policy can be seen in the following table 2:

| Strategy                                | Average difference |
|-----------------------------------------|---------------------|
| Standardization, database, and surveillance | 0                   |
| Health impact Control                   | 0                   |
| Institutional and health worker strengthening | 0                   |
| Socialization and advocation            | -0.25               |
| Research and development                | -1                  |
| Awareness and communication improvement | 0                   |
| Total Average                           | -0.21               |

In table 2, the average gap (difference) obtained was less than 0 (-0.21), which means that the implementation of PMK 57/2016 RAN-PDKAM policy is still not following the action plan and does not succeed to overcome the mercury usage in the ASGM. The gap occurred due to available unachieved indicators in several programs attached on the socialization and advocation strategy, and training and development strategy.

3.3.3. Effectiveness of PP 21/2019 RAN-PPM. The gap analysis result of PP 21/2019 RAN-PPM can be seen in the following table 3:

| Component                                                                 | Average Difference |
|---------------------------------------------------------------------------|---------------------|
| Commitment, coordination, and cooperation strengthening between relevant ministry/governmental institution and ministry/non-ministry governmental institution | 0                   |
In Table 3, the average gap (difference) value obtained was less than 0 (-0.24), which means that the implementation of PP 21/2019 RAN-PPM is still not following the action plan and does not succeed to overcome the mercury usage in the ASGM. The gap occurred because some indicators were unachieved in several programs attached in components of leadership, institutional and human resource capacity improvement in mercury elimination and components of community involvement strengthening through communication, information, and education.

3.3.4. Policy Implementation Effectiveness Recapitulation. The implementation effectiveness recapitulation result of all policies can be seen in the following Figure 7.

![Figure 7. Policy implementation effectiveness recapitulation.](image)

Based on the figure above, the RAN-PPM PE 2014-2018 ESDM policy obtained the highest gap value at -0.41, followed by the PP 21/2019 RAN-PPM at -0.24, and PMK 57/2016 RAN-PDKAM at -0.21.

4. Discussion

4.1. Community response on the danger of mercury and policy implementation

From the community perspective, they literally had a quite good awareness in the danger of mercury during the gold processing in the ASGM as presented in Figure 1. The interesting condition is that the community (miners) still uses mercury although aware of other methods (non-mercury method) to extract gold and quite aware of the emergency of mercury for the environment and human health. However, based on the interview results, the reason why the community still uses mercury is due to cheaper price, easier to obtain, can be used repeatedly, and more effective to extract gold. Mercury amalgamation is the most common method of gold recovery used by artisanal miners. This technique is favored because it is considered by miners to be effective, easy to use, cheap, and mercury is readily available [10].

In addition, the use of mercury as a gold extractor has been a habit for a long time and continued for decades in Bolaang Mongondow District. The habit of using mercury is certainly not easy to change due to closely related to the inherited behaviour. A further study is required to focus on the socio-economic factors and strategies to change these attitudes and behaviour of the people who live and work around the ASGM communities towards reducing the Hg usage [11].

The community response on the mercury elimination policy was quite positive as long as there was continuous socialization and education, followed by the availability of other alternative methods, which did not inhibit the community livelihoods. Poverty, lack of socio-economic alternatives, and seasonal factors in agricultural businesses are the main drivers for many people to enter ASGM. Despite the
negative challenges and problems associated with the ASGM, this activity has proven to be an economic resource that can potentially support the rural development and provide benefits to the government [12].

Basically, the community will obey the rules when the policy makers, namely the government, are also consistent in implementing the regulations. This study results indicate that the lack of socialization about the danger of mercury and information related to the mercury usage elimination becomes the determining factors that influence the mercury usage in ASGM [13].

4.2. Low awareness level of technical offices on mercury elimination policy

This study results indicate that not all respondents were aware of four policies that were asked to the technical offices. This finding needs to be scrutinized because as a technical office, they should be the actors to implement these policies in Bolaang Mongondow District, but there are still the ones who have never known about one or more of these policies. These data reflect that there is no communication and coordination between the central government, provincial government, and district government regarding the implementation of these policies. The central government, namely the authorized ministry who creates the policy, rarely visits the region directly. Effective policy design to address the environmental concerns requires a set-up intervention that considers each problem specificity, and the types of pro-environmental behaviour that policy makers want to induce [14].

Likewise, in the internal of the technical offices across in Bolaang Mongondow District, there is no information exchange distribution, good coordination, and good socialization, which result in low awareness of various policies to eliminate the mercury usage. In fact, the implementation of these policies is carried out on the cross-sectoral of the technical offices. The local government as the spearhead of policy enforcement does not have a sufficient awareness about the mercury elimination policy, and there are even some technical offices that do not know at all about the available policy. The low awareness level of the local government will affect the implementation of these policies. This is the time to review these policies either in the policy-making process (agenda setting, formulation, adoption, implementation, and evaluation), policy needs, policy motives, and policy objectives [15].

Based on the description of the technical offices awareness on each policy, there are no technical offices that consistently have full awareness on these four policies. The most concerned condition is that BAPPEDA as a planner department was unaware of UU No. 11/2017, PMK 57/2016 RAN-PDKAM, and PP 21/2019 RAN-PPM policies. This fact leads to a pessimistic impression and message about the efforts to eliminate mercury in ASGM, as how the policy can be implemented if the technical office which is the main responsible actor to implement the policy does not even have the same and equitable awareness. We cannot expect the community to stop using mercury if the government itself remain unaware of these policies. So far, we often assume that the community are the ones who are wrong and violate the rules, but these study results prove that there is an important role of the government (central and local) as a regulator that does not function significantly. Aspects that cause the policy implementation failure must be carefully considered, which includes the program, process, and political aspects [16]. In the program aspect, policy is often seen as a compliant activity within the government.

4.3. Implementation ineffectiveness of mercury elimination policy

The implementation evaluation results of each mercury elimination policy indicates that the three policies measured have gaps in their implementation, therefore all policies are ineffective to overcome the mercury usage in ASGM. Gaps occur when what is regulated and targeted in policies do not match with the conditions that occur in the field. The implementation gap will depend on the implementation capacity of the trusted organization/actor to implement the policy. The implementation capacity is the ability of an organization/actor to implement the policy decisions, therefore the goals stated can be achieved [17]. This study proves that low awareness of the technical offices causes low organizational capacity, which can not implement the policies optimally.

The main reason of not achieving the mercury elimination policy plan and target in ASGM at Bolaang Mongondow District is because these regulations and policies are not implemented, resulting in the policy implementation ineffectiveness. The policies were not implemented because no funds were
budgeted for activities related to the implementation of these policies in the planning process. Some of the main problems that often cause the ineffectiveness of international policies such as the Minamata Convention on Mercury include the lack of resources, weak regulations, and implementation plans that are not implemented properly [18]. The policy success is not measured from when the policy has been completed, but how the policy can be effectively applied to the community and provide the expected impact.

These study results become a momentum for deep reflection and contemplation for policy makers to take an inventory and investigate the bottleneck factors at the same time. There have been so many regulations and policies along with their derivatives are made to eliminate the mercury usage, but the data from this study proves that these policies have not been able to achieve the goal of eliminating the mercury usage stated in each policy. The policy period has expired but the targets for each policy have not been achieved. The policies are unsustainable, making the policy makers prefer to immediately replace and create new policies by setting new targets and deadlines rather than conducting introspection and thorough evaluation. Every policy made has taken considerable time, energy, ideas, and funds. Do not let everything be in vain as these policies remain ineffective. This is the time to review these policies either in the policy-making process (agenda setting, formulation, adoption, implementation, and evaluation), policy needs, policy motives, and policy objectives. In the process aspect, the policy simply fails because it cannot be continued from an idea into a reality through the successful completion in the policy processing stages. From the political aspect, policies can form and be formed by politics, which causes the policy outcomes have political consequences [19].

Facts and data remark that the mercury usage in the ASGM has an impact on the environment and human health. At first glance, it seems very easy to eliminate the mercury usage simply by stopping the mercury distribution, which then resolves the problem. However, the implementation is not that simple. The government should work with the ASGM communities to implement local solutions and focus on a more sensitive, participatory, and inclusive approaches that equally notify the economic, social, environmental and health aspects. So far, the scientific findings and policies to eliminate the mercury usage in ASGM have not touched and answered directly and concretely the target group (miners) needs. A collaboration between science (scientists) and policy (government) to combat the mercury usage in ASGM is very appropriate and needs to be continued. However, the problem of using mercury in ASGM is so broad and complex as not enough to solve it only from a scientific and policy perspective. The interactive model considers policy implementation as a dynamic process, because the parties involved can propose changes at various implementation stages [20].

The central government, namely the relevant ministries as policy makers, must go down to the field to conduct intensive monitoring and supervision to ensure the implementation of the policies that have been made. The biggest homework must be completed by the government by actively involving and mobilizing all stakeholders, especially the miner community to immediately and consistently implement the mercury usage elimination policy. There is a growing consensus that communities should be involved in the management of mining activities to catalyze broad-based economic development while simultaneously achieving maximum social and economic benefits [21].

Thereby, a participatory approach with the ASGM community is required to create breakthrough locally based strategies and accommodate their aspirations so that the mercury usage elimination can be successful. A community-based approach can be more effective than conventional technical strategy that dominated the mercury elimination initiation. Therefore, it requires partnerships and collaborations of three parties, namely the government (policy maker), scientists (research), and community (aspirations). It is important to facilitate a high engagement of three parties in finding best ways to influence policy and practice and to actively disseminate research findings to relevant [22].

5. Conclusion
Low socialization about the danger of mercury and lack of information related to the mercury usage elimination are the determined factors that also influence the mercury usage in the ASGM. There is no equal distribution of awareness about various policies related to the mercury elimination in the technical
offices of the Bolaang Mongondow District Government. The evaluation results of the three mercury elimination policies (RAN-PPM PE 2014-2018 ESDM, PMK 57/2016 RAN-PDKAM, and PP 21/2019 RAN-PPM) are ineffective to eliminate the mercury usage in ASGM at Bolaang Mongondow District.

References
[1] Gibb H and O’Leary KG 2014 Mercury exposure and health impacts among individuals in the artisanal and small-scale gold mining community: a comprehensive review Environmental Health Perspect. 122 667–72
[2] UNEP 2017 Global Mercury: Supply, Trade, and demand (Geneva: UNEP) p 84
[3] Rantung J L and Wantasen S 2016 Biomonitoring dampak ekologis Hg di Daerah Aliran Sungai Toraut Kabupaten Bolaang Mongondow Jurnal Eugenia 22 55-61
[4] Latuconsina L, Polii B and Umbuh J M L 2018 Mekuri dan dampak terhadap kesehatan penambang emas di Desa Lanut Kecamatan Modayag Kabupaten Bolaang Mongondow Timur Provinsi Sulawesi Utara Jurnal Kesehatan Masyarakat 6 64-74
[5] McConnell A 2010b Understanding Policy Success: Rethinking Public Policy (Basingstoke: Palgrave Macmillan Press)
[6] Adeshivili M, Gugushvili T, Gujaraidze K and Macharashvili I 2012 Environmental policy, institutional and regulatory gap analysis (Georgia: Green Alternative)
[7] Parasuraman A, Berry, Leonard L, Zeithaml and Valarie A 1994 Reassessment of expectations as a comparison standar in measurung service quality: implications for future research Journal of Marketing 58 111-124
[8] Admaja A F S 2013 Study of the directorate of standardization readiness in implementing SNI ISO/IEC 17065 Buletin POS dan Telekomunikasi 11 223-234
[9] Tjiptono F 2005 Pemasaran Jasa (Yogyakarta: Andi)
[10] Krisnayanti B D, Christopher W N, Anderson, Utomo W D, Feng X, Handayanto E, Mudarisma N, Ikram H and Khususiah 2012 Assessment of environmental mercury discharge at a four-year-old artisanal gold mining area on Lombok Island, Indonesia Journal of Environmental Monitoring 4 2598-607
[11] Isaza A S, Palacio C V and Arango S 2015 Phasing out mercury through collective action in artisanal gold mining: evidence from a framed field experiment Ecological Economics 120 406-15
[12] Oramah I T, Richards J P, Summers R, Garvin T and MacGee T 2015 Artisanal and small-scale mining in Nigeria: Experiences from Nigeria, Nasarawa and Plateau states The Extractive Industries and Society 2 694-703
[13] Saguin K 2018 Policy consulting in developing countries: evidence from the Philippines Journal Asian Public Policy 11 188-205
[14] Osbaldiston R and Schott J P 2012 Environmental sustainability and behavioral science: meta-analysis of proenvironmental behavior experiments Environment and Behavior 44 257-299
[15] Dunn W 2004 Public Policy Analysis: An Introduction (New Jersey: Pearson-Prentice Hall)
[16] McConnell A 2010b Understanding Policy Success: Rethinking Public Policy (Basingstoke: Palgrave Macmillan Press)
[17] Wahab S A 2014 Analisis Kebijaksanaan: Dari Formulasi ke Penyusunan Model-Model Implementasi Kebijakan Publik (Jakarta: Bumi Aksara Press)
[18] Sippl K 2015 Private and civil society governors of mercury pollution from artisanal and small-scale gold mining: a network analytic approach The Extractive Industries and Society 2 198–208
[19] Bovens M, Hart P and Peters B G 2001 Success and Failure in Public Governance: A Comparative Analysis (Cheltenham: Edward Elgar)
[20] Dye T R 1981 Understanding Public Policy (New York: Prentice-Hall International, Inc., Englewood Cliffs)
[21] Langston J D, Lubis M I, Sayer J A, Margules C, Boedhihartono A K and Dirks P H G M 2015

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Comparative development benefits from small and large scale mines in North Sulawesi, Indonesia *The Extractive Industries and Society* 2 434-444

[22] Uzochukwu B, Onwujekwe O, Mbachu C, Okwuosa C, Etiaba E, Nyström M E and Gilson L 2016 The challenge of bridging the gap between researchers and policy makers: experiences of a Health Policy Research Group in engaging policy makers to support evidence informed policy making in Nigeria *Globalization and Health* 12 67