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**MERCURY ELIMINATION IN ARTISANAL AND SMALL SCALE GOLD
MINING: PROGRESS AND BARRIERS IN IMPLEMENTING NATIONAL
ACTION PLAN TO ELIMINATE MERCURY IN INDONESIA
(CASE STUDY: BANYUMAS REGENCY)**

A thesis presented in partial fulfilment of the requirements for the degree of

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Abstract

The artisanal and small-scale gold mining (ASGM) sector is one of the main contributors of mercury emissions Indonesia. As a result of the participation of Indonesia in the Minamata Convention on Mercury, Indonesia established the national action plan (NAP) to eliminate mercury in ASGM that started in 2014 and ends in 2018. To date, there is no report or study that discusses the implementation progress of the NAP. The aim of this research is to investigate the progress of the NAP to eliminate mercury in ASGM in Indonesia. In addition, the study aims to identify barriers for implementation of the NAP.

The research in this thesis is a qualitative research that utilises a case study method, in order to gain a deep insight into how stakeholders implement the NAP. Banyumas regency is taken as the case study, since the area has extensive ASGM activities, which emit a high level of mercury into the environment. The primary data for this research is gathered through semi-structured interviews, while secondary data is obtained from institution reports, newspaper articles and government websites. The findings of this research have identified several action plans, for example: the establishment of a stakeholder's forum at national level; a study on alternative technology; health effects and environmental tests; and training for the miners, which were all undertaken according to the NAP. However, other action plans, for example, regulations regarding formalisation of ASGM; a mercury database; alternative livelihood training; and mercury awareness included in the education curriculum are progressing slowly. In addition, there are four barriers that hinder the implementation of the NAP: institutional barriers (lack of resources, political will and poor coordination); policy barriers (lack of legal formalisation framework and policy support); technical barriers (lack of supporting tools, lack of information on ASGM and miners' involvement, low level of trust in alternative technology and location difficulties) and socio-economic barriers (miners' beliefs and social conditions).

This research proposes several recommendations to improve the progress of the NAP and to reduce barriers toward implementation, such as improvement in financial availability by

cooperating with other actors such as Bappenas, to secure the funding for the implementation of NAP and regulations improvement; strengthening the implementation of NAP by appointing leading ministries such as Coordinating Ministries of Maritime affairs to coordinate the implementation of NAP and adding participation of other actor such as academics to participate in the NAP; and developing approaches and tools to disseminate information.

Keywords: artisanal and small-scale gold mining, ASGM, mercury, national action plan, implementation, barriers, Indonesia.

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List of Abbreviations

ASGM	Artisanal and small scale gold mining
Bappenas	National Development Planning Agency
BPPT	Agency of Technological Research and Development
BPS	Central Bureau of Statistic
CIA	Criminal Investigation Agency
LIPI	Indonesian Institute of Sciences
MCSME	Ministry of Cooperative and Small - Medium Enterprise
MoCI	Ministry of Communication and Informatics
MoEC	Ministry of Education and Culture
MoEF	Ministry of Environment and Forestry
MoEMR	Ministry of Energy and Mineral Resources
MoHA	Ministry of Home Affair
NAP	National Action Plan
NGO	Non-Governmental Organisation
UI	University of Indonesia
WPR	People's mining area

Chapter 1

Introduction

1.1 Background of the study

Gold is one of a number of valuable products produced by the extractive mining industry that provides incomes for many countries and their people. One type of gold production comes from artisanal and small-scale gold mining (ASGM), which has been practised for a long time. In rural areas, where people are trying to escape from poverty, gold mining offers a better option than their current living, for example agriculture. Approximately, 20-30 million people around the world work in ASGM and they contribute between 17% and 20% to the world's gold production (Buxton, 2013; Seccatore, Veiga, Origliasso, Marin, & De Tomi, 2014). There is no exact definition for ASGM (McQuilken & Hilson, 2016), but the common characteristics for ASGM are as follows: individuals or small groups of miners who are mostly informal and/or illegal; the use of rudimentary techniques and low technology; labour intensive; insufficient education or training; and low levels of environmental safety and health awareness (Heemskerk, 2005; Hilson, 2002a; Villegas, Weinberg, Levin, & Hund, 2012). Therefore, most ASGM activities create major environmental problems during and/or after operations.

One major environmental problem associated with ASGM is caused by the use of mercury, which is a toxic material. Mercury is used to bind the gold from the fine particles of rock, which is known as the amalgamation method (Hinton, Veiga, & Veiga, 2003). Most artisanal and small-scale miners prefer amalgamation, since it is inexpensive and quick and easy compared to other methods, such as cyanidation (Hinton, Veiga, & Veiga, 2003; Spiegel & Veiga, 2005). Spiegel and Veiga (2010) estimate that globally 1000 tonnes of mercury per year is used in ASGM, where it contributes to one third of anthropogenic mercury use around the world, as predicted by the United Nations Environmental Programme (UNEP, 2013a). As a consequence, there is a need to protect the environment from the overuse of mercury.

The extensive use of mercury causes adverse impacts on human health. Mine waste or tailings derived from ASGM operations generally still contain a high level of mercury, and much of this tailings are dumped into a river or onto land (Heath, 2005; Ogola, Mitullah, & Omulo, 2002). Once mercury is absorbed by aquatic life, such as fish, it will transform into methylmercury, which then becomes absorbed into the food chain and transferred to the human body (Spiegel & Veiga, 2005). Methylmercury is known to be the source of infertility in humans, neurological damage and disorders, infant's cerebral palsy, mental health symptoms, and acute poisoning (Choy et al., 2002; Ratcliffe, Swanson, & Fischer, 1996). For example, the Minamata case in Japan was one disaster that damaged the environment. Between 1932 and 1968, a huge amount of waste containing mercury (approximately 27,000 kg) was dumped into Minamata Bay, which caused the death of over 900 people and two million people suffered health problems from consuming fish contaminated with mercury (McCurry, 2006). Consequently, this type of situation has become an international concern and many efforts are now targeted to finding environmentally friendly methods to save the environment.

An international legally binding treaty called the Minamata Convention on Mercury was launched in 2013 and signed by 92 countries (Spiegel, Keane, Metcalf, & Veiga, 2015). Article 7 of the Convention (UNEP, 2013b) demands that all countries design a National Action Plan (NAP) to diminish and if possible phase out the use of mercury in ASGM. Indonesia is the third highest mercury consumer in ASGM and it emits approximately 195 tons of mercury annually, just from the ASGM sector (Dewi, 2012; Koekkoek, 2013). Therefore, as one of the signatory participants of the convention, Indonesia has established a national action plan to eliminate mercury in ASGM. The Indonesian national action plan provides guidelines on how to control and reduce the use of mercury in ASGM between 2014 and 2018.

1.2 Problem Statement

Designing and implementing a National Action Plan to phase out mercury in ASGM is a complex situation involving interdisciplinary actors and knowledge. It calls for multiple

stakeholder engagement and collaboration, in order to implement mercury reduction policies (Hentschel & Hruschka, 2002; Spiegel, 2009b). The Indonesian NAP emphasises the collaboration of various stakeholders, such as ministries, local governments and academic and civil society organisations (CSOs). The performance of the programmes is indicated by how the implementations are undertaken by these stakeholders. Thus, on-going progress reviews need to be communicated, in order to measure the effectiveness of the NAP. However, there is a limit to information on how the NAP has been applied by associated stakeholders. While each actor provides reports based on their roles and responsibilities, the progress report is scattered amongst the stakeholders. This situation creates difficulties in identifying the types of programmes that have been implemented and how successful they have been.

Generally, in the case of developing countries, implementation gaps or deficits exist between the intention and the actual realisation of policy implementation (Jordan, 1999; Makinde, 2005). These gaps are mostly caused by the existence of barriers that slow and/or prevent the policy from being implemented. By 2018, it was targeted that Indonesia has to have a progress report on the implementation of programmes within the NAP and factors that affect implementation. This report is crucial, in order to respond to and accomplish Indonesia's commitment to the Minamata Convention on Mercury, which started from 2014, and to reduce and eliminate mercury use, especially in ASGM.

1.3 Research aim, question and objectives

This research aims to investigate the extent to which Indonesia is ready to implement its NAP, and in so doing, to identify the potential barriers that have affected implementation of plans to eliminate the use of mercury in ASGM, during the period between 2014 and 2016.

The research question is: 'What progress has been made by the NAP to eliminate mercury in ASGM in Indonesia during the period between 2014 and 2016 and what are the barriers that hinder the implementation of the NAP to eliminate mercury in ASGM in Indonesia?'

Research to achieve this aim has been conducted with the following objectives:

1. To examine and identify the progress that has been made in addressing the NAP for mercury elimination during the period 2014 – 2016, at local and national level;
2. To identify the barriers to the Indonesian NAP to eliminate mercury in ASGM, as perceived by the policy actors;
3. To investigate how those barriers influence the implementation of the NAP;
4. To propose recommendations in order to reduce these barriers and improve the implementation progress of the NAP.

1.4 Thesis structure

The structure of this research is shown in the following:

Chapter 1 is the Introduction to this report and presents a background to the study, problem statements, aim, research question and objectives.

Chapter 2 presents a review of mercury use in ASGM and the Indonesian Action Plan for mercury elimination. This chapter describes ASGM in Indonesia, and presents a description of the conditions at ASGM operations Indonesia. This chapter also explains the efforts of the Indonesian government to reduce mercury usage and phase out mercury in ASGM, prior to the implementation of the NAP. In addition, this chapter also informs on the plan and indicators for the NAP to eliminate mercury in ASGM in Indonesia, between 2014 and 2018.

Chapter 3 presents a literature review which explains the policy implementation theory and theoretical frameworks that are crucial to identifying and categorising barriers in the NAP implementation progress. In addition, a framework to assess the implementation of the NAP in accordance to the Minamata Convention on mercury is also discussed in this chapter. These frameworks are important for stakeholders to phase out mercury in ASGM in Indonesia.

Chapter 4 describes the methods used in data collection and data analysis. This chapter also explains the background for the case study used in this thesis, the limitations of the thesis and research ethics needed to conduct the study.

Chapter 5 presents the findings of field research to assess the progress of the NAP to eliminate mercury in ASGM in Indonesia between 2014 and 2016, based on the grey literature analysis and interview results. This chapter identifies the barriers that affect the implementation of the NAP for mercury elimination in ASGM.

Chapter 6 analyses and discusses the research results according to the findings from the interviews. This chapter presents several recommendations to reduce barriers and improve the progress of NAP.

Chapter 7 draws together the conclusions of this research based on a synthesis of ideas from the literature review and discussion results, together with recommendations for further research.

Chapter 2

Mercury in ASGM and the Indonesian Action Plan for Mercury Elimination

2.1 Introduction

The key stakeholders of the Indonesian National Action Plan (NAP) in response to the Government of Indonesia's commitments to the Minamata Convention on Mercury are from central government. In order to understand how government sector coordination to achieve the requirements of the NAP might work, this chapter presents a background on the government institution structures that exist within Indonesia. This chapter also presents a review of the current state of ASGM in Indonesia, the regulations associated with ASGM, and describes a project to reduce mercury undertaken by an international donor in the past, called The Global Mercury Project. Finally, this chapter presents a description of the National Action Plan to eliminate mercury in ASGM, over the years 2014 - 2018.

2.2 Brief overview of Indonesia

2.1.1 Indonesia's demography

The Republic of Indonesia is a country located within the South East Asian continent. The country is situated in the middle of the Indian Ocean and Pacific Oceans. Indonesia has several neighbouring countries near its borders: Singapore, Malaysia and Philippines at the northern border; Australia and East Timor in the south; and Papua New Guinea in the east, as seen in Figure 2.1.

Indonesia is an archipelago country comprised of 17,504 islands with a total area of 1,913,578 km² (Statistics Indonesia, 2017b). There are five major islands in Indonesia: Java, Sumatra, Kalimantan, Sulawesi and Papua. As a tropical country, Indonesia only has two seasons: the rainy season (October to April) and the dry season (April to September) (Wardani & Kodoatie, 2008). Based on the population census in 2010, the total population

of Indonesia is 237 million (Statistics Indonesia, 2012), which is the fourth largest in the world (The World Bank, 2016). Indonesia is rich in mineral resources, such as gold, nickel, copper, tin, diamonds, silver, iron and zinc (Dorian, Clark, & Djumhani, 1986). Thus, the mining sector is the second largest contributor to exports in Indonesia, which include mineral exports (Statistics Indonesia, 2017a).



Figure 2.1: Map of Indonesia

Source: Central Intelligence Agency (n.d.)

2.1.2 Government institutional structures

Indonesia is a democratic republic country that gained its independence from the Dutch in 1945. According to Law number 32, year 2004, concerning regional administration, there are four levels of government structure in Indonesia: central, province, district or regency, and village. However, local government structures are only comprised of provinces and regencies (Sutiyo & Maharjan, 2017). Villages are under the direct control and supervision of their regency government (Duncan, 2007). The task of the central government is to formulate national policy and general guidelines (Sutiyo & Maharjan, 2017), while the provincial government has a role to supervise, coordinate and help the regency government whenever they have a problem in their duties. A regency government has the task to serve

the public in matters associated with education and health and the development of basic infrastructure (Sutiyo & Maharjan, 2017). The structure levels of government in Indonesia can be seen in Figure 2.2.

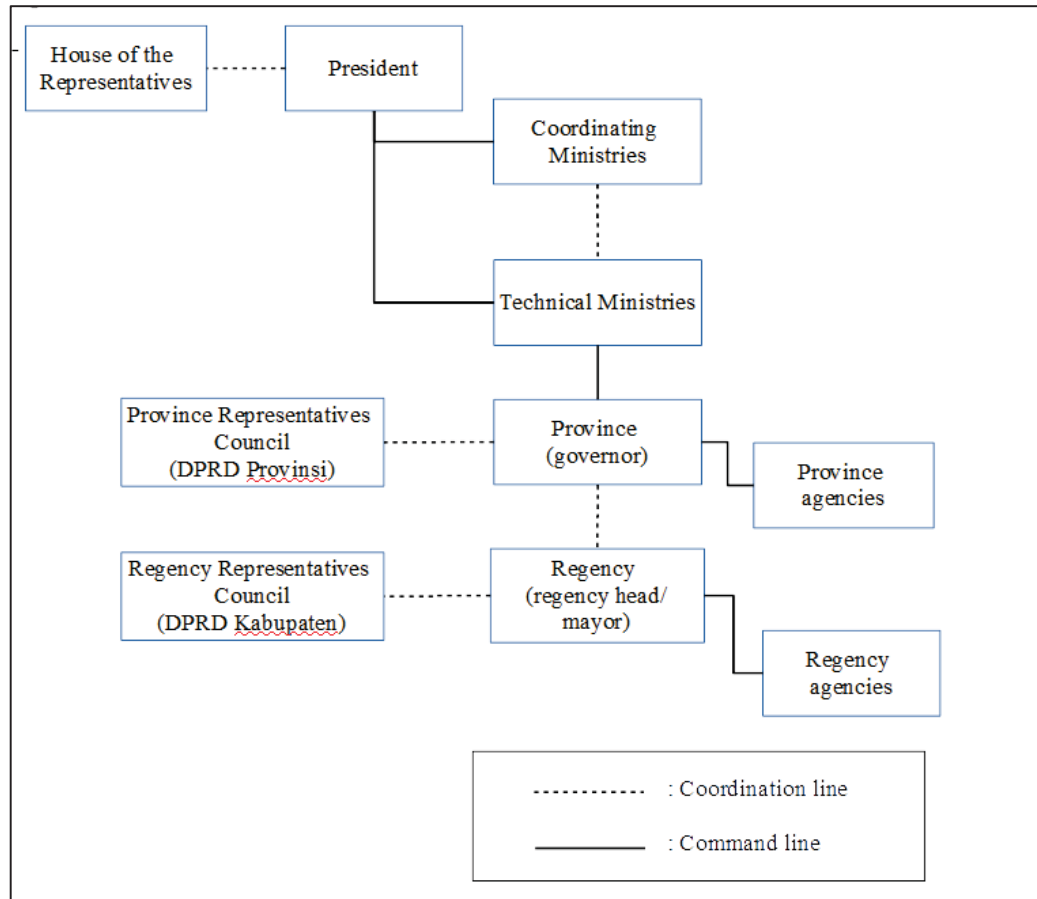


Figure 2.2: Government structures in Indonesia

Adapted from: Sutiyo and Maharjan (2017)

2.1.3 Coordination between ministries

In the central government, there are thirty technical ministries assigned to helping the president to solve specific sectoral issues, such as natural resources, health, education and so forth (Sugandi, 2017). In addition, these ministries are coordinated under four coordinating ministries, in order to simplify the coordination and controlling task for the president: the Coordinating Ministries for Maritime Affairs and Natural Resources, the Coordinating Ministries for Economy, the Coordinating Ministries for Human

Development and Cultural, and the Coordinating Ministries for Politics, Security, and Legal (Dirhamsyah, 2016). Based on Law number 39, year 2008, regarding the state ministries, the position of Coordinating Ministries in Indonesia is higher than the thirty technical ministries. Therefore, Dirhamsyah (2016) asserts that the success and failures of a government policy is determined by the performance of the Coordinating Ministries in coordinating and monitoring the activity undertaken by technical ministries.

There are several policies or programmes that require the coordination of inter-ministries. For example, in agriculture, the Ministry of Agriculture is responsible for food production and must cooperate with other ministries, such as the Ministry of Trade, to sustain the supply chain for food, or the Ministry of Public Work to construct irrigation facilities (Datta et al., 2011). The same condition applies to the NAP for mercury elimination in ASGM. Not all ministries described as stakeholders in the NAP for mercury elimination (as seen in Appendix 1) are under the same coordinating ministries. For example, MoEMR is under the coordination of the Coordinating Ministries of Maritime Affairs and Natural Resources, while MOEF and BPPT are under the coordination of the Coordinating Ministry for Economic Affairs and the Coordinating Ministry for Human development, respectively (Dirhamsyah, 2016).

Inter-ministerial coordination in Indonesia, especially for ministries that are not under the same coordinating ministries, is facing various challenges. Firstly, the ministries compete over resources or territories of the policy or government programmes (Datta et al., 2011). Secondly, several ministers have been appointed from a particular political party, which might then increase the rivalry between political parties (Datta et al., 2011). Therefore, many of the policies or programmes that need the coordination of various ministries in Indonesia usually experience delays, or the programmes progress only slowly (Smoke, 2015).

2.1.4 Relations between central government and local government

As a country comprised of many islands, Indonesia implements a decentralised system to simplify the task of central government. Decentralisation is an act to transfer the power and

resources from central government to lower level government (in this case province or regional government), in order to simplify the administration process and the use of natural resources (Ribot, 2002). One central government task is to provide general regulations, for example towards the management of natural resources, and the local government will then provide the specific regulation in accordance with the conditions of the local area (Datta et al., 2011).

As seen in Figure 2.2, central government has a direct command line to the governor of a province and a coordination line with the regency government. This means that more authority is given to regency governments to manage their areas with the help of the provincial government. The intention of this coordination line, is to facilitate the practice of bottom-up policy implementation; If there is a programme or policy coming from the central government, then consultation and negotiation with the local government in a regency is needed before it can be implemented (Datta et al., 2011). However, the consultation and negotiation of these programmes from central government to regency government are only in theory, since many regencies still produce low revenues. Thus, many regency governments still depend on the central and provincial government to provide additional funds, such as autonomy funds to cover their expenditure (Alm, Aten, & Bahl, 2001; Datta et al., 2011).

2.3 ASGM in Indonesia

ASGM activities in Indonesia have been practised for several decades. ASGM activities started during Dutch colonization in the 17th century and spread widely; they have been increasing along with the discovery of new gold reserves and higher gold prices (Aspinall, 2001; Reid, 1990). The characteristics of ASGM in Indonesia mostly follow the characteristics of ASGM seen in other developing countries, as shown in the introduction chapter. Artisanal and small scale gold miners in Indonesia work both in riverbanks and beds, and in the land (Arifin, Sakakibara, & Sera, 2015; Aspinall, 2001). If they work in riverbanks, they will follow the trail of gold ores carried by river flow which then becomes suspended in the riverbanks. For the miners who are working in the land, they will dig deep

to create an underground tunnel (Bose-O'Reilly et al., 2010). Due to financial limitations, most ASGM miners extensively use mercury to obtain the gold, as this technology is cheap and simple. There is generally little to no consideration paid to the known low gold recovery and severe environmental damage that is associated with amalgamation (Velásquez-López, Veiga, Klein, Shandro, & Hall, 2011). ASGM operations using a high amount of mercury are distributed around Indonesia (Figure 2.3).

There is no exact information about the number of ASM miners in Indonesia. Balifokus, one of Indonesia's NGOs, estimates there are approximately 800 ASGM sites in Indonesia involving approximately 250,000 miners who produce approximately 40 – 60 tons of gold annually (Veiga, Angeloci, Hitch, & Velasquez-Lopez, 2014). Aspinall (2001) predicted almost 90% of ASM miners in Indonesia are seen as illegal miners. An illegal miner is a miner who does not own a legal requirement, such as a mining and environmental permit (McQuilken & Hilson, 2016). Nevertheless, Lahiri-Dutt (2004) asserts that not all miners who do not own a licence are illegal miners, since some of them can be categorised as 'informal miners'. An informal miner is a miner who does not have a legal permit to mine, but nevertheless he/she has a social licence to operate¹ from the local community or indigenous people (McQuilken & Hilson, 2016). This difference in status is mainly influenced by the political conditions of a country (Lahiri-Dutt, 2004).

There are several characteristics of artisanal and small scale gold miners in Indonesia. Firstly, approximately 75% of miners come from outside the indigenous community (Aspinall, 2001). Many miners from Java Island come to islands outside their island, for example Kalimantan, to pursue gold mining (Spiegel, 2012b). Therefore, it is difficult to differentiate between local miners and outsiders. Secondly, many local miners have a limited education regarding mining techniques, since most of them come from farming backgrounds (Aspinall, 2001). Their education background ranges from primary and middle school to high school. Fourthly, most of the miners have minimum capital. Thus, most of them prefer to use simple equipment, such as a dishpans, sluice box and trommel (Aspinall, 2001).

¹ Social licence to operate is a consent from local community or indigenous people to mine in a certain area, which mostly unwritten (Prno & Slocombe, 2014)

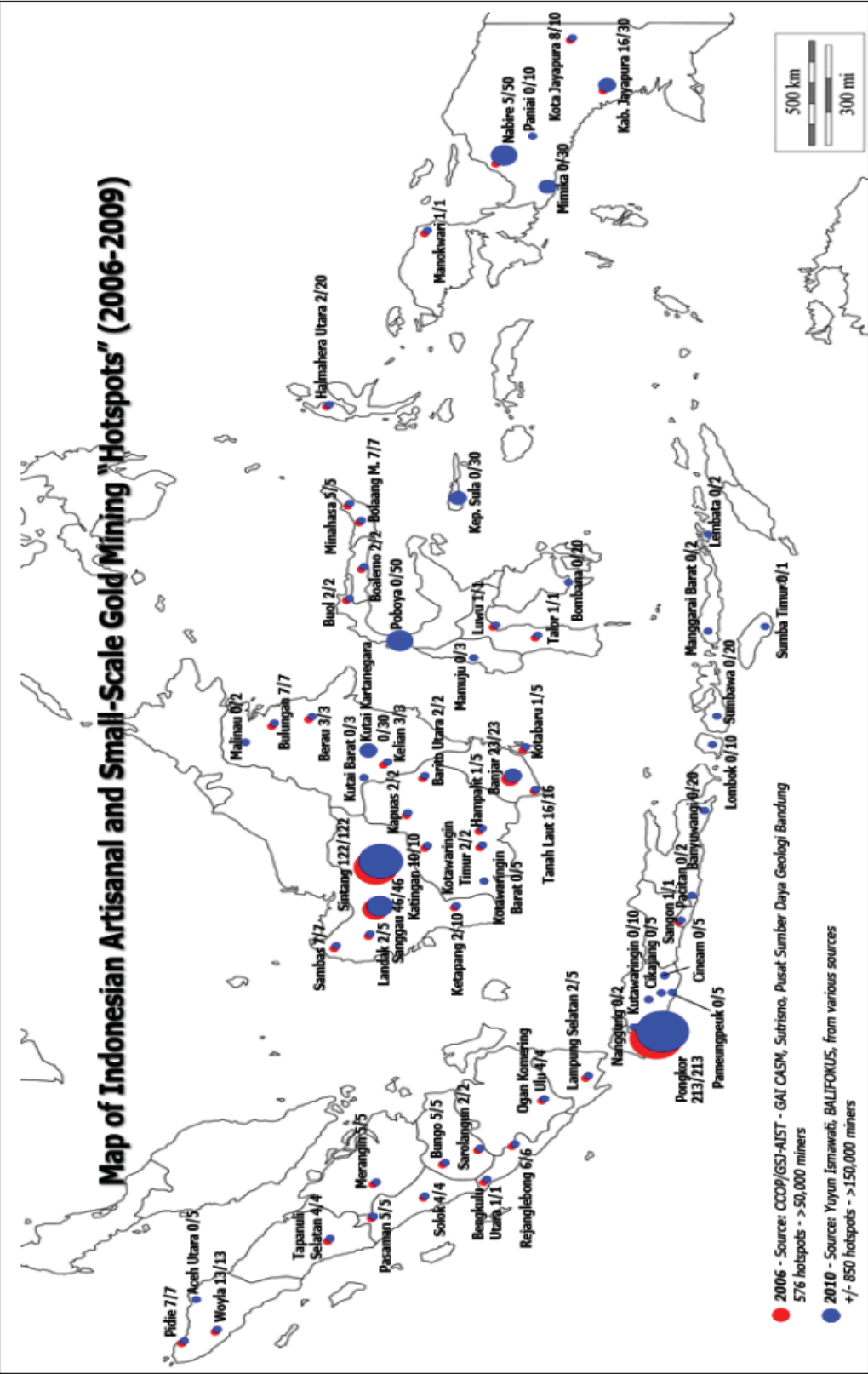


Figure 2.3: Distribution of ASGM in Indonesia

Source: Ismawati (2011, p. 22)

2.4 ASGM and mercury regulations

There are several regulations associated with ASGM and mercury usage for mining activities. In the case of the mining sector, the regulations mainly follow the new mining law, which is Law no. 4/2009 regarding Mineral and Coal Mining (Ocallaghan, 2010). In the environmental sector there are several regulations, such as: Law no. 41/1999 regarding Forestry; Law No. 32/2009 regarding Management and Protection of Environment; Government Regulation No. 18/1999 regarding Hazardous and Toxic Wastes Management; and Government Regulation no. 74/2001 regarding Hazardous and Toxic Substance Management. The distribution of mercury itself is managed and controlled by Trade Minister Decree No.75/M-DAG/PER/10/2014 regarding the second amendment of Trade Ministry Decree No.44/M-DAG/PER/2009 regarding Procurement, Distribution and Control of Hazardous Material. The Indonesian President released seven President's Instructions on March, 9th 2017 regarding mercury use in ASGM (Sekretariat Kabinet Republik Indonesia, 2017). Further explanations about these laws and regulations associated with ASGM are provided in Table 2.1.

Table 2.1: Regulations and instructions associated with ASGM

No	Regulation	information
1	Law 4/2009	a) All small-scale miners must work inside the small-scale mining area (WPR) and hold a people mining permit. b) The criteria for a small-holder mining area (WPR) are: • Located in the river or between the side and the riverbank; • Maximum depth for the mining activities is 25 metres; • Mining area is a terrace sediment, flood plain and ancient river sediment; • The maximum area for a small-holder mining area is 25 hectares;

No	Regulation	information
		• It must be an area or place where small-holder mining has been done for at least 15 years; • People mining permit (IPR) are issued by a regency government to individuals, groups of individuals and/or cooperatives; • Issuance of IPRs can be delegated to sub-regency heads. c) IPRs will be issued for a maximum of five years and the area of IPR can be granted to: • Individual miner for a maximum of one hectare; • A group of individuals for a maximum five hectares; • A cooperative for a maximum of 10 hectares. d) Mining technical requirements for IPRs will be provided by regency/municipality. • Regency must be responsible for technical security in IPR that covers occupational safety and health, environmental management, and post mining; • Supervision and monitoring shall be done by mine inspector.
2	Law 41/1999	• All mining activities must not be done in areas designated as protected areas.
3	Law 32/2009	• A person or a group of people who use hazardous and toxic materials and produce waste hazardous and toxic material must be responsible for the management of those materials and its waste.
4	Law 23/2014	• The authority to issue a licence for mining minerals and coal is given to the provincial government, not a regency government anymore.

No	Regulation	information
5	Government Regulation No. 18/1999	Any type of mercury containing waste must be managed and controlled properly.
6	Government Regulation No. 74/2001	Mercury is categorised as a hazardous and toxic material and therefore its usage is limited.
7	Trade Minister Decree No. 75/M-DAG/PER/10/2014	- Importation of mercury is limited and must have consent from Ministry of Trade. - Importation of mercury for mining usage is prohibited.
8	7 President's Instructions in 2017	- To manage artisanal and other small-scale mining inside and outside the forest. - Prohibiting mercury use in artisanal and small-scale mining. - Periodically monitor the use of mercury at all levels of mining sector. - To evaluate mercury supply and distribution including monitoring of importation. - To educate people about the threat from mercury towards their health, not only adults but also children. - Provide alternative livelihoods for miners. - Provide medical help for people who have been exposed to mercury.

According to Law number 4, year 2009 concerning mineral and coal mining, the regency government has the authorisation to issue all mining permits inside their area, including people's mining licences (Gandataruna & Haymon, 2011). However, with the enactment of Law number 23, year 2014, regarding regional governments, regencies cannot issue mining licences. Moreover, the authority to issue mining licences has been given to provincial governments. This is the result of a misuse of authority in regency provinces, in regards to

the issuing of mining licence (McCarthy & Robinson, 2016). Regardless of Law 23, year 2014, the Indonesian Mining Law (Law 4/2009) does not require a social licence in order to mine within a community, as one of its requirements. Thus, this will result in all artisanal and small-scale gold miners, who do not own a permit, becoming illegal miners. Since the formalisation² of ASM miners is one of the issues in the ASGM sector of Indonesia, as explained in Chapter 3, it is important to know whether, with the enactment of this new law, these issue will still appear as one of the barriers - or not.

2.5 ASGM mining techniques

Not all ASGM in Indonesia uses mercury. The choice of technology used by miners is based, in part, on the geological conditions of the gold ore being exploited. Spiegel and Veiga (2010) describe three types of ore mined by ASGM miners: placers, eroded and primary ore. The amount of mercury used in the processing of those ore properties increases in the order they are written, as seen in Figure 2.4. Despite the richest gold being generally found in alluvial ore, not all miners pursue this type of deposit. Most ASM miners work either eroded (colluvial) ore, or primary deposits (Spiegel & Veiga, 2010). This is due to a current-day reduction of gold reserves in riverbanks due to extensive mining (Diana, 2016). Miners today generally search for gold by following the trail of the gold vein, which leads them from placer ore to eroded and/or primary ore (Langston et al., 2015). These types of ore require chemical help, such as mercury or cyanide, to liberate gold from gangue mineral (Spiegel & Veiga, 2010).

Mining methods used by ASM miners in Indonesia are varied. The traditional method is the panning method called ‘dulang’ in Indonesian, where miners use a metal or wooden dishpan to separate gold from other particles by gravity (Aspinall, 2001). This method is used for placer gold and takes place in the river banks (Soemarwoto & Ellen, 2010). Some miners also use a sluice box, where the ore will move through a sluice that is covered by jute or carpet after being sprayed with high pressure water (Hinton, Veiga, & Veiga, 2003).

² Formalisation here has the meaning of a process of transferring the right to mine, the right to have a land title and the right to own minerals, for an individual or a group from the government (Siegel & Veiga, 2009). Formalisation is usually given in the form of a legal or formal licence

The jute or carpet then traps the gold and separates it from the non-valuable minerals (gangue). For primary ore, most miners dig a hole and mine the gold ore through a vertical shaft (Soemarwoto & Ellen, 2010). This ore will need further processing, such as crushing and grinding, as seen in Figure 2.4.

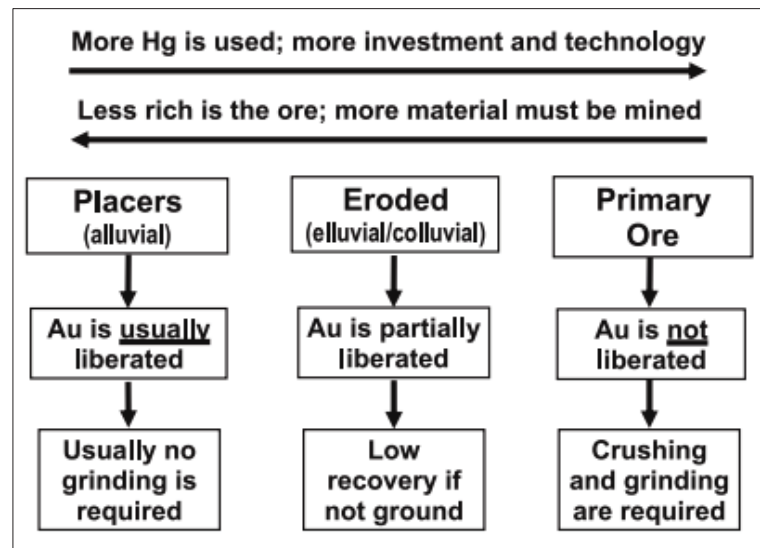


Figure 2.4: Degree of mercury used based on ore types

Source: Spiegel and Veiga (2010, p. 379)

Amalgamation is achieved by inserting mercury into several stages of the gold extraction flow sheet, as seen in Figure 2.5 for placer gold ore, mercury is added in two ways: (1) mixing it directly into the whole ore, or (2) mixing it with a heavy concentrate of minerals that have been separated by gravity concentration (Veiga, Maxson, & Hylander, 2006). For the dulang method, miners put the mercury directly into a dishpan and shake it to create a solid amalgam. While, for the sluice box, mercury is inserted inside the box and it traps the gold during the flow of the alluvial ore (Veiga et al., 2006). After the gold is trapped, the waste (tailing) from the mining is dumped into the river and this increases the mercury concentration in the river (Ogola et al., 2002).

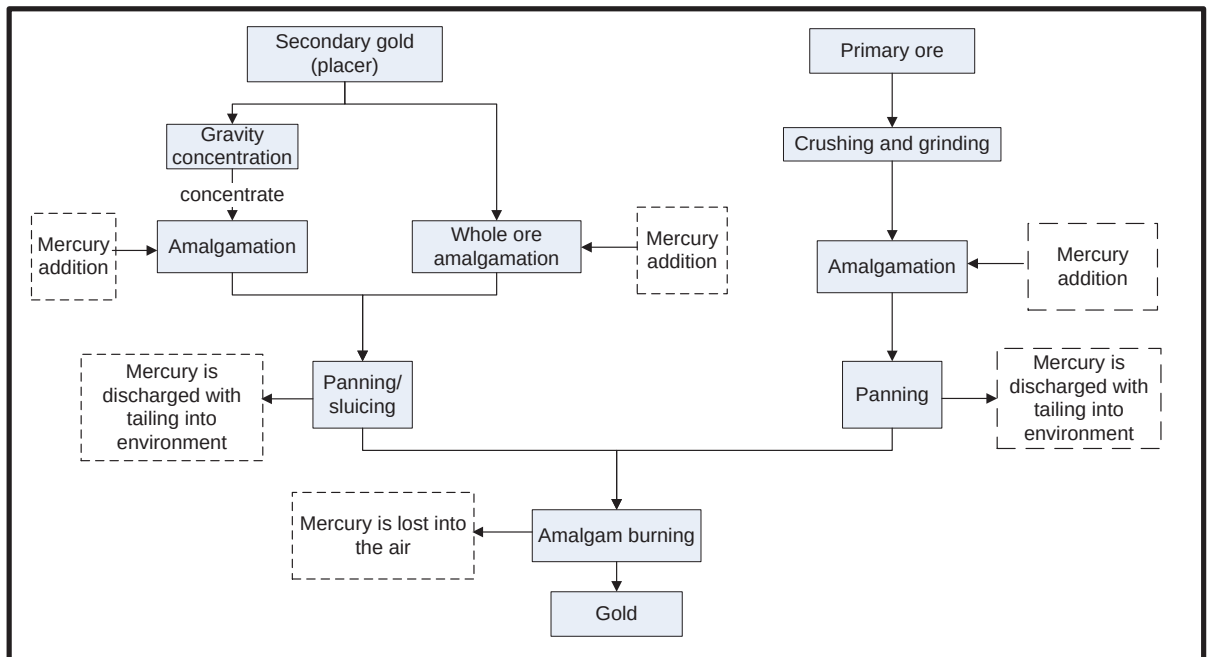


Figure 2.5: Mercury additions in ASGM

Source: Soemarwoto and Ellen (2010) and Veiga et al. (2006)

Miners who find primary ore will need to crush the ore into fine particles. In several regions, miners crush the ore by hand and then transfer the prepared ore into several trommels or a 'gelundung'. These are steel rod mills (a rotating drum with steel rods which further crush the ore) which mix mercury and gold by spinning it (Soemarwoto & Ellen, 2010). Some miners spend more time mixing the mercury and gold ore, thus causing more mercury residue being left on the bottom of the trommel (Veiga et al., 2006). This method increases the level of mercury in the tailing, which is then dumped into the river or soil, thus causing more pollution.

After amalgamation, miners will recover the solid amalgam by panning it, or by collecting it on the bottom of a sluice box (Veiga et al., 2006). In order to liberate the gold from the mercury, miners usually burn the solid amalgam, since mercury easily vaporises in temperatures lower than gold (Soemarwoto & Ellen, 2010). Many miners burn the amalgam in a pan or shovel, and thus they inhale the volatilised mercury, which makes them vulnerable to mercury poisoning (Veiga et al., 2006).

Several miners in Indonesia also combine cyanidation³ and amalgam, in order to increase gold recovery (Gunson et al., 2006). Mercury contaminated tailings are put inside a cyanidation tank for two to three days, and then the cyanidation tailings containing mercury will be dumped into a pond or river (Veiga, Angeloci, et al., 2014). However, this method is very dangerous to the environment. Bio-accumulation of mercury-cyanide complexes will increase the methylmercury level in biota, as has been extensively reported for a river in North Sulawesi (Castilhos et al., 2006; Veiga, Angeloci, et al., 2014).

Many miners use mercury without knowing the exact quantity needed to capture the gold. In order to produce 1 g (gram) of gold, miners use about 10 g of mercury (Güiza & Aristizabal, 2013). However, to capture 1 g of gold, only 1g of mercury is needed, and thus 9 g of mercury will be released into the environment (Güiza & Aristizabal, 2013). This ineffective use of mercury is typical of ASGM miners throughout Indonesia. Table 2.2 shows the estimated quantity of mercury dispersed into the environment in several major ASGM sites around the country.

Table 2.2: Estimation of mercury quantity released by ASM miners

No	Area	Quantity (Kg/year)	Sources
1	Galangan, Central Kalimantan	1,000 – 2,000	Veiga (2003)
2	Manado, North Sulawesi	20,000 – 30,000	Castilhos et al. (2006)
3	Tetelu, North Sulawesi	300 – 500	Castilhos et al. (2006)
4	Poboya, Central Sulawesi	3,400	Basir-Cyio, Hasanah, Nur, and Serikawa (2012)

Mercury contaminates soil and water through waste and tailing disposal, and air through mercury volatilisation from the burning process (Malm, Pfeiffer, Souza, & Reuther, 1990; van Straaten, 2000). Scholars estimate that, globally, from 1,000,000 kg of mercury waste

³ Cyanidation or cyanidation leaching is a process of extracting gold from ores by utilising aqueous cyanide (CN⁻) solutions (Mekuto, Ntwampe, & Akcil, 2016)

produced by ASGM, 40% will be discharged into the atmosphere, while 60% is dispersed into soil and water (Telmer & Veiga, 2009). The high quantity of mercury released by ASGM in Indonesia will influence the level of mercury in the environment and affect human health.

2.6 Mercury contamination in Indonesia's environment

Most artisanal and small scale gold miners dump tailings contaminated with mercury directly into a water body or soil. Mercury dumped in rivers and soil can flow to other places not associated with mining (Ogola et al., 2002). Therefore, several rivers near ASM activities, as seen in Table 2.3, have high levels of mercury that exceed environmental standards for water and sediment. In the case of water, the standard used is the drinking water standard from the World Health Organization (WHO, 2008) and also the Indonesian Government Regulation no. 82/2001 regarding the management of water quality and control over water pollution, which are 0.006 mg/L and 0.005 mg/L, respectively. For sediment in rivers, the standard is 1.0 mg/kg, according to the Indonesian standard known as the SNI (Male, Reichelt-Brushett, Pocock, & Nanlohy, 2013), in addition to the high trigger value from the Australian and New Zealand Standards for water quality⁴ (ANZECC and ARMCANZ, 2000).

Table 2.3: Level of mercury in rivers near major ASGM activities

No	Sampling sites	Mercury level in water (mg/L)	Mercury level in sediment (mg/kg)	Sources
1	Talawaan River upstream, North Sulawesi	0.2554	-	Ayhuan, Atteng, Dondokambey, and Randuk (2003)
2	Talawaan River downstream	0.013	4 - 6	Limbong, Kumampung, Rimper, Arai, and Miyazaki (2003)

⁴ The standard level of mercury in the river's sediment is 0.15 mg/kg and 1 mg/kg for Interim Sediment Quality Guidelines (ISQG)-low and ISQG-high, respectively

No	Sampling sites	Mercury level in water (mg/L)	Mercury level in sediment (mg/kg)	Sources
3	Barito River, Central Kalimantan	0.242	1.7 – 2.4	Caravanos et al. (2013) and Stapper (2011)
4	Cipamancalan River, West Java	0.0169-0.0170	2.94 – 23.41	Hidayati, Juhaeti, and Syarif (2009)
5	Tajum River, Central Java	0.479 – 1.928	6.993 – 11.886	Fahmi, Budianta, and Idrus (2014)
6	Wubudu River, Gorontalo	-	2.5 -11	Arifin et al. (2015)

Most of the rivers in Table 2.3 are used for agricultural and fishery purposes by local people (Fahmi et al., 2014; Limbong et al., 2003). Limbong et al. (2003) indicates that the level of mercury in the biota is proportional to the level of mercury in the sediment. A similar condition could occur in water. The high level of mercury in water and sediment will increase the level of mercury in the food chain. Several researches have shown that the level of mercury in rice grain, fruit and fish in the vicinity of ASGM areas is higher than the standard. For food, the maximum level of mercury in rice grain is 0.02 mg/kg, according to the Chinese National Standard Agency (CSNA, 2005). Samples taken from rice fields in the vicinity of the Artisanal Buladu gold mine, Gorontalo, show the average of total mercury in brown and white rice grain are 0.603-1.085 mg/kg and 1.042-1.812 mg/kg, respectively (Mallongi, Pataranawat, & Parkpian, 2014), while in Cisit, West Java, the average mercury concentration in brown and white rice grain are 0.585 mg/kg and 1.186 mg/kg, respectively (Bose-O'Reilly et al., 2016). In Poboya, Central Sulawesi, the concentration of mercury in fruit (in this case banana) sold in the market is 0.31 mg/kg higher than the Indonesian standard, which is 0.03 mg/kg (Sari, Inoue, Matsumoto, & Yokota, 2016b; Standar Nasional Indonesia, 2009).

For water biota, the monitoring of mercury level uses two standards: methyl mercury and mercury. The maximum permitted level of methyl mercury in fish is 0.5 mg/kg according to WHO (1990), while the maximum allowable concentration of total mercury in fish and fishery products, according to the Indonesian standard, is 0.5 mg/kg (Badan Standardisasi Nasional, 2009). Several scholars have recorded the level of mercury in fish in the vicinity of ASGM areas (Table 2.4).

Table 2.4: Level of mercury in fish near ASGM site

No	Sampling sites	Mercury level (mg/kg)	Fish species	Sources
1	Minahasa Peninsula, North Sulawesi	0.07-2.08	<i>Osteochilus mossambicus</i> (carp)	Kambey, Farrell, and Bendell-Young (2001)
2	Talawaan River North Sulawesi	0.1–3.14	Caranz Sp (carnivorous fish)	Limbong et al. (2003)
	Wubudu River, Gorontalo	0.5-0.7	<i>Lutjanus synagris</i>	Arifin et al. (2015)

Data in Table 2.4 shows that mercury levels in food and fish in the vicinity of ASGM operations have exceeded the maximum recommended standard. Many of these foods are consumed daily by local people. Hence, it is important to know the relationship between the high level of mercury in the food chain and the level of mercury in the local people; and its health effects.

2.7 Mercury and its effect on a human body

There are several threshold levels of mercury that can be accepted by a human body. WHO (1990) recommends the safe Limit of Biological Tolerance (LBT) of mercury in hair for the general population is 6 mg/kg. For pregnant women, Yagev and Koren (2002) recommend a stricter, which is 5 mg/kg. While for mercury in blood, the maximum level is 15 µg/L (American Conference of Governmental Industrial Hygienists, 2012). Health assessments

for the ASGM sector have been done at several ASGM sites in Indonesia. These health assessments have reported that many miners and local people near ASGM sites have high mercury concentrations, as shown by hair assessments, which indicate severe mercury poisoning. Miner's hair measurements in Tatelu, North Sulawesi, by Castilhos et al. (2006) indicate a mercury concentration as high as 7.7 mg/kg. Similar results were obtained by Gunson et al. (2006), where 54% of the amalgam burners in Tatelu suffer severe mercury poisoning. Gunson et al. (2006) estimated that 18% of children working with mercury had mercury intoxication.

An investigation by Bose-O'Reilly et al. (2010) at an ASGM site in Central Kalimantan and North Sulawesi showed an extremely high mercury concentration in hair of 17 mg/kg and 13 mg/kg, respectively. Bose-O'Reilly et al. (2010) assert that this high level indicated the consumption of fish from a pond contaminated with mercury tailings and the inhalation of mercury in the case of the amalgam workers. A high level of mercury exposure results in several symptoms of mercury poisoning. The number of panning and smelting workers that suffer eye tremors is 60% and 66.7%, respectively. In North Sulawesi, the percentages of panning and amalgam smelting workers that suffer eye tremor are 23.5% and 38.3%, respectively.

Hair samples from local people and miners in Gorontalo, who live near the ASGM activity, were taken by Arifin et al. (2015). The results of tests showed the median of total mercury from 95 samples to be 7.1 ± 2.0 mg/kg, with a minimum concentration of 2.1 mg/kg and maximum concentration of 144.8 mg/kg. Neurological examination of 44 people showed that 81% showed Babinski reflex symptoms, 68% showed bluish gums, while 59% had tremors. Arifin et al. (2015) asserted that mercury dumped from the ASGM site in Gorontalo has entered the food chain, thus creating adverse effects on human health.

A recent survey by Bose-O'Reilly et al. (2016) was conducted in a village near an ASGM site in Cisitu, West Java. They identify that mercury from the mining site has entered the river used by local people to irrigate their paddy fields. Mercury analysis from the hair samples of 18 people showed that 13 had a mercury concentration between 1-5 mg/kg, with

five people having a high concentration above 5 mg/kg. The maximum concentration was 25 mg/kg. Clinical examination showed six people with an average mercury concentration level of 6.7 mg/kg had severe neurological symptoms (ataxia, tremor, paraesthesia and numbness).

From the several cases mentioned here, it is clear that the high usage of mercury in ASGM throughout Indonesia has affected the environment. Most mercury has entered the miners through amalgam burning and the food chain, such as rice, fruit and fish. This condition can endanger people, even those not involved with mining, especially pregnant women and children. There is a clear evidence of children working and living in and around mining sites to be intoxicated by mercury (Gunson et al., 2006). With the continuous inhalation of mercury vapour and the consumption of food contaminated with mercury, more neurological symptoms will be seen by future generations, as seen in the Minamata tragedy (McCurry, 2006). Therefore, it is important to phase out mercury in ASGM and shift to better methods for gold recovery.

2.8 Global Mercury Project

Previous efforts have been undertaken by the Indonesian government to reduce mercury use in ASGM. The Global Mercury Project (GMP) is a major international ASGM-focused development project that was implemented in Indonesia in 2002. This project was initiated by the United Nations Industrial Development Organization (UNIDO) in collaboration with a number of governments and non-government organisations in developing countries (Spiegel & Veiga, 2005). The purpose of the project was to remove barriers to the adoption of cleaner production⁵ practices in ASGM; increase miners and government capabilities; develop better regulations for ASGM; and improve monitoring of mercury pollution and assessment for human health in ASGM sectors (UNIDO, 2013). The GMP was started in 2002 and continued until the middle of 2008 in Brazil, Lao PDR, Indonesia, Sudan, Tanzania and Zimbabwe (Spiegel & Veiga, 2010).

⁵ Cleaner production is the environmental improvements as a result of the integration between technological improvement and/or substitution with environmental strategy and policy to minimise and reduce mining waste and pollution (Hilson, 2003; Van Berkel, 2000)

In Indonesia, the GMP was conducted at several ASGM sites: (1) Galangan, Central Kalimantan; (2) Tanoyan, North Sulawesi; (3) Sekonyer River, Central Kalimantan; and (4) Talawaan, North Sulawesi (Sulaiman, Baker, Susilorini, Telmer, & Spiegel, 2007; Veiga, 2003). Several activities were undertaken at these mining sites, as reported by Sulaiman et al. (2007). The first activity was a health and environmental assessment. This activity was important to identify mining sites with a high concentration of mercury, known as ‘mining hotspots’ (Veiga & Baker, 2004). With proper identification of these mining hotspots, priority action could be made towards key sites which presented a high risk of exposure to mercury.

Following identification, a campaign for raising awareness was implemented at the mine site and the city nearby. This campaign’s focus was on miners, people living in the vicinity of the sites, gold shop operators, government officers and NGOs (Sulaiman et al., 2007). In several areas, booklets were distributed to schools, and television and radio were used to disseminate information. Demonstrations of alternative technologies to replace mercury were made by a Transportable Demonstration Unit (TDU) (Spiegel & Veiga, 2005). This campaign was used to change people’s views and behaviour towards mercury, thus reducing the risk of mercury exposure contamination. Technological introductions which followed the campaign, such as retorts, cut the emission of mercury vapour during the amalgam burning; while portable magnetic sluice boxes and cyanidation were proposed as alternative processing techniques which could replace mercury use (Sulaiman et al., 2007).

Better policies for ASGM were developed by the GMP, including the creation of coordination between local and national stakeholders. The GMP team worked with local governments, for example in Katingan, Central Kalimantan, they worked to develop simple and clear regulations to legalise ASM activities (Sulaiman et al., 2007). Katingan district established regulations on mercury use and management in 2007, in order to regulate mercury use by miners and gold shops. Minimum technology and standards for ASGM, were defined as the result of this collaboration (Sulaiman et al., 2007).

As part of capacity building, several workshops and training events were presented by UNIDO. Most local government officers, women's organisations representatives and several members of local NGOs participated in a Training of Trainers (TOT) (Sulaiman et al., 2007). The purpose of this training was to produce trainers that were able to spread knowledge regarding mercury, as well as alternative technology for cleaner practices. The hope was that an increase in the number of trainers would increase the number of miners and people becoming aware about the danger of mercury (Spiegel & Veiga, 2010).

The GMP project was an excellent project that was targeted to lead to a reduction in the use of mercury in ASGM. However, there were several gaps in the implementation of the project. Firstly, GMP was only conducted in only a few locations, due to budget constraints (Sulaiman et al., 2007). Thus, there were no observations regarding mercury reduction in certain ASGM locations, for example in Banyumas (the focus area for the current study). Secondly, there were several changes in government regulations following the implementation of the GMP. For example, the new mining law 4/2009, which gives more authority to local government to manage the mining sectors including ASGM than the old mining law, that came into effect in 2009 (Gandataruna & Haymon, 2011). This law had a major impact on GMP efforts as the law manages the formalisation of ASM miners and environmental management in the ASGM sector.

Furthermore, between 2002 and 2007, Indonesia was not subject to a legally binding treaty to reduce mercury use. With the participation of Indonesia as one of the Minamata Convention signatories in 2013, it was hoped that there would be an increased effort to reduce mercury in ASGM. The approach of the Indonesian National Action Plan is different to the approach of the GMP. One focus of the NAP is to fully eliminate mercury, while the focus of the GMP was to simply reduce mercury use. Therefore, with these different aims, the approach or techniques could be different. For example, in GMP the use of mercury would be minimised, while in the NAP the use of mercury would be eliminated.

2.9 The Minamata Convention on Mercury

The Minamata Convention on Mercury agreement was signed in 2013 (Chapter 1), in order to reduce mercury usage and emissions globally in several sectors. One of the largest contributors to mercury pollution is the ASGM sector (UNEP, 2012). Therefore, Article 7.2 of the agreement states that parties that have ASGM “*Shall take steps to reduce country, and where feasible to eliminate, the use of mercury and mercury compounds in, and the emissions and releases of the environment of mercury from, such mining and processing*”.

Many countries face different challenges in reducing and/or eliminating mercury use in ASGM. This means that the approach to the reduction and/or elimination of mercury may be different from one country to another (Veiga, Angeloci-Santos, & Meech, 2014). The Minamata Convention therefore acknowledges flexible approaches and solutions in the formulation of signatory country National Action Plan’s (Spiegel et al., 2015). However, a NAP to reduce and/or eliminate mercury in ASGM has to be made in accordance to several points from Annexes C in the Minamata Convention on Mercury:

1. Steps must be taken to eliminate mercury practices and promote non-mercury methods.
2. Strategies must be developed to formalise and regulate ASGM sectors.
3. Baseline estimates of mercury utilised and practices used must be established.
4. Strategies for reducing and controlling mercury trade and its emissions must be adopted.
5. Public health strategies that incorporate health data collection, training for health-care employees and awareness-raising must be developed.
6. Strategies for promoting information to artisanal and small-scale gold miners and affected communities must be implemented.

2.10 National Action Plans to eliminate mercury in ASGM 2014-2018

In October 2013, Indonesia signed the Minamata Convention of Mercury, in Japan, together with 91 other countries (Minamata Convention on Mercury, 2017). The agreement within the convention will become an obligation, once a country ratifies the convention (Lennett & Gutierrez, 2014). Despite Indonesia's failure to ratify the convention ("Indonesia didesak segera ratifikasi Minamata," 2017), the country has committed to the reduction and elimination of mercury, especially in the ASGM sector, by creating its National Action Plan to eliminate mercury use in ASGM.

The National Action Plan to eliminate ASGM mercury use is a four-year national strategy which started in 2014 and will end in 2018. The NAP purpose is to protect human health and the environment from the adverse effects of mercury (Kementerian Energi dan Sumber Daya Mineral, 2013). This plan will be implemented by the introduction of responsible practices in ASGM activities, which focus on the removal of mercury; the adoption of cleaner production practices and technology; tackling social, institutional and financial issues; and better improvement in the regulation network. Furthermore, there are four goals needed to achieve its purpose: (1) implementation of policy and regulations associated with ASGM; (2) implementation of research and development of non-hazardous and non-mercury technology in ASGM; (3) awareness improvement in stakeholders knowledge regarding the risks of mercury; and (4) total mercury elimination in ASGM (Kementerian Energi dan Sumber Daya Mineral, 2013).

2.10.1 Components of National Action Plan

In order to achieve the purpose goals here, the Indonesian government has set three key components within NAP (Table 2.5):

- (1) Legal framework and institutional strengthening.
- (2) Research and development.
- (3) Improvement of awareness and communication.

Table 2.5: Summary of goals, key components and indicators of NAP

Mechanisms	Information
4 Goals	1. Implementation of policies and regulations associated with ASGM 2. Implementation of research and development of non-hazardous and non-mercury technology in ASGM 3. Awareness improvement for stakeholders regarding the risks of mercury 4. Total mercury elimination in ASGM
3 Key components	1. Legal framework and institutional strengthening 2. Research and development 3. Improvement of awareness and communication
15 Indicators	• Key component 1: 1.1 Regulations to support mercury elimination and prohibit mercury in ASGM 1.2 Information on mercury trade and illegal distribution 1.3 Establishment of stakeholder's national and regional forum 1.4 Implementation of competency improvement programme for government staff 1.5 Evaluation of NAP activities and voluntary activities • Key component 2: 2.1 Database on mercury usage 2.2 Study on alternative technology 2.3 Study on health effects due to mercury 2.4 Study on mercury levels in the environment 2.5 Study on mercury lifecycle • Key component 3: 3.1 Socialisation, training and demonstration of alternative technologies 3.2 Media cooperation 3.3 Alternative livelihood training 3.4 Inclusion of the danger and risk of mercury in the national education curriculum 3.5 Evaluation of improvement in awareness raising

Each component of the NAP serves a different purpose. The first key component has the purpose to promote the policies and programmes used to eliminate the use of mercury in ASGM and to cut the supply chain of the mercury (Kementerian Energi dan Sumber Daya Mineral, 2013). Cutting the mercury supply chain means that the Indonesian government will prohibit the production of mercury and prohibit its distribution in ASGM.

The second key component has the purpose to provide data and/or information regarding mercury exposure and its toxicity with respect to human health and the environment (Kementerian Energi dan Sumber Daya Mineral, 2013). Another purpose of the second component is to develop and assess mercury-free alternative methods, which are suitable for use by miners. ASGM miners are expected to change their methods to non-mercury processing, by introducing them to viable alternative technologies.

The third key component has the purpose to improve the awareness of the people to the dangers of mercury. This component is not only targeted towards the miners directly, but also to communities in the vicinity of a mine or mining area (Kementerian Energi dan Sumber Daya Mineral, 2013). It is hoped that by increasing the awareness of people of the danger of mercury, the views and behaviour of the miners towards mercury use will change and this will encourage miners to eventually stop using mercury.

The NAP to eliminate mercury emphasises the need for collaboration between various stakeholders. Therefore, it states that ministries or agencies involved in each programme and the relevant coordinating ministry or ministries have the task, not only to implement the activities, but also to gather information regarding the activities that are undertaken (Kementerian Energi dan Sumber Daya Mineral, 2013). Moreover, the NAP also regulates a general time line and indicators to monitor the progress of programmes. Appendix 1 informs the relevant stakeholders, which support the programmes, in addition to agencies or ministries in charge of implementation. A complete translation of key components for programmes and their timelines is presented in Appendix 2.

2.10.2 Stakeholders involvement

The implementation of the NAP needs the extensive participation of stakeholders. of the list of stakeholders includes government and non-government parties, for example ministries, agencies, universities and NGOs, as seen in Appendix 1 (Kementerian Energi dan Sumber Daya Mineral, 2013). Central government agencies, however, dominate the implementation of the action plan, with local governments generally only participated in three programmes of the action plan (appendix 1). Most of the programmes in the NAP involve a top-down policy⁶, which means that only ministries or agencies decide on the programmes or actions in certain years, and they implement these⁷ in their agreed locations.

2.10.3 Monitoring and evaluation

Appropriate monitoring and evaluation is essential on order to understand the progress of NAP implementation. According to the plan, monitoring should be implemented at least twice a year and evaluation should be implemented once a year (Kementerian Energi dan Sumber Daya Mineral, 2013). Monitoring and evaluation of the three components should be undertaken by all stakeholders but is coordinated by the Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral, 2013). Monitoring implementation progress is achieved by comparing indicator progress against the target outcomes of the programme (Kementerian Energi dan Sumber Daya Mineral, 2013). In this way, any implementation gaps between the actual and planned programmes can be identified.

Despite the fact that monitoring and evaluation should be implemented once a year (Chapter 1), in reality, programme implementation reports are scattered between all stakeholders (e.g Agrawal, 2015; Direktorat Pengelolaan Bahan Berbahaya dan Beracun, 2016; Direktorat Teknik dan Lingkungan Mineral dan Batubara, 2017; The Blacksmith Institute, 2014). To date, there is no official report from the Indonesian government that

⁶ For explanation of top-down policy see Chapter 3

⁷ The ministries and agencies decide what they will do for the current year by holding a meeting in NAP national forum. For a clear explanation see Chapter 5

informs the entire progress of implementation for each programme of the NAP. This knowledge is essential in order to determine what action plans have been implemented and not implemented, thereby identifying barriers to realisation of the target outcomes of the NAP.

2.11 Summary

Indonesia is an archipelago country that adheres to a democratic, republic government system. Indonesia is led by a president and supported by technical ministries. Indonesia also uses a decentralisation system to delegate tasks and services to regency governments supervised by provincial governments. Coordination among ministries is challenging, since not all ministries are under the same coordinating ministries and this is due to political tension. Central government can coordinate directly with local government. However, many local governments still depend on financial assistance from central government.

ASGM activities in Indonesia started in the 17th century. Today, many miners exploit both alluvial and primary hard rock deposits of gold. There are approximately 800 ASGM sites around Indonesia and approximately 250,000 miners. According to literature, many miners do not own a legal licence to mine. There are several regulations that manage ASGM and the use of mercury in ASGM. In general, these regulations obligate the miners to have a licence, and place limits on both mercury trade and usage. The mining techniques employed by artisanal and small-scale miners in Indonesia are varied and are influenced by the geological conditions of the ore being exploited. If miners find alluvial ore, they can successfully use simple techniques and equipment, such as gold pans and/or a sluice box. However, when they find colluvial and primary ore, more complex techniques and equipment are needed to liberate the gold. The two common techniques used by miners in Indonesia are amalgamation and cyanidation. Amalgamation is a technique that uses mercury to recover metallic gold, while cyanidation is a technique to leach gold from rock using cyanide solution.

Amalgamation is simpler than cyanidation and this technique has been used since the start of ASGM in Indonesia. However, mercury that is discharged with mine waste (tailings), together with mercury volatilised during amalgam burning has created a large amount of contamination within the environment in the vicinity of ASGM areas. Several studies have shown a high level of pollution in a number of areas in Indonesia. A high level of mercury has also been found in food, such as fish, rice and fruit. Consequently, as a result of health assessments, it has been shown that many people living in the vicinity of ASGM operations are being poisoned by mercury. Human health impacts of mercury manifest as neurological effects, such as tremors, reflex symptoms and numbness. In the long term, mercury could be the cause of a tragedy in Indonesia, such as the Minamata tragedy in Japan that endangered future generations.

A past programme called the Global Mercury Project, managed by an international donor, was implemented in order to reduce mercury usage in ASGM. However, this programme only collaborated with a small number of stakeholders and ended in 2007. In 2013, Indonesia joined the Minamata Convention on Mercury. One of the provisions of the Minamata Convention is that every country needs to make an action plan to phase out mercury use. Indonesia followed the provision by establishing the NAP to eliminate mercury in ASGM for the period 2014 to 2018. The NAP to eliminate mercury is the first action plan for mercury elimination that emphasises the need for stakeholder's collaboration, including government institutions, NGOs and academics. There are three key components of the NAP and 15 indicators that need to be achieved by stakeholders. Monitoring and evaluation for the NAP is done twice a year and once a year, respectively. To date, however, there has been no government report that informs on the implementation progress of NAP. Therefore, there is urgent need for a study to identify the implementation progress of the NAP to eliminate mercury in Indonesian ASGM.

Chapter 3

Barriers to mercury reduction policy in ASGM: A literature review

3.1 Introduction

This chapter draws on literature to provide essential background information on the research subject. Firstly this chapter provides a definition for policy implementation and barriers then secondly explains the approach to policy implementation generally used by governments in developed and developing countries. Thirdly, this chapter explores barriers for mercury reduction and/or elimination based on the literature relating to ASGM. These barriers are identified and examined through an appraisal of programmes undertaken by government institutions or non-government organisations in several developing countries. Specific consideration is made of how these barriers influence the implementation process. Identified barriers are categorised into four areas: institutional, policy, technical and socio-economic. Fourthly, this chapter reviews past barriers to mercury reduction in Indonesia, and lastly, this chapter describes the framework that is being used to assess the implementation of NAP to comply with the article 7 of the Minamata Convention on Mercury.

3.2 Defining policy implementation and barriers

3.2.1 Policy implementation

Barriers to policy implementation are part of the problem in the domain of public policy. Jenkins (1978) defines public policy comprehensively as “a set of interrelated decisions taken by a political actor or group of actors concerning the selection of goals and the means of achieving them within a specified situation where those decisions should, in principle, be within the power of those actors to achieve” (p.6). While Cochran and Malone (2005) define public policies as “... government decisions and actions designed to deal with a matter of public concern” (p.1). From the previous definitions, it can be asserted that public policies are a process of designing goals and actions that should be taken by such actors to

deal with public concerns. Therefore, the definition is in line with the purpose of drafting the NAP, which is to deal with mercury usage concerns in ASGM.

From a political science perspective, some general definitions of policy implementation are associated with the actions taken following policy decisions, in order to achieve agreed objectives among actors. According to Van Meter and Van Horn (1975), implementation is “[The] actions by public and private individuals (or groups) that are directed by the achievement of objectives set forth in prior policy decisions” (p.447). Sabatier and Mazmanian (1980) define implementation as:

“The carrying out of a basic policy decision, usually made in a statute (although possible through important executive orders or court decision. Ideally that decision identifies the problem(s) to be addressed, stipulates the objective(s) to be pursued, and, in a variety of ways, ‘structures’ the implementation process.” (p. 540).

While Barrett (2004) simply defines implementation as “putting policy into effect” (p.252), DeLeon (1999) asserts that implementation is “little more than a comparison of the expected versus the achieved” (p.330). These differences in viewing and defining policy implementation, among political scientists, reflect that policy implementation is the process of putting action into words derived from the policy decision by public or governmental organisations, in order to produce the expected effect. Furthermore, the results of the policy are influenced by the number of intentions put into action and measured by comparing the intentions with the actions.

3.2.2 Barriers

The existence of barriers affects the performance of policy implementation. Scholars have defined the meaning of barriers from various perspectives. According to Seffrin, Panzano, and Roth (2009), a barrier is “an event or condition that hinders the adoption decision, the advancement of the project or sustained implementation” (p. 262), while Rubin and Herstad

(2009) define an implementation barrier as “the conditions that inhibits the seamless execution of national policies into on the ground programs” (p.4). These two definitions show that barriers are more likely to be associated with the conditions or factors that may delay or prevent the planned action being executed. As a consequence, barriers to policy implementation generate gaps in achieving the expected objectives.

3.3 Approaches to policy implementation

Policy implementation is a continuing process of putting plans into actions. This process involves other actors that own the resource and/or are assigned to do the implementation, based on regulations (Jann & Wegrich, 2007). The implementation process itself is also influenced by the motives, views, resources and values grounded in each actor that are often different from each other (Crabbé & Leroy, 2008). Thus, the diversity of policy actors also creates different interpretations of the policy goals, which are also seen in the approaches taken to implement the policy. There are three approaches generally used by government to implement a policy: top-down, bottom-up and hybrid (Pülzl & Treib, 2007).

3.3.1 The top-down approach

This approach focuses on the decision-making made by central government and the control to generate the desired policy outcome (Makoza & Chigona, 2016). Central government provides clear objectives, goals and intent together with the specific expected output, which is then handed down to administrative agencies for implementation (Barrett, 2004). This approach views policy initiators as the central actors and focuses their interest on clear policies and issues that can be controlled at central level (Matland, 1995). Sabatier (1986, pp. 22-23) informs that the starting point of this approach derives from questions set by central government:

- 1) To what extent were the actions of implementing officials and target groups consistent with the objectives and procedures outlined in the policy decision?

- 2) To what extent were the objectives attained over time, for example, to what extent were the impacts consistent with the objectives?
- 3) What were the principal factors affecting policy outputs and impacts, including those relevant to the official policy, in addition to other politically significant ones?
- 4) How was the policy reformulated over time on the basis of experience?

Various critics have emerged from the implementation of this approach. Firstly, this method overemphasises the role of central policy makers (Matland, 1995). Secondly, this method does not fully accommodate the needs or innovations of the implementers at the lowest level and the target group for which the policy is going to be implemented (Hartley, 2005). In addition, this approach ignores the ability of assigned actors to implement the policy and therefore, it can sometimes create an ambiguous language that cannot be understood by the implementers (Berman, 1978).

3.3.2 The bottom-up approach

The bottom-up approach focuses on policy implementation at the bottom of the network. This means the policy should be implemented by negotiations between policy-makers and front-line actors or beneficiaries, rather than regulation enforcement from central government (Winter, 2003). Moreover, Lipsky (2010), as one of the proponents of this theory, recommends that policy formulation should start from knowing the nature of street-level bureaucrats, such as teachers, the police, lawyers and so forth, as frontline workers. Therefore, the application of policy needs to take into account specific local circumstances, in order to reduce implementation gaps and improve the effectiveness of the policy implementation.

Furthermore, this bottom-up approach sees activities in the policy implementation phase formed from the nature of different groups or organisations and it is also shaped through the process of consensus among the organisations (Hjern & Porter, 1981). Therefore, policy

planning should be gathered from identifying the respondents from relevant organisations, which is usually done by using snowball sampling⁸ (Hill & Hupe, 2002).

There are several critics regarding the bottom-up approach. Firstly, this model has over emphasised the importance of local actors and tends to neglect the role of central government, which also has a direct influence over the implementation of policy (Matland, 1995). Secondly, this approach is useful in determining the actors involved directly in a policy area, and it relies heavily on the perceptions and activities of local implementers (Hjern & Porter, 1981). Thus, Sabatier (1986) asserts that this approach fails to identify the indirect factors that influence the actors, which can be seen from the top-down view.

3.3.3 Combination of top-down and bottom-up approach

The third approach in policy implementation is a combination of top-down and bottom-up models. This approach does not solely depend on the decision maker or bottom level implementer, however this approach comes from the negotiation between both sides (Pülzl & Treib, 2007). Furthermore, this approach combines socio-economic conditions and legal instruments, as seen in the top-down approach, with the behaviour and perspectives of street level bureaucrats in the bottom-up model (De Gruyter, Rose, & Currie, 2015). However, the weakness of this approach is an extended time in the formulation of the policy and so many negotiations must be completed in the implementation of the policy. Therefore, Sabatier (1986) suggests that this method is appropriate for a policy implemented for a period of 10-20 years.

3.4 Theoretical framework for barrier categorisation

Many reports and journals regarding management of ASGM or mercury reduction efforts have identified general barriers faced by developing countries, as seen in the examples above. Barrier categorisation offers a systematic way to explore and organise barriers into categories that share similar sources or conditions (Shackleton, Ziervogel, Sallu, Gill, &

⁸ Snowball sampling is a technique to obtain an important informant or respondent through the information from other respondent or informant (Noy, 2008)

Tschakert, 2015). Therefore, barrier categorisation provides an easy way to collect and analyse barriers. Currently, no journals associated with the problem of mercury reduction in ASGM have categorised barriers to mercury reduction in ASGM. The closest barrier categories towards ASGM are only found in barriers to ASGM development in Africa by Traore (1994). Therefore, this thesis examines three barrier models that are still connected with ASGM, in order to enrich the literature on barrier categories. Firstly, the barrier categories model from the development of ASGM in Africa by Traore (1994). Secondly, the mechanisation effort in artisanal and small-scale diamond mining by Priester, Levin, Carstens, Trappeniers, and Mitchell (2010) in several countries in Africa and Latin America, and lastly, the barrier category model from the cleaner production efforts in small and medium-scale companies by Neto, Leite, Shibao, and Lucato (2017) in Brazil.

3.4.1 Barrier categories for ASGM development in Africa

Traore (1994) proposes four general constraints or barrier that could be recognised as a framework of barrier categories that can prevent ASGM development in Africa. The first group of barriers are structural barriers that are mainly associated with institutions and regulations. These barriers are comprised of a lack of focus from institutions towards ASGM; legal, legislative and regulatory weaknesses that cause vagueness and confusion within the implementation; lack of small-scale mining organisation; lack of women's involvement; and insufficient cooperation between local and national government institutions. The second group of barriers are technical barriers that relate to scientific technology, mining standards, ASGM information and training. The third group of barriers are environmental barriers associated with environmental views, where the ASGM sector is seen as a major environmental polluter bringing about negative social effects on communities. The last group of barriers are commercial barriers associated with difficulties in tax collection, miner's inadequate capital and marketing issues.

The barrier category framework as proposed by Traore (1994) to identify the barrier of ASGM in Africa is very simple as seen in Figure 3.1, and this is a key strength of his framework. However, there are several issues that Traore does not mention in his barrier

categories. Firstly, he does not touch on the availability of the government's budget, as mentioned by several scholars (e.g Chouinard & Veiga, 2008; Spiegel, 2014). Secondly, Traore does not mention the remoteness of locations as one of the barriers in the development of ASGM. Thirdly, he does not recognise formalisation as one barrier generally seen in developing countries.

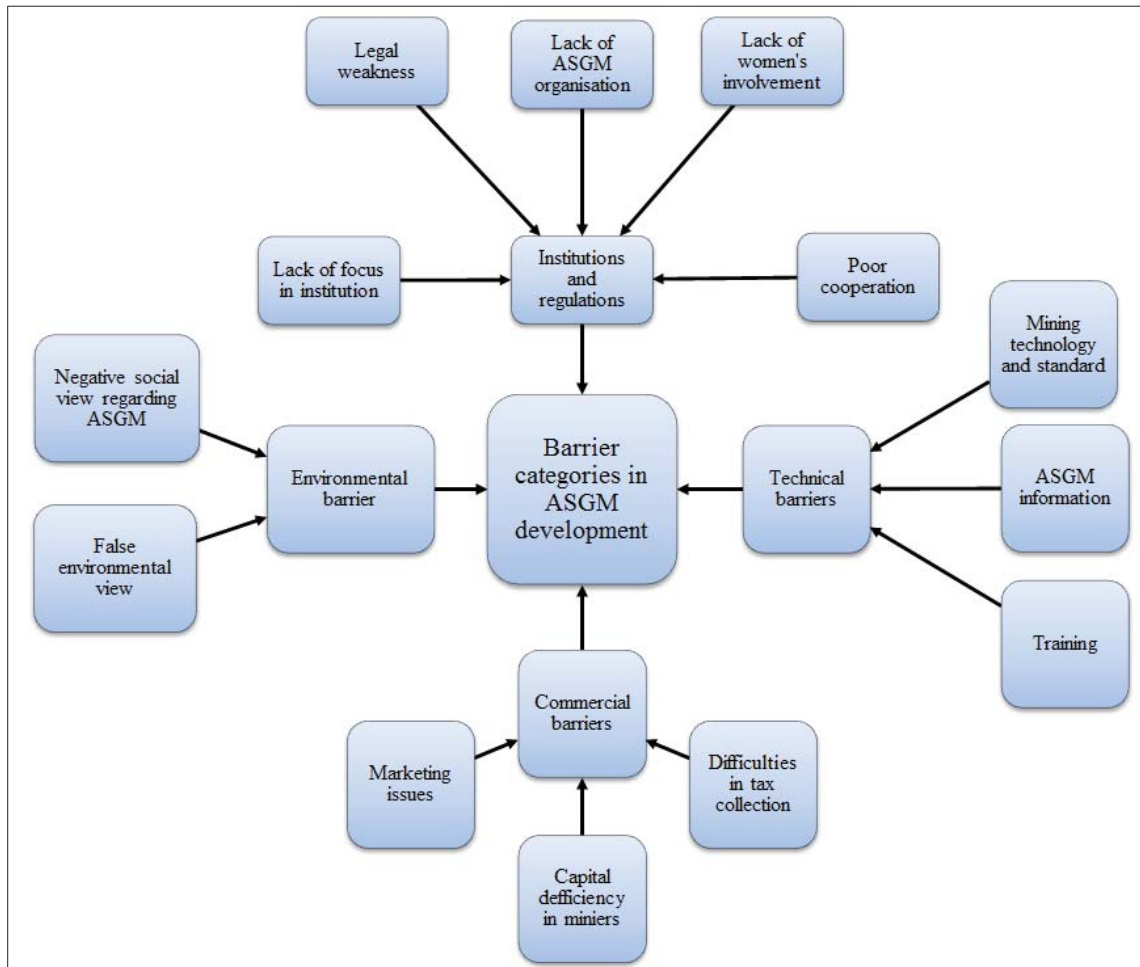


Figure 3.1: Barrier categories toward ASGM development

Source: Traore (1994)

3.4.2 Barrier categories for mechanisation of artisanal diamond mining

Artisanal diamond mining has similar problems to artisanal gold mining, in regards to its production. Governments in developing countries want to change mining methods from traditional to mechanical, in order to reduce accidents and increase miners' incomes

(Vlassenroot & Van Bockstael, 2008). Priester et al. (2010) investigated key barriers that influence the success factors of mechanisation projects in artisanal diamond mining, by governments and NGOs in several African and Latin American countries. They indicate there are five key barriers to mechanisation in artisanal diamond mining: firstly, enabling the environment. This barrier mainly consists of regulatory and political factors, institutional and commercial factors. Examples of this barrier are political stability and conditions, formalisation bureaucracy, strict environmental regulations, governments' political will, land rights, financial access for miners, and lack of incentives. Secondly, socio-economic barriers, such as the legal status of artisanal miners' organisations, the trading chain, cost of labour, perception of mechanisation's benefit for miners, miner's education level and culture. Thirdly, there is a technological barrier, such as appropriate technology, level of trust in the technology's effectiveness among the miners and level of training. Fourthly, there are geographical factors, such as deposit characteristics and location of the miners' operation. Lastly, there are programmatic design barriers, such as miners' involvement in a project or government programmes.

The barrier category framework offered by Priester et al. (2010) as seen in the Figure 3.2 is a comprehensive model. They offer a balance category that consists of barriers from both sides; government and miners. Nevertheless, there are several factors that Priester et al. (2010) do not mention when discussing the barriers for artisanal diamond mining. Firstly, they do not mention the coordination or communication barrier among government agencies. Secondly, Vlassenroot and Van Bockstael (2008) assert that the involvement of various ministries is important and this becomes a challenge in the formalisation of artisanal diamond miners. However, Priester et al. (2010) do not recognise stakeholder's involvement as a barrier in their explanation. Finally, they do not mention the limitations of budget and time for governments and NGOs, when implementing a programme or project for mechanisation.

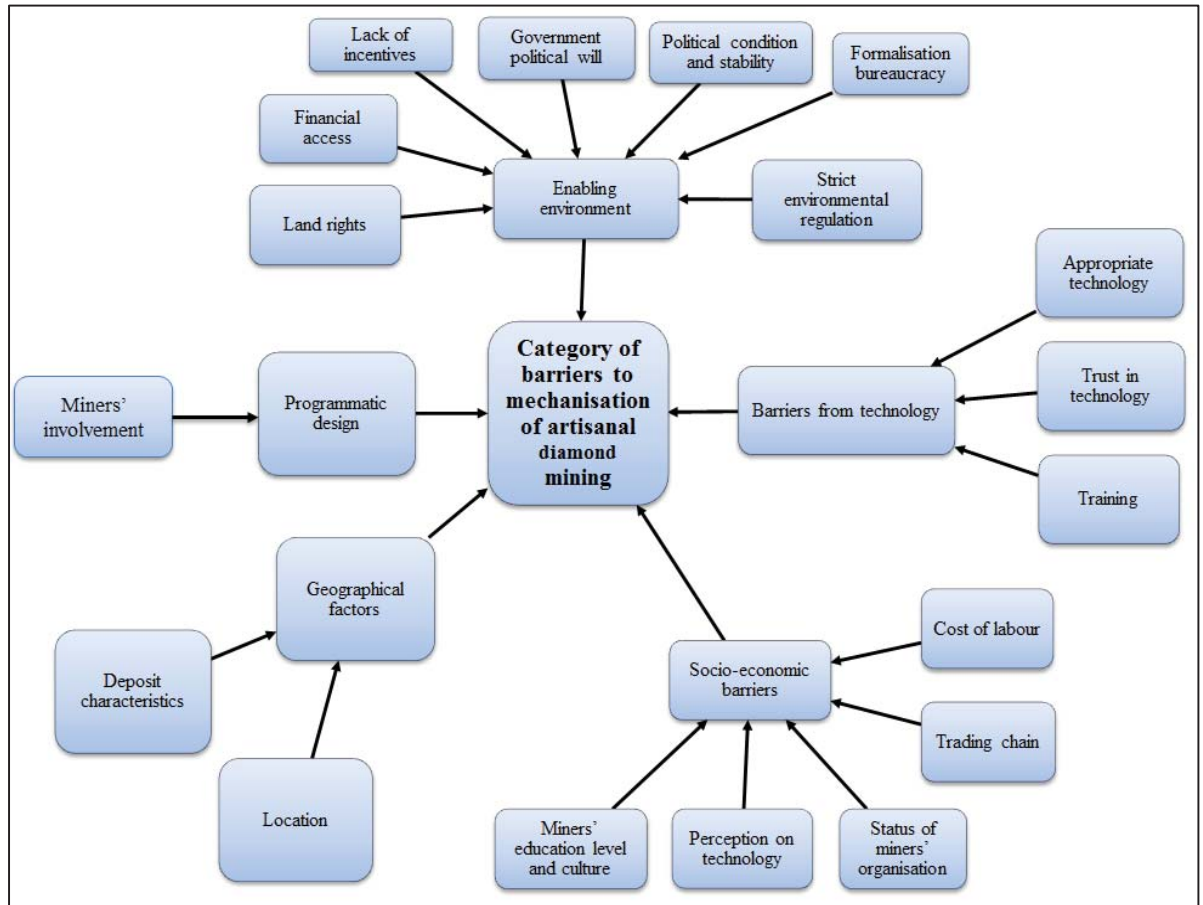


Figure 3.2: Barrier category framework for mechanisation of artisanal diamond mining

Source: Priester et al. (2010)

3.4.3 Barrier categories for cleaner production in small and medium-scale companies

Cleaner production practice is a sustainable way to reduce pollution, while adding economic benefits from waste minimisation (Govindan, Madan Shankar, & Kannan, 2016). Therefore, Neto et al. (2017) offer a framework to overcome barriers in the implementation of cleaner production in small and medium-scale companies. The focus of their study is on the metal industry in Brazil. This framework can be adapted to overcome barriers in mercury elimination in the ASGM sector, since the focus of the NAP is to switch from mercury processing to a cleaner process. Barrier categories and a summary of sub-barrier categories can be seen in Table 3.1.

Table 3.1: Barriers to the implementation of cleaner production

Barriers	Sub-barriers
Economic and financial	• Inadequate capital for investment • Lack of financing access and financial incentives
Technical	• Inadequate technical and technological knowledge • Lack of skilled workers • Lack of supporting infrastructures
Cultural	• Resistance to change the practice • Lack of environmental knowledge • Inadequate investment for environmental training
Legislation	• Regulations ignorance • Lack of environmental standards • Weak inspection • Lack of budget to conform with regulations
Government	• Inadequate incentive policies • Inadequate support for regulations
Organisational	• Inadequate manager capabilities • Insufficient worker's involvement • Lack of interest to apply cleaner practices

Table 3.1 is a comprehensive summary of barriers. However there are some limitations this framework. Firstly, in the case of organisational barriers, not all ASGM miners are coordinated within an organisation, such as cooperatives, since most of them are working individually or in a non-formal group (Heemskerk, 2005). Secondly, there are barriers that are not suitable for the ASGM sector, such as manager's capabilities and investment from the business sector to create training sessions. Lastly, the focus of the framework is only towards a legal industry. Thus, they do not consider formalisation or legalisation as one of the barriers.

3.5 Framework for barrier categories in the current research

The barrier category models described in this review have their own strengths and weaknesses. However, the models described here do not fit with the needs of this research, since most of the categories from the frameworks above are based on the miners' perspective and only accommodate a small portion of perspectives from the government side. Therefore, this research will propose a new barrier category, by adapting the barrier categories from the three frameworks above to accommodate a category from the perspective of the implementers of the policy, or in this case the NAP. This framework summarises the barriers in the reviewed models into four barrier categories: institutional, policy, technical and socio-economic. This removes the categories that are not related to barriers relevant to mercury reduction in ASGM. Moreover, based on an extensive literature review, these barriers are divided into several sub-barriers, as seen in Figure 3.3. It is important to note that several sub-barriers stated in this chapter might not be found in the finding of this research, since the different locations of ASGM in different countries will have different barriers.

3.5.1 Institutional barriers

An institutional barrier relates to policies, standards, or conditions inside and outside the agency that prevents them from implementing a policy. Phasing out mercury usage in ASGM cannot be accomplished by just one government agency's involvement: other agencies also have an important role to play in the activities. However, government agencies have their own tasks, responsibilities and interests, which influence their motives to implement (or not implement) a policy (Hoggart, 1986).

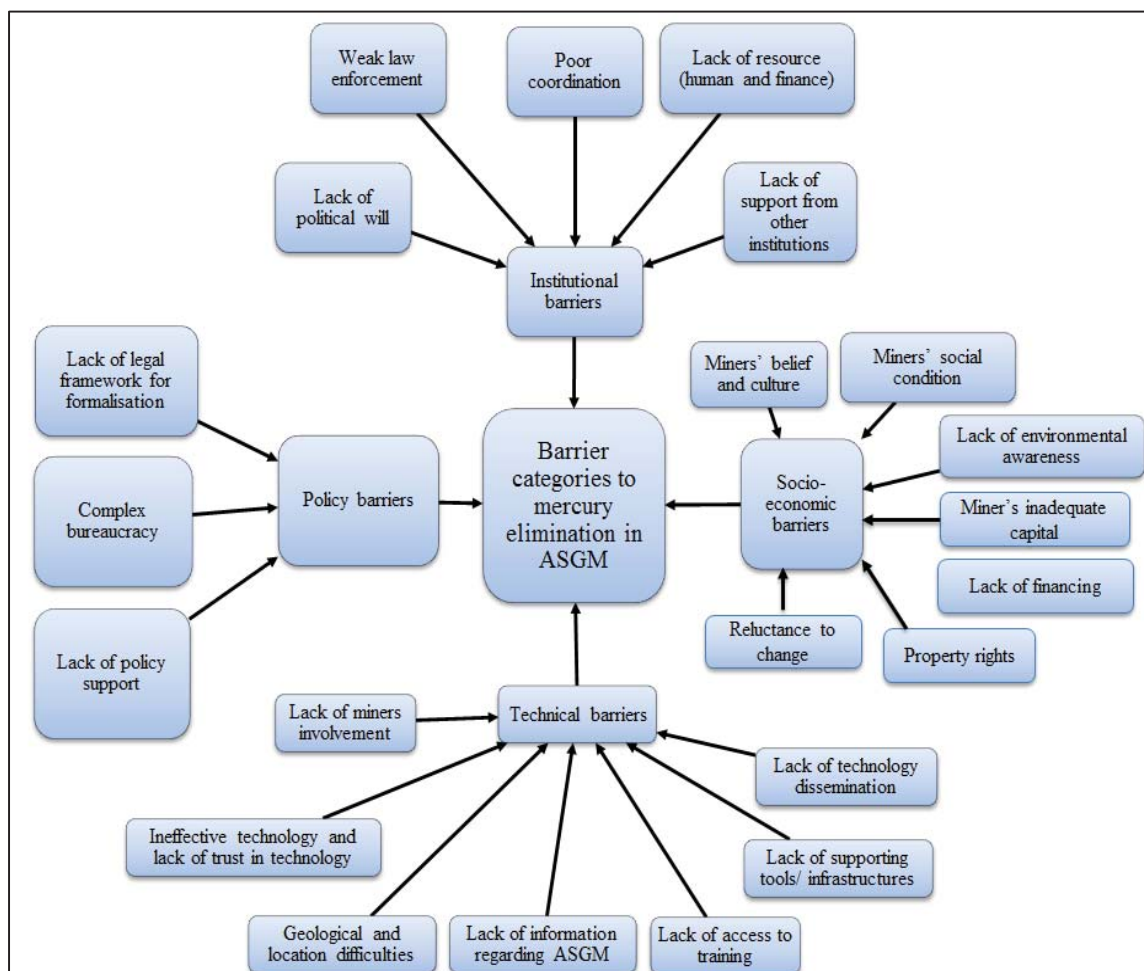


Figure 3.3: Framework for barrier categories to mercury elimination used for the current research

As mentioned in chapter 1, NAP emphasises collaboration among stakeholders. Collaboration without coordination will prevent information dissemination, create redundancy in the work and reduce communication among the stakeholders (Gronau, Röchert-Voigt, & Proske, 2011). In addition, without proper coordination and/or a coordinating agency to supervise and coordinate the stakeholder's tasks, the government agency will act according to the resources they have, their own understanding and their perceptions (Jennings & Jo Ann, 1998; Van Der Meer & Edelenbos, 2006). Several scholars have identified poor coordination among governments, NGOs and academics as a factor that has led to the failure of mercury reduction programmes in the past (Buxton, 2013; Collins & Lawson, 2014; Nyame, 2010; Spiegel, 2009a).

Not all governments support the ASGM sector. Some are reluctant to establish regulations or policies to legalise or to help the ASGM sector and to provide help for artisanal and small scale gold miners (Hentschel & Hruschka, 2002; Hilson & Gatsinzi, 2014; Rajaei et al., 2015; Roopnarine, 2006; Sousa et al., 2011; Teschner, 2012). A lack of political will to regulate and help the ASGM sector has led to an increasing number of unidentified miners who use mercury in their activity.

Many governments in developing countries face the problems regarding the magnitude of budgets to run their programmes. Budget allocations for ministries or agencies to handle environmental problems are either not sufficient or they are cut in the middle of the year (Guerrero, Maas, & Hogland, 2013; Johnson & Reath, 1996). Insufficient budgets in government institutions has slowed down activities for supervising and monitoring activities in the ASGM sector (Roopnarine, 2006; Sousa et al., 2011; Spiegel, 2009b). Without regular supervision and monitoring, it is difficult to know the success rate of mercury reduction following ASGM policy implementation (Hentschel & Hruschka, 2002), especially to the implementation of NAP.

Other barriers have also been identified by several scholars, such as the understaffing of institutions, the lack of capability from government staff and corruption inside institutions (Burke, 2006; Hilson & Vieira, 2007; Jönsson, Appel, & Chibunda, 2009; Meech, Veiga, & Angeloci, 2014; Miserendino et al., 2013; Spiegel & Veiga, 2005; Veiga, Angeloci-Santos, et al., 2014). These barriers prevent law enforcement and reduce the frequency of training and technological demonstrations (Hilson, Hilson, & Pardie, 2007; McDaniels, Chouinard, & Veiga, 2010; Schmidt, 2004). Furthermore, barriers, such as insufficient staff and inadequate capabilities mentioned above, will reduce the participation level of government agencies and, as a result, this low participation level will also slow down the progress of the policy implementation.

3.5.2 Policy barriers

Policy barriers are mostly associated with legislation and regulations to support mercury elimination in ASGM. Unclear and/or weak regulations are one of the policy barriers in developing countries. Furthermore, many regulations, especially regulations associated with ASGM, do not regulate specifically on who should coordinate law enforcement, and if there is one, that agency will have a weak role due to lack of sufficient power given by its government (Hentschel, Hruschka, & Priester, 2003; Spiegel, 2009a).

Lack of supportive policies and overlapping policies become the next policy barrier in mercury reduction. Malehase, Okonkwo, and Daso (2016) and Veiga, Angeloci-Santos, et al. (2014) assert that formalisation of the miners is one of the best ways to control mercury usage and emissions in ASGM. However, in several developing countries, miners who want to get a formal licence, need to apply for a mining licence that is seen as part of a long and/or complex bureaucracy (Veiga, 1997). For example, this licencing process could need consents from various agencies, such as the Ministry of Environment, Ministry of Forestry, Ministry of Mining and/or local province (Sousa et al., 2011; Veiga, Angeloci-Santos, et al., 2014). Complex bureaucracy occurs due to strict regulations from the government or an inadequate legal framework for the licencing that creates complexities within the process. ASGM is comprised of small-scale businesses that need simple and supportive regulations (Sousa et al., 2011), so that miners can easily apply for a licence and then be legalised. Moreover, slower formalisation, due to a lack of supportive policies, will inhibit the process of ASGM data collection. Consequently, without complete data for ASGM, the target of identifying miners that need to be assisted is unclear and the progress in programmes for mercury reduction will be difficult to assess (Ledwaba, 2017).

Overlapping policies between inter-governmental or inter-ministerial departments is a common barrier in policy implementation. One example can be seen in ASGM in Tanzania, where overlapping policies generate conflict among government agencies when deciding who has the right to supervise, monitor or provide training for miners (Mutagwaba, 2006). Overlapping policies also influence the level of coordination and connections between

institutions, for example, in the education sector in Indonesia, where general schools and religious schools are under the control of different ministries and led by ministers from competing parties (Datta et al., 2011). As a result, a lack of coordination and cooperation appears among the competing ministers (Datta et al., 2011). Moreover, overlapping policies can also induce another conflict, such as budget prioritising in the government, as those institutions also have a vested interest in obtaining a larger budget to support their activities (Aagaard, 2011).

3.5.3 Technical barriers

Technical barriers can be associated with knowledge, equipment, technical standards, location, geological conditions and expert availability. In several developing countries, a lack of experts in local and/or national agencies slows the progress of technology transfer, and even prevents the continuity of a mercury reduction programme initiated by an international donor or agency (Hilson, 2006). In addition, the conditions and number of supporting infrastructures, for example, training centres and mercury monitoring facilities, also influence the successful level of mercury reduction (Hilson & Vieira, 2007; McDaniels et al., 2010; Roopnarine, 2006).

Knowledge and understanding of appropriate techniques and technological approaches that are suitable for a particular community is important, in order to reduce the use of mercury in ASGM (Hentschel & Hruschka, 2002). Miners' trust in new technology is one of the common barriers experienced by several developing countries who have introduced alternative techniques and technologies that were too complex and thus unpopular with miners. For example, in Guiana, the government tried to implement a sluice box technology, which is unpopular among mine workers (Hilson & Vieira, 2007). The sluice box was not comfortable to use, according to the miners. Several countries tried retorts that can trap mercury vapour (Metcalf & Spiegel, 2007; Sulaiman et al., 2007). However, some mining communities rejected this method and complained about the longer time needed for the burning process. They were also worried that they might lose some gold if they used the retorts (Jönsson, Charles, & Kalvig, 2012). Forcing technology on miners will only reduce

the level of trust from miners. Therefore, Veiga, Angeloci-Santos, et al. (2014) recommend educating miners slowly and patiently, in order to increase their trust in the alternative technology.

Location is another barrier in this category. Most ASGM activities are located in remote areas, which are difficult to reach and only a few government representatives are available in those areas (Drace et al., 2012; Hilson & Pardie, 2006; Sousa et al., 2011). With limited staff to monitor activities and the remoteness of an area, many ASGM activities cannot be reached and recorded. Moreover, ASGM remote locations can also slow the transfer of knowledge regarding the danger of mercury and the value of alternative and appropriate technology for miners (Drace et al., 2012; Nyame, 2010).

Geological information is important to identify the possibility of ASGM occurrence in specific locations (Hilson et al., 2007). However, many developing countries have incomplete geological data, especially mineral reserve data (Hilson & Maponga, 2004). Hence, providing clear geological mapping and information can enable government agencies and NGOs to map ASGM locations, in order to identify the potential existence of artisanal and small gold miners (Nyame, 2010). In addition, the migration of miners from one location to another can also be known from those maps. Knowledge about the geological conditions can also help decisions about suitable technologies and methods to replace mercury, based on local conditions (Hilson et al., 2007).

The final barrier from this category is the information regarding the number of miners and mercury used in ASGM. Without this information, government and NGOs agencies will have difficulty in prioritising the areas that should get more attention (Malehase et al., 2016). Furthermore, this barrier is connected to resources available in government agencies. An example for this barrier is the limitation in budgets and human resources that have resulted in agencies failing to conduct proper monitoring and supervision, which then leads to inadequate data collection on miners (Spiegel, Savornin, Shoko, & Veiga, 2006).

3.5.4 Socio-economic barriers

Socio-economic barriers are related to the conditions of miners. False views or beliefs regarding the toxicity of mercury are one of the existing socio-economic barriers, which can be seen in several communities. Many miners believe that mercury is not dangerous for their health. This perception is seen in several developing countries, such as Ghana and Brazil (Hilson, 2006; Hilson & Pardie, 2006). In addition, there was a famous case in Brazil in 1987, where a miner from Brazil drank mercury in front of a TV audience to demonstrate how harmless mercury is (Veiga, 1997). In several ASGM areas, traditional customs can act as a barrier. For example a local community may prohibit an activity to be done on a certain day or prohibit women to enter the mine site (Heemskerk, 2005).

Some miners believe that changing or modifying the amalgamation method will reduce gold production (Jönsson et al., 2009). Some even gather during the amalgam burning process just to witness whether the gold is missing or not and to prevent theft (Nyame, 2010). Some scholars suggest it is useful to know the miners' views and beliefs first, before deciding on an approach to eliminate false views and beliefs (Hentschel & Hruschka, 2002; Shandro, Veiga, & Chouinard, 2009). Knowing and understanding the two factors above can help decisions about the technical approach suitable for different communities. The next step is then educating the miners to change their views and beliefs. Miserendino et al. (2013) assert that educating miners is the best way to change false views.

Social conditions, such as the surroundings of the environment also influence the success of a mercury reduction or elimination programme. For example, miners in Ecuador prefer to keep using mercury without retort, due to its easiness of use and its convenience since they are doing it in an open space (Kiefer, Drace, Seney, & Veiga, 2015). In several areas, poverty is one of the reasons for miners to keep using mercury (Debrah, Watson, & Quansah, 2014). Due to conditions in the environment, such as limited job opportunities and political conflict, miners in several developing countries are trapped in a poverty trap (Hilson & Pardie, 2006; Miserendino et al., 2013). Generally, many artisanal and small-scale gold miners live and work in poor economic conditions (Hilson & Ackah-Baidoo,

2011; Spiegel, 2009b). When they are offered an alternative technology to replace mercury, they will think twice, since the cost to install the technology and buy alternative tools is not cheap. Furthermore, many miners have a low level of education and knowledge regarding mining or geology (Veiga, Angeloci-Santos, et al., 2014; Willden, 2014). Thus, a single workshop to educate some miners cannot solve the mercury problem directly.

In order to accommodate the social conditions of miners, technologies to replace mercury must be cheap, easy to use and produce fast results (Hinton, Veiga, & Veiga, 2003). Moreover, educating miners will take time and it will need to be done patiently, several times (Veiga, Angeloci-Santos, et al., 2014). Another way to reduce mercury is to provide an alternative livelihood for miners. Several projects by international donors and government institutions have introduced alternative livelihoods⁹ in some developing countries. For example the involvement of United Nations Development Programmes (UNDP) in Ghana by introducing agriculture activities like plantation of cassava and oil palm, poultry and snail rearing (Hilson & Banchirigah, 2009). However, Hilson (2007) criticises these activities by international donors to introduce alternative livelihoods, since they only offer a western solution and neglect the social conditions of the local miners. In addition, Siegel and Veiga (2010) assert that switching the livelihood for the artisanal and small scale miners will need a lot of effort especially to remove barriers like access to market, capital and infrastructure.

Switching the mercury amalgamation method to another method is going to add more costs for miners. To support their capital, other financing is needed, since many of these miners generally have limited capital (Aryee, Ntibery, & Atorkui, 2003). According to Spiegel (2012c), microfinance¹⁰ is one of the solutions for miners, in order to provide more capital. However, several cases show that it is not easy for miners to obtain financial help, due to

⁹ According to Siegel and Veiga (2010), alternative livelihood is the establishment of law and economic incentives to switch the profession from doing artisanal and small-scale mining to other sectors. While, according to Wright et al. (2016), alternative livelihood is the effort to reduce the occupation that damages the environment by replacing it with an occupation that has a lower impact towards the environment but still offers an equivalent income.

¹⁰ Microfinance is a loan, savings or insurance that can be accessed by a poor entrepreneur who does not have collateral and does not qualify to get a loan from a bank (Brooks, 2013)

the unavailability of microfinance in their region and a lack of donor and government support (Hilson & Ackah-Baidoo, 2011; Spiegel, 2012c).

The last barrier from a socio-economic perspective comes from property rights issues. A property right is the right to use or dispose of a resource in a certain location (Webster & Lai, 2003). Many artisanal and small-scale gold miners work informally and illegally, since the government does not issue them permits to mine in a specific area (Spiegel et al., 2015). Without having a formal property right, these miners will continue to use mercury, since they cannot get loans to increase their capital (Siegel & Veiga, 2009). Eventually, with limited capital, these miners cannot upgrade their facilities to a cleaner production.

Following on from this narrative, Table 3.2 presents a summary of the barriers that are experienced by government institutions and international donors in the implementation of mercury elimination programmes and other programmes that are indirectly relating to mercury reduction in ASGM (for example legalisation of ASGM).

Table 3.2: Most frequent barriers to the mercury reduction

Barrier category	Example	References
Institutional	Weak law enforcement,	Meech et al. (2014), Miserendino et al. (2013), Teschner (2012)
	Poor coordination,	Buxton (2013), Collins and Lawson (2014), Nyame (2010), Spiegel (2009a)
	Lack of human resource,	Burke (2006), Hilson and Vieira (2007), Jönsson et al. (2009), Meech et al. (2014), Miserendino et al. (2013), Spiegel and Veiga (2005), Veiga, Angeloci-Santos, et al. (2014)
	Lack of political will	Hentschel and Hruschka (2002), Hilson and Gatsinzi (2014), Roopnarine (2006), Rajae et al. (2015), Sousa et al. (2011), Teschner (2012)
	Lack of support from other institutions	Spiegel and Veiga (2010), Sulaiman et al. (2007)
Policy	Inadequate budgets for stakeholders	Mutagwaba (2006), Roopnarine (2006), Sousa et al. (2011), Spiegel (2009b),
	Complex bureaucracy	Meech et al. (2014),
	Lack of policy support	Debrah et al. (2014), Hilson and van der Vorst (2002), Hilson and Vieira (2007), Hinton, Veiga, and Beinhoff (2003), Miserendino et al. (2013), Rajae et al. (2015), Sulaiman et al. (2007)

Barrier category	Example	References
	Inadequate legal framework for formalisation	Krisnayanti, Vassura, Asmara, Ekawanti, and Suheri (2016), Hruschka (2011), Macdonald, Lund, Blanchette, and Mccullough (2014), Meech et al. (2014), Metcalf and Spiegel (2007), Sánchez-Vázquez, Espinosa-Quezada, and Eguiguren-Riofrio (2016), Spiegel (2016),
Technical	Lack of supporting tools and/or infrastructures	Hilson and Vieira (2007), McDaniels et al. (2010), Metcalf and Spiegel (2007), Roopnarine (2006), Spiegel (2012b), Sulaiman et al. (2007)
	Lack of technology information dissemination	Aryee et al. (2003), Buccella (2013), Hilson and Vieira (2007), Spiegel et al. (2006), Malehase et al. (2016),
	Lack of miners' involvement	Buxton (2013), Jönsson et al. (2009), Køster-Rasmussen et al. (2016), Spiegel and Veiga (2010)
	Lack of training and access to training	Appel, Andersen, Na-Oy, and Onos (2015), Aryee et al. (2003), Hilson (2006), Hinton, Veiga, and Veiga (2003), Ledwaba (2017), Spiegel et al. (2006), Malehase et al. (2016), World Health Organization (2016)
	Lack of miners' involvement	Buxton (2013), Jönsson et al. (2009), Køster-Rasmussen et al. (2016), Spiegel and Veiga (2010)
	Lack of training and access to training	Appel et al. (2015), Aryee et al. (2003), Hilson (2006), Hinton, Veiga, and Veiga (2003), Ledwaba (2017), Spiegel et al. (2006), Malehase et al. (2016), World Health Organization (2016)

Barrier category	Example	References
	Lack of information regarding ASGM activities	Echavarria (2014), Hilson (2006), Hilson (2007), Ledwaba (2017)
	Geological and location difficulties	Aryee et al. (2003), Davies (2014), Echavarria (2014), Hilson (2007), Krisnayanti et al. (2016), Meech et al. (2014), Miserendino et al. (2013), Sulaiman et al. (2007)
	Ineffective technology and lack of trust in technology	Hilson (2006), Hilson and Vieira (2007), Miserendino et al. (2013), Veiga, Angeloci, et al. (2014)
	Miners' beliefs and culture	Heemskerk (2005), Jönsson et al. (2009), Kiefer et al. (2015), Nyame (2010), Sulaiman et al. (2007), Veiga (1997)
Socio-economic	Miners' social conditions	Debrah et al. (2014), Hilson and Ackah-Baidoo (2011), Hilson and Pardie (2006), Miserendino et al. (2013), Spiegel (2009b), Veiga, Angeloci-Santos, et al. (2014), Willden (2014)
	Lack of environmental awareness	Hilson and Vieira (2007), Soemarwoto and Ellen (2010)
	Miners' inadequate capital and poverty	Aryee et al. (2003), Hinton, Veiga, and Beinhoff (2003), Meech et al. (2014), Spiegel (2009b), Spiegel et al. (2006), Willden (2014)
	Difficulties in financing	Aryee et al. (2003), Meech et al. (2014), Metcalf and Spiegel (2007), Veiga, Angeloci-Santos, et al. (2014)
	Property rights	Hinton, Veiga, and Beinhoff (2003),
	Reluctance to change	Davies (2014),

3.6 Known barriers to mercury reduction in Indonesia

Over the past two decades, many local and international agencies and governments have put a great deal of effort into reducing the use of mercury in ASGM across developing countries. Generally, those efforts have involved several activities, such as the creation of policies, training, medical help and micro-credit (Hilson, 2006; Spiegel & Veiga, 2007). Several projects to reduce mercury usage have also attempted to switch processing activity towards cleaner production practices (Drace et al., 2012; Sulaiman et al., 2007). However, most of these efforts have not reduced mercury usage, as desired. Moreover, in the past, governments and international donors did not properly identify and evaluate the barriers to reducing mercury in their programmes or projects (Nyame, 2010; Sousa et al., 2011; Sousa & Veiga, 2009). Therefore, it is crucial to gain a better insight into the barriers that have impeded efforts by the Indonesian government and international donors in the past to reduce mercury in ASGM, prior to the enactment of the NAP to eliminate mercury.

3.6.1 Institutional barriers

The Indonesian government and UN have participated in the GMP (Chapter 2), a previous initiative to eliminate mercury in ASGM. Based on project evaluations, there are several institutional barriers to mercury reduction in Indonesia. Sulaiman et al. (2007) identify several factors. Firstly, there is a lack of local government responsibility to control and monitor ASGM activities. Without proper control and monitoring, there is a possibility the usage of mercury will rise in line with the increase of hotspot areas. Secondly, some local governments do not have sufficient human resources to monitor and implement the regulations. The effect of this lack of monitoring and limited human resources in government institutions has exacerbated the increasing use of mercury in several areas. Several new areas in Indonesia have been mined and miners are using mercury to process gold, which then creates damage, not only from mercury pollution, but also from other environmental problems such as deforestation ("Aktivitas tambang ilegal kian marak," 2017; Male et al., 2013).

Research by Spiegel (2012b) in Galangan Region, Central Kalimantan discovered that monitoring of ASGM activities cannot be done, due to inadequate qualified staff in the local and regional government. Spiegel also identified poor coordination between central and local government, as indicated by the confusion of local government staff when asked about the national programme for small-scale mining.

Several scholars have discovered limitations in budgets as another institutional barrier. For example, research by Wardhana (2003) shows that every year the government's budget in Central Kalimantan Province, to monitor and supervise artisanal and small-scale gold miners, is decreasing. Sulaiman et al. (2007) also highlight the government's budget as one of the financial barriers, together with the availability of a NGO's budget in the implementation of a GMP. With so many miners distributed in remote areas, the funds needed to educate, monitor and supervise the miners are not sufficient. Budget reductions have made data collection of artisanal and small-scale gold miners unclear and this has also hindered the process of transferring knowledge. Therefore, budget availability connects with other barriers, such as technical and socio-economic barriers.

3.6.2 Policy barriers

There are several policy barriers in the GMP. Sulaiman et al. (2007) experienced a complex bureaucracy in several local regions that slowed the formalisation progress. Therefore, miners would not know about the alternative technology to replace mercury. According to the new mining law, the formalisation of the artisanal and small-scale miners is done by the government regency (Chapter 2). Similarly, Spiegel (2012b) also experienced the same barrier during his research in 2010. He found that the slow progress of formalisation towards ASGM hinders the process of the transfer of knowledge. Furthermore, while formalisation is at a slow pace, mining areas, which have been previously worked by artisanal and small-scale miners, have been given to large-scale companies, which has led to conflicts between large-scale miners and artisanal and small-scale gold miners (Spiegel, 2012b).

Insufficient regulations and standards to control the usage of mercury in ASGM also contribute to policy barriers (Sulaiman et al., 2007). In addition, many regions do not have any regulations that cover and manage artisanal and small-scale mining activities (Spiegel, 2012b). Even if there is a regulation regarding ASGM, there is a possibility of an overlapping regulation and mandate between one agency and another, as seen in other mining regulations (Ocallaghan, 2010).

3.6.3 Technical barriers

Sulaiman et al. (2007) describe several technical barriers to the GMP project. Firstly, there are inadequate support facilities, such as cyanidation processing facilities. Without the existence of a cyanidation facility, they argue that miners will continue to use mercury. Moreover, poor local government infrastructure such as laboratory or equipment to monitor mercury emission also creates difficulties when monitoring the level of mercury in the environment. Similar barriers were also identified by Spiegel (2012b), who found a lack of local government infrastructure to monitor small-scale area activities and boundaries.

Secondly, most of ASGM activities are located in remote places, where it is difficult to reach miners, due to the lack infrastructure, such as transportation or roads (Sulaiman et al., 2007). Thirdly, a lack of government experts threatens the continuation of GMP programmes in the future. This will affect the number of trainers needed to distribute the information about mercury to miners, who have not attended workshops.

Lastly, alternative technology to replace mercury can be different from one site to another, depending on the geological conditions or, in particular, the ore type. In the past, several demonstrations of gravitational technology by a GMP to replace mercury have failed to maximise the gold production (Sulaiman et al., 2007). This failure occurred due to the size of the gold particles, which were very fine and it was difficult for them to be caught by gravity concentration. Thus, these miners are still using mercury to obtain gold as they did not adopt the alternative technology (Sulaiman et al., 2007).

3.6.4 Socio-economic barriers

Location, property rights and culture are the main factors that contribute to socio-economic barriers in Indonesia. Most of the mineral reserves in Indonesia are distributed over remote areas (Wiriosudarmo, 2001), where locations are difficult to reach by government or NGO staff. Several past GMP projects in Indonesia have faced this barrier, thus slowing the effort to record the number of miners and to transfer knowledge (Chouinard & Veiga, 2008; Sulaiman et al., 2007). Difficulties in reaching miners also reduces the monitoring effort of government staff, since they are limited by a lack of finance and an insufficient number of staff (Spiegel, 2012b).

Many artisanal and small-scale gold miners in developing countries are working without legal permits, as required by law. Moreover, the informality status of artisanal and small-scale gold miners, especially in Indonesia, has resulted in difficulties to obtain information regarding their distribution (Lahiri-Dutt, 2004). Spiegel (2012b) highlights this status and states that miners, therefore, do not own a property right to mine. Without owning a property right to access and control the mining area, the artisanal and small-scale gold miners will still use mercury, since there is no security in the continuity of their mining activities (Whitehouse, Posey, Gillis, Long, & Mulyana, 2006).

In several ASGM communities in Indonesia, low safety and environmental awareness have become a part of the miners' culture. Sulaiman et al. (2007) describe a ritual of several mining communities who put mercury on their skin or drink it, in order to make them stronger. He also identifies those rituals as a barrier, since it demonstrates a low awareness towards the danger of mercury. Similarly, Soemarwoto and Ellen (2010) discovered low environmental awareness in different areas, which is caused by culture uncommonness. The miners in a certain area believe that the more they are the victims, whether from mercury poisoning or an accident, the more gold they will get from that area. This type of culture becomes another barrier that complicates the effort to educate miners, due to their cultural resistance.

Sulaiman et al. (2007) also identify that artisanal and small scale gold miners do not have sufficient capital to buy operating equipment, such as cyanide, as another barrier. In addition, many microfinance institutions are not willing to provide loans to those miners, if they do not have a proper licence from the government (Spiegel, 2012b). Therefore, this barrier is connected to other barriers.

3.7 Framework for effective implementation of NAP

The design of key components and sub-components of the NAP for mercury elimination in ASGM in Indonesia, follows Article 7 and Annex C of the Minamata Convention on Mercury (Kementerian Energi dan Sumber Daya Mineral, 2013). In order to identify progress and implementation gaps, a comparison between actual implementation versus success indicators will be used as the first method (Chapter 5). However, quantifying the progress of NAP implementation is difficult, since there is no national or international standard that can be used to assess the progress of a mercury reduction project or programme (McDaniels et al., 2010).

Due to difficulties identifying the quantification of such progress, Spiegel et al. (2015) suggest three necessary factors for effective implementation, as seen in Figure 3.4. They propose that these factors, which they see as a framework, should be based on points from Annex C of the Minamata Convention on Mercury that need to be prioritised. Moreover, they assert that their research is built on experiences from past mercury reduction projects (particularly the GMP) and the observation of miners' needs, which they refer to as grassroots needs. Their framework can also be used to assess the implementation progress of the NAP and provide recommendations for improving the implementation. Since quantifying the progress of the NAP is difficult, the current study utilises the framework suggested by Spiegel et al. (2015), in order to assess what programme is working well (or not well) (Figure 3.4).

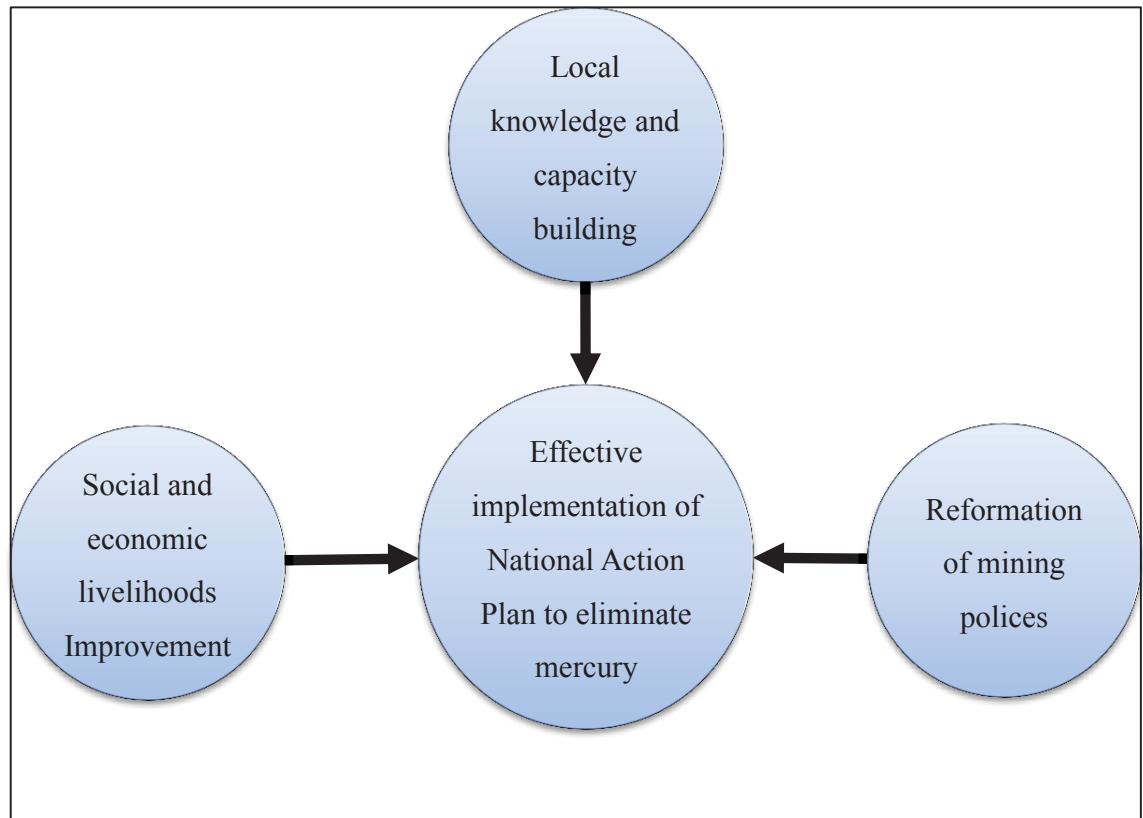


Figure 3.4: Framework to assess effective implementation of NAP

Source: Adapted from Spiegel et al. (2015)

3.7.1 Local knowledge and capacity building

Spiegel et al. (2015) suggest acknowledging local knowledge in regards to cleaner technology practices and capacity building. Several efforts to introduce cleaner technologies have failed in the past, since those technology alternatives were not appropriate to the local conditions of miners (Hilson & Vieira, 2007; Jönsson et al., 2012). Therefore, Hilson (2005) asserts that without knowing the base information of ASGM communities, such as the number of miners, ethnicity background and level of education, intervention programmes for miners are usually not sustainable. Building on several failures of technology introduction in the past, the implementation of a NAP needs to be tailored and based on the characteristics of the community, which means those local communities also need to be involved in the decision-making process regarding the alternative technology needed to replace mercury (Spiegel et al., 2015).

Eliminating mercury cannot be achieved without knowledge improvement, referred to in this case as capacity building. Spiegel et al. (2015) recommend the integration of local culture in regards to capacity building with local miners. There are several examples of integration between modern knowledge and local culture that have been used to disseminate information. Firstly, the use of theatrical play to introduce the danger of mercury in Zimbabwe called “Nakai” (Metcalf & Veiga, 2012). Secondly, story-telling by a local leader in Papua New Guinea (PNG), which is a custom in rural community life (Crispin, 2003). By using an information tool that acknowledges local culture, it is hoped that the message regarding the danger of mercury can be conveyed and understood by local communities (Metcalf & Veiga, 2012). Another way to introduce technology is by adapting to the nomadic culture of the miners by the use of a “transportable demonstration unit” (TDU) (Spiegel & Veiga, 2005), where miners are given options so they can choose the alternative technology that best suits them and their community.

Stakeholders, such as a government (and especially local governments) should also be a target for capacity building, in order to improve their knowledge (Spiegel et al., 2015). Several studies report a lack of capacity in government, especially in regards to knowledge of technology (effectiveness or options) and knowledge regarding the danger of mercury itself (Miserendino et al., 2013; World Health Organization, 2016). Thus, capacity building for government staff, especially local government staff, is important. Knowledge improvement in government staff ensures the continuity of a mercury elimination programme implemented by an international donor or NGO (Sippl, 2015), or a programme implemented by central government.

3.7.2 Social and economic livelihoods empowerment

An improvement in social and economic livelihoods through mining community empowerment initiatives is another factor to assess effective implementation of NAP. A risk awareness and economic empowerment programme should be undertaken, not only for male mine workers, but also for women, since many women are excluded in social and economic initiatives (Traore, 1994). Furthermore, this factor emphasises the need for

microfinance programmes to increase miners' capital. Despite the risk of loan default, as seen in micro-funding programmes in ASGM over past years (Hilson & Ackah-Baidoo, 2011), Spiegel (2012c) asserts that microfinance could help to alleviate capital burden, especially for miners in rural areas, so they can buy the necessary facilities to replace mercury. Therefore, micro-funding programmes should be created, based on the culture and characteristics of the miners in a certain area and not only follow the market-driven priorities of a traditional bank (Spiegel et al., 2015).

Finding other livelihood options that can give higher income than the mining sector is difficult and they are called myths by Siegel and Veiga (2010). However, miners should be introduced to other viable livelihoods, since mining is not going to last forever. Alternative livelihoods are another factor not included in the framework to assess effective implementation of NAP. Empowerment by proposing an alternative livelihood is also needed by the miners in ASGM, so they can switch to another livelihood if the mineral reserve has run out (Ribeiro-Duthie et al., 2017). Several large-scale mining (LSM) companies in Latin America have used their corporate social responsibility (CSR) fund to provide ASGM miners with alternative livelihood training (Ribeiro-Duthie et al., 2017). This training has the purpose to help miners to switch their job to other sectors, such as farming or fisheries, or to improve the mining knowledge of artisanal and small-scale miners and prepare them to enter LSM. Several livelihood options for miners could be agriculture, aquaculture or other sectors that are viable according to local conditions (Sippl & Selin, 2012).

3.7.3 Reformation of mining policies

Compared to large-scale mining industries, ASGM is facing a more complex bureaucratic licence process, as seen in several developing countries (Hilson & McQuilken, 2014). Many artisanal and small-scale gold miners have lost their areas and their mining rights, due to the ambiguity of policies (Peluso, 2017; Spiegel, 2012b). In addition, several policies do not support mining activities. For example, shifting regulations in Zimbabwe that used to legalise panning in river beds, now ban these panning activities (Spiegel,

2009a). Harsh policies towards ASGM, for example, pressuring artisanal and small-scale gold miners in Zimbabwe or Ghana to close their activities, without any better solutions, can also shock the miners (Spiegel, 2014; Teschner, 2012). Fast changes to regulations will bring about confusion among miners, which will then impede efforts to reduce usage of mercury. Many miners will hide or be reluctant to meet government staff.

Besides regulations connected to formalisation, environmental policy should also support artisanal and small-scale gold miners. In several developing countries, artisanal and small-scale gold miners are obliged to make an environmental impact assessment (EIA) (Macdonald et al., 2014). The registration process for EIA is a long process that requires time and cost for miners (Debrah et al., 2014; Hilson, 2002b). Consequently, many artisanal and small-scale miners are choosing to work illegally in order to reduce this problem and therefore, simple and clear regulations and a partnership between ASGM and large-scale mining needs to be created, through the development of a new breakthrough towards cleaner production practices (Spiegel et al., 2015).

3.8 Summary

Policy implementation is a process of putting action into words derived from the policy decision by organisations and/or institutions. Barriers, on the other hand, are conditions that impede policy implementation. There are three approaches to policy implementation usually done by organisations or institutions. Firstly, the top-down approach, an approach where the central government or headquarter decide the policy or regulation that needs to be done by the implementer in the bottom level. Secondly the bottom-up approach; an approach towards policy implementation that is fully based on the need of bottom implementer. Lastly, a combination of the top-down and bottom-up approaches. This approach consists of a negotiation between the decision maker and the implementer at the bottom level. Thus, this approach is more suitable for a long-term policy.

Policy implementation is not always perfect. There are always barriers that impede the progress and success of policy implementation. The research described in this thesis utilises

barrier categorisation to identify and simplify the analysis of barriers. At the moment, no scholar has described or proposed a framework to categorise barriers in elimination of mercury from ASGM. Therefore, the current study describes three frameworks used to categorise barriers in the ASGM sector: barrier categories that prevent ASGM development in Africa; barrier categories for mechanisation of artisanal diamond mining; and barrier categories for cleaner production in small and medium-scale companies. These three Barrier category models each have their strengths and limitations. A general limitation is that they focus on the barrier from the miners or company side with less emphasise on the barrier from the government side. Thus, these barrier models are not ideally suited to the current research.

This research proposes a new framework by adapting and summarising the frameworks that have been reviewed. Four barrier categories are proposed: institutional, policy barriers, technical barriers and socio-economic barriers. In the past, several projects to reduce mercury, for example, GMP, have been conducted in several areas in Indonesia. Most of the barriers in the implementation of GMP relate to the formalisation of ASGM, alternative technology and to the continuity of the programme. However, the project was done before the new mining law was enacted and before Indonesia became a participant of the Minamata Convention on Mercury. There are no researches and journal studies available that analyse the progress of mercury elimination in Indonesia, Therefore, there is a gap in the research to mercury elimination that needs to be studied further.

This research also utilises the framework for effective implementation of NAP. This framework can be used to assess what programme is working and what programme is not working in accordance with the Article 7 and Annex C of the Minamata Convention on Mercury. The framework for effective implementation of NAP asserts that three factors need to be considered if the government wants the implementation of the NAP to become successful. Firstly, identify local knowledge and improve capacity building both of government and miners. Secondly, social and economic livelihood empowerment is needed, which translates to improving economic condition of the miners by providing

capital and acknowledging women participation. And lastly, reformation of mining policies must be progressed before meaningful results can be expected.

Chapter 4

Research Methodology

4.1 Introduction

The selection of appropriate methodology is a key first step of research. As described in Chapter 1, the aim for the current research was to identify progress of the implementation of the NAP to eliminate mercury from ASGM in Indonesia. The research also sought to identify barriers that impede the implementation of the NAP. Appropriate research methods to conduct the research needed to achieve these aims are identified in this chapter. This chapter describes the sampling methods, data collection and analysis used in the research, outlines the ethical considerations of the research, and presents an overview of Banyumas regency which was identified as the case study for this research.

4.2 Research method

There are several research options that can be used to identify the progress and barriers to mercury reduction in ASGM in Indonesia. According to Creswell (2014), qualitative research is “an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem” (p.4), while quantitative research is “an approach for testing objective theories by examining the relationship among variables” (p.4).

Qualitative research is used when researchers are going to describe, investigate and explain the occurrence of a phenomena (Stewart-Withers, Banks, McGregor, & Litea, 2014). This is different to qualitative research which occurs through several methods: direct engagement between researchers and participants through observations and ethnographic techniques; in-depth interviews with individuals or groups; or interpretation of reports, maps, archival documents, visual images and maps (Gregory, Johnston, Pratt, Watts, & Whatmore, 2009).

Quantitative research is used when researchers want to study the relationship between one variable with another and the result will be drawn from statistical tests (Sandelowski, 2000). Several techniques are used by social scientists in regards to quantitative methods, as stated by Overton and Diermen (2014). Firstly, observations that involve measurement and where the results can be quantified. Secondly, questionnaires that involve closed questions. Thirdly, structured interviews, which tend to be used together with the qualitative method, in order to delve more deeply into information gathered following the closed questions.

There are strengths and weaknesses within these two methods. The qualitative method has strengths that include a deeper and richer research into complex social phenomena (Goodwin & Horowitz, 2002). Qualitative research also offers detailed information on the interactions between the actors involved, the role of the actors and the processes of certain activities (Easterby-Smith, Lyles, & Peteraf, 2009). However, there are several limitations within the qualitative method. A key weakness that is relevant to the current study is that the researcher's subjectivity can influence results and consume more time during the interviews or the observation process (Choy, 2014). Moreover, issues, such as confidentiality and anonymity can be a problem when presenting the results (Anderson, 2010).

With respect to quantitative methods, a strength is the provision of reliable results that can be verified, and which can be generalised (Overton & Diermen, 2014). In addition, this method can save time and informs an exact result by providing numerical data (Choy, 2014). The weakness of the quantitative method lies in the depth of the results. This method cannot delve deeper into a complex problem, since it does not accommodate human perceptions (Choy, 2014). Sandelowski, Voils, and Knafl (2009) assert that a lack of consideration of complexity, discourse and the human voice, can be seen as the primary weakness of quantitative research techniques.

There has been no study undertaken to investigate the implementation progress of the NAP to eliminate mercury in Indonesia and its barriers, from inception through to the present

time. Thus, an in-depth study needs to be done, in order to determine the extent of progress and to identify barriers according to the perceptions of the implementers. A qualitative method is able to delve in-depth into complex processes and explore the challenge of a policy through the lens of its implementers (Marshall & Rossman, 2011). This means that a qualitative method can provide detailed information and in-depth understanding on the progress and barriers to mercury elimination in ASGM sectors. Based on the explanation presented here, the current research adopted a qualitative research approach.

4.3 Case study approach

According to Bromley (1990), a case study is “a systematic inquiry into an event or a set of related events, which aims to describe and explain the phenomenon of interest” (p.302). A case study is a useful research method to answer questions that require an extensive and in-depth explanation regarding a specific setting, location and/or organisation (Marshall & Rossman, 2011); and it is useful when finding the answers to questions about how the implementation of a policy is proceeding and/or why it is not being done properly (Crabbé & Leroy, 2008). Moreover, a case study is a method that allows the researcher to answer questions about a condition/situation where a new phenomenon is occurring and minimal research has been done on the phenomenon by questioning ‘how’ and ‘why’ (Yin, 2009).

A case study approach can be either a single or multi-case and it is the appropriate method to be used in any phase of a policy cycle (Crabbé & Leroy, 2008). Nevertheless, Gary (2011) suggests that researchers should consider carefully the choice of single or multi-case, since this choice can influence the level of information obtained and the generalisations of the findings. He asserts that one case can gain greater detail, but fewer generalisations of the findings - and vice versa.

The extent of NAP implementation can be different from one location to another. Policy implementation is enclosed within an institutional, cultural, geographical and political context, and cannot be described without some appreciation of this context (Deleon & Resnick-Terry, 1998). Thus, a single case study, using a top-down approach, is a good

option to gain insight into NAP implementation. A single case study can also be an example of policy implementation, illustrating the how the NAP is being implemented in Indonesia.

This research utilises a single case study for NAP implementation in Banyumas regency for several reasons. Firstly, multiple case studies could not be completed within the time limitations of the current work. Secondly, Banyumas regency has many ASGM activities that still use mercury in their gold processing (Aziz, 2014; Fahmi et al., 2014) and recent research by Sari, Inoue, Matsumoto, and Yokota (2016a) indicates an increasing level of mercury in the Cihonje river, near the ASGM activity in this regency. This river is used for daily activities, and this makes the wider community vulnerable to mercury poisoning. Thirdly, the researcher is already familiar with the conditions of the area, as he once lived not far from the current day mining operations. Therefore, the existence of mercury gold processing, the increasing rate of mercury pollution and the researcher's familiarity with the conditions, made Banyumas regency a good candidate for case study qualitative research, in order gain an understanding of implementation progress and barriers to the NAP in Indonesia.

4.4 Selection of participants

Selecting participants is another important issue in qualitative research and it can be done by reviewing the literature; making observations; examining media documentation; and/or preliminary interviews (Creswell, 2014). There are two methods for the selection of participants. Firstly, purposive sampling, which is a method used to choose participants (sample) based on the level of knowledge or role that they have regarding the research topic (Tongco, 2007). This method is also used to choose participants who are willing and ready to be interviewed. Secondly, snowball sampling is a technique that chooses participants through their contact with other informants (Noy, 2008). In this technique, a repetitive process is put in place, by asking a respondent to contact other respondents who hold information associated with the research.

The current research utilised both sampling methods. The researcher first selected respondents based on the stakeholders listed by the NAP (Appendix 2), with respondent names coming from the database of a person in charge of the NAP for the ministries and agencies in the MoEMR. Secondly, the researcher filtered the respondents based on their participation. Filtering respondents from a list of government institutions was very important for the current research, in order to ensure an adequate number of respondents. The filtering of respondents was checked by several main stakeholders (the MoEMR, MoH, and MoEF). Filtering respondents was also important due to time limitations, as it was not possible to include all government institutions listed in the NAP as participants in this research. Thirdly, in order to cross-check information from the stakeholders regarding implementation, several participants that the researcher assumed to be important, such as the village head and cooperative staff, were also selected for interview. These participants were identified from the interviews with local government staff.

Participants targeted for interview:

1. **Government sectors.** Most implementation of the NAP is undertaken by central and local governments. However, not all government institutions listed in the NAP were interviewed. Participants from ministries, agencies and local government institutions that are actively involved in the implementation of the NAP as stated by the main respondents (the MoEMR, MoEF, MoH and BPPT) were selected for the research. Respondents from the MoEMR are the larger portion of respondents, since most of the action plan is associated with the tasks and duties of the MoEMR. Snowball sampling was used to engage more respondents who had information associated with the implementation of the NAP. Table 4.1 shows the institutions that are the target of this research. Originally, 22 participants from various institutions were targeted for interviews. However, during the research, two respondents could not be interviewed. There was no response to the researcher's emails and phone calls to one respondent (MoECS), and distance to the location of another made interviewing this respondent not practical (Yayasan Tambuhak Sinta). The total number of respondents interviewed during the research was 20 (Appendix 3).

2. **NGOs.** As one of the counterparts of the government in the implementation of the NAP, NGOs play an important role. Several activities are run through collaboration between government institutions and NGOs, for example, past surveys on alternative technology and mercury levels in ASGM.
3. **Local village office and local cooperation.** The local village office is the venue for workshops with miners which are scheduled as part of the NAP. Furthermore, the local village office acts as the place where all government agencies and local cooperatives meet, thereby connecting the ASGM miners with the central government. Local cooperatives also have a role as a gathering place for small-scale gold miners. Therefore, the view of village government and cooperatives is important on any assessment of the implementation of the NAP. Information collected from local cooperatives can be used to validate information from the government or NGOs.

Respondents from 11 institutions were interviewed (Table 4.1). Academics and local miners were not included in the research, due to their current lack of involvement in the NAP, and legal issues identified by several respondents. Purposive sampling was used to gather information from the NAP actors while snowball sampling was used to obtain information external to stakeholders listed in the NAP. The full list of participants and methods used to select the participants are presented in Appendix 3.

Table 4.1: Institution targets and respondents

No	Institutions	Level	Purpose	Number of participants
1	Ministry of Environment and Forestry (MoEF)	National	To obtain information regarding planning and implementation of NAP	1
2	Ministry of Energy and Mineral Resources (MoEMR)	National	To obtain information regarding planning and implementation of NAP	6
3	Ministry of Health (moH)	National	To obtain information regarding planning and implementation of NAP	1
4	Coordinating Ministry for Maritime Affairs	National	To obtain information regarding coordination and implementation of NAP	1
5	Agency for Assessment and Application of Technology (BPPT)	National	To obtain information regarding research of technology	2
6	Blacksmith Institute (NGO)	National	To obtain information regarding miner's training and technology development	1
7	The Energy and Mineral Resources Agency of Central Java Province	Local	To obtain information regarding implementation of NAP	3
8	Health Agency of Banyumas Regency	Local	To obtain information regarding implementation of NAP	1

No	Institutions	Level	Purpose	Number of participants
9	Environment Agency of Banyumas Regency	Local	To obtain information regarding implementation of NAP	1
10	Paningkaban village office	Local	To obtain information regarding implementation of NAP	1
11	Sumber Rejeki Cooperation	Local	To obtain information regarding implementation of NAP	2

4.5 Data source and collection method

According to Yin (2009), there are six possible resources that can be obtained when conducting case study research: documents, archival records, interviews, direct observations, participant-observation and physical artefacts (p.102). Table 4.2 shows the strengths and weaknesses of each type of data source. However, no single source from these resources is better than the other resources. Therefore, Yin (2009) suggests a combination of the six resources, such that each may complement another.

Table 4.2: Strengths and weaknesses of data source

Source of evidence	Strengths	Weaknesses
Documentation	• Stable – can be reviewed anytime • Unobtrusive – the result comes from a case study • Exact – contains a clear name, reference and event details	• Irretrievability – could be difficult to retrieve • Biased selectivity • Reporting bias – resonates with researcher bias • Access – may be intentionally blocked
Archival records	• Similar to above • Accurate and quantitative	• Similar to above • Limited access due to privacy issues
Interviews	• Targeted - focuses on case study topic • Insightful – offers perceived causal interpretation	• Bias due to poor or unclear questions • Response bias • Incomplete answers • Reflexivity – respondent answers only what they think interviewer wants to hear

Source of evidence	Strengths	Weaknesses
Direct observation	• Reality – covers events in real time • Contextual – covers the case situation	• Time-consuming • Selectivity – difficult to cover broad activities • Reflexivity – the presence of observer might change the event • Cost – more time needed by observers
Participant-observation	• Same as direct observation • Insightful into interpersonal behaviour	• Same as direct observation • Bias due to actions of observer
Physical artefacts	• Insightful into cultural features and technical operations	• Selectivity • Availability

Source: Yin (2009, p. 102)

In order to obtain evidence and information to achieve the research's objective, two methods of data collection were used: review of documentation and interviews with stakeholders involved in ASGM. Interviews and documentation generate primary and secondary data, respectively. The combination of both methods is expected to not only provide more in-depth data, but also to validate data/information through cross-verification between the methods (Yin, 2009).

4.5.1 Documentation

Basic case study information can be obtained as secondary data by analysing existing documentation and such analysis can be used for several purposes. Firstly, information in documents can give basic explanation and/or indicators regarding the condition of a policy or phenomena (Bowen, 2009). Secondly, information in documents can trigger further questions to be asked during the interview, which will enrich the interview questions

(Goldstein & Reiboldt, 2004). Thirdly, document analysis provides traceability of policy changes or evolution, by observing periodic reports, for example, government periodic reports (Yin, 2009). Fourthly, document analysis can be used to verify findings in the field, which can then be further investigated (Bowen, 2009).

Types of documents may include minutes of meetings, institutional letters, institutional or organisational reports, newspaper articles, websites and so forth (Yin, 2009). For the current research, documents were used to corroborate information gathered during the interviews. In addition, documents were able to provide the correct spelling of an organisation's name; an exact date of an event; and to provide numerical data, for example, data regarding the level of mercury in the environment in the vicinity of an ASGM operation. However, Yin (2009) provides warning on the usage of documents, since they may not always be accurate and sometimes they can create a bias, because a document only reports based on the perceptions of the author.

There are several types of documentation according to Yin (2009): letters, diaries, email communication, agendas, progress reports, news clippings from mass media, government websites and many others forms of information that can add to a data base. Several types of documents were utilised in this research.

1. Official government reports: Several government reports were used in this research. Firstly, reports regarding the implementation of the NAP, such as workshops or training notes from ministries. Secondly, reports regarding environmental and health tests by local governments and ministries and thirdly, reports from the provincial government. However, not all these reports are available as online published reports. Some are only in the form of hardcopy or they are unpublished.
2. Newspaper articles: Information regarding the implementation of the NAP and/or its barriers has also been written about in newspapers in the past. While information from newspapers can complement government reports, the limitations of this type of data should be noted. Several scholars mention the validity of newspapers as the main

weakness (Earl, Martin, McCarthy, & Soule, 2004; Franzosi, 1987). Information in a newspaper is selected and is influenced by the interests of the editor, thus creating a bias towards information generated by that newspaper. Consequently, information gathered from newspapers should always be followed by clarification from respondents.

3. Government websites: Several ministries have also put information regarding their activities on their websites. In addition, government websites also contain statistical information and information regarding their tasks and duties. Thus, important information useful for this research could potentially come from these websites.

4.5.2 Interview

Interviews are an essential source of information for research employing the case study method. Interviews provide an opportunity for the researcher that cannot be acquired by other methods (Cunningham, 1993). Interviews also provide insights into how participants view policy and its complex implementation (Seidman, 2013). Qualitative interviews vary, depending on the structure of the questions. They can be categorised as follows: unstructured (open-ended) interviews; semi-structured interviews; and structured or survey interviews (Gary, 2011). Unstructured question are similar to daily conversations, where questions are utilised in an interpretative case study (Gary, 2011). Participants are not presented with formal questions and thus they direct the interview and the researcher listens and carefully records the information. A structured interview is mainly where a researcher presents a list of questions (questionnaires) to the participants, and therefore a face to face meeting is less important (Gary, 2011). Semi-structured interviews are a mix of both methods above, where a researcher asks a list of questions and follows up with further questions on viewpoints that need more attention (Gary, 2011). Thus, this method offers flexibility and it is likely to obtain more detailed information from the participants (Rabionet, 2011).

The current research utilised semi-structured interviews due to the flexibility that this method offered to enable the researcher to gain more insight into the progress of the NAP.

This method also assisted the researcher to obtain an in-depth understanding of the barriers to the NAP, based on the perceptions of stakeholders. For this study, the questions put to the various respondents could be the same, depending on the relevant component of the NAP (i.e. specific action plans), since an action plan of the NAP can sometimes can be undertaken by several stakeholders (Kementerian Energi dan Sumber Daya Mineral, 2013). In addition, by putting the same question to various respondents, the different answers obtained can help to increase the reliability of the data (Voss, Tsikriktsis, & Frohlich, 2002). The list of questions for the interviews is presented in Appendix 5.

Research to generate data was carried out between February 13th, 2017 and March 30th, 2017. Twenty interviews were conducted with participants (Appendix 3). The interviews were done face to face with the researcher in the cities of Jakarta, Semarang and Purwokerto, in order to get close to the working locations of the institutions or respondents. Interviews for respondents in ministries, agencies and NGOs were done in Jakarta. Interviews for provincial government staff were done in Semarang and interviews for regency government staff, village heads and local cooperative members were done in Purwokerto.

Some respondents were interviewed several times by phone, face to face meeting and email, due to time limitations and to clarify the answers of other respondents. The interviews were carried out in the Indonesian language and sometimes in the Javanese language, since English is not the first language in Indonesia. The respondents were contacted by email or phone call to set up the interview date, time and location. As part of confirming the interview the researcher needed to obtain consent from the supervisor of the respondents, and the interview set-up process allowed the researcher to provide any advance information requested by the respondents. Before the interview started, an explanation was given about the research, approximately five to ten minutes to explain the research consent form (Appendix 4) that needed to be signed by all respondents. During the interview in Purwokerto, respondents from the cooperative also advised that they were the owner of a cyanide-gold processing centre that already proposed the gold processing licence to local government and working inside WPR. Thus, the legality status of the

respondent is not an issue. Therefore, during the interview with the cooperative members, several questions outside the NAP implementation were also asked, in order to enrich the knowledge of the researcher, for example, a question regarding gold processing and information about the gold processing plant.

During the interviews, participants were asked to describe activities that they had done in regards to implementation of the NAP, including activities undertaken in Banyumas regency by cooperative members and village heads. In addition, the respondents were also asked about barriers to implementation and their opinions regarding the implementation of the NAP, for example, whether it needed improvement and what improvement could be done, in order to improve the progress of the NAP and reduce barriers. The duration of the interviews was between 45 minutes and two hours. This research utilised a tape-recorder after first requesting consent from the respondents to record audio. The majority of the interview questions were developed from information on the NAP to eliminate mercury, but several questions were developed by the researcher, in order to obtain more clarity on this NAP information.

One of the limitations of an interview is the inaccuracy of the data (Yin, 2009). Not all respondents can remember exact dates, times and location, and therefore, cross-checking between documents and interviews is important. If there is a lack of clarity in the answers from respondents, information can be clarified through document analysis and vice versa.

4.6 Data analysis

Raw information from research without proper analysis will not provide good meaning. Dey (1993) asserts that data analysis is important, in order to interpret data obtained from the research. However, data analysis in a qualitative study is not the same as that in a quantitative study. According to Pope, Ziebland, and Mays (2000), qualitative research does not generally provide comprehensive numerical or statistical data, such as that generated by a quantitative study. Qualitative data analysis will give a simple count of research findings, in order to provide a summary relevant to aspects of the analysis.

Analysis in a qualitative study tends to be generated in a textual form and listed based on categories, according to new or existing theory (Pope et al., 2000).

Textual information can contain rich information and have different meanings. Therefore, the information should be filtered, in order to reduce the importance of data that is not useful and provide more focus to the dataset. To help the analysis of qualitative data, the current research utilised the four steps of qualitative data analysis adapted Creswell (2014)'s steps of qualitative data analysis (Figure 4.1).

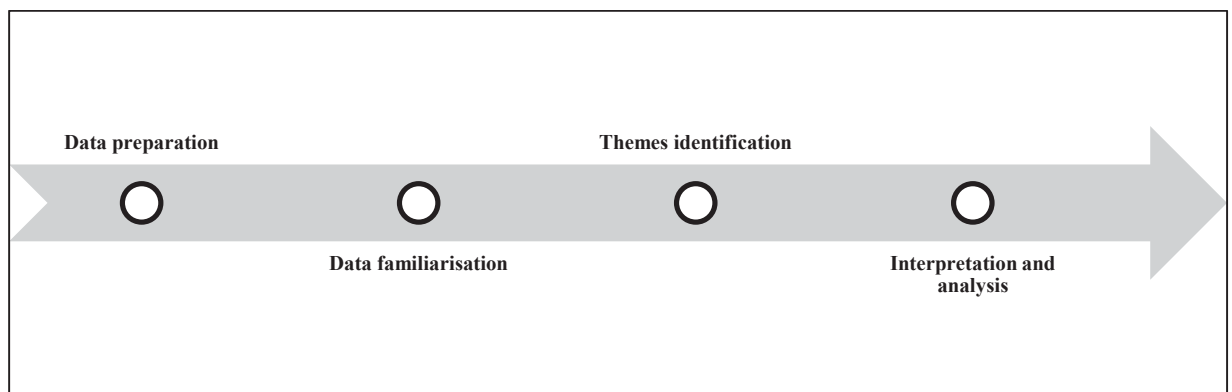


Figure 4.1: Steps of qualitative data analysis

Adapted from : Creswell (2014)

The first step is to organise the data from the research. According to Braun and Clarke (2006) this means that researchers should spend time engaging with the data. This activity includes transcribing the interviews and sorting the information gathered from the documents. Of the interviews in the current study with 20 respondents, 19 were recorded by audio-tape and one respondent refused to be recorded. All interviews were fully transcribed by the researcher (by analysing tapes or field notes). Despite only one respondent refusing to be recorded, several respondents asked not to be recorded when giving information that they assumed to be sensitive. Information from the unrecorded interviews was comprehensively written in the field notes.

The second step is to read all the data from documents and to transcribe the data. Through this process, Braun and Clarke (2006) assert that the researcher's familiarisation with the

width and depth of the content can be improved. This may mean that the researcher will gain an understanding about what the respondents are trying to say or inform, including what their intonation implies. This is a crucial step in assessing how useful the information gathered from the respondents is (Creswell, 2014). As the transcribed data was in the Indonesian and Javanese language, the researcher selected the most important information and translated it into English.

Theme identification is the third step of the data analysis procedure. In general, data from the research was coded into smaller groups. Coding, with respect to qualitative research, is a short word that symbolically captures the summary and essence of a text or visual information (Saldaña, 2016). Coding will lead to theme identification. A group of coding will form a theme that can be narrated into a story line, or it can establish a new framework for researchers who use a grounded theory approach (Creswell, 2014). However, data from this research was not targeted for coding, since the themes for this study (such as NAP indicators and barrier categorisation) were pre-determined in Chapter 3. Coding was however used to protect the confidentiality of the respondent.

The last step of data analysis is interpretation. This means that themes should be defined and interpreted. In this step of the data analysis procedure the researcher interprets the findings, based on his/her viewpoint. Creswell (2014) asserts that one of the ways to discuss research findings is by comparing these findings to studies in the past in order to identify whether they are in line, diverge or contrast with past work.

4.7 Ethics approval and consideration

Research involving human participants generally requires ethical approval. In order to determine the level of ethics approval needed, screening questions were used which was discussed between the researcher and the supervisor of this research. Subsequently, the research was reviewed by the Massey University Human Ethics Committee and was judged as a low risk research. The notification letter received on 17 January 2017 can be seen in Appendix 6. Maintaining the confidentiality of respondents was an important consideration

of the research, as people in Indonesia, especially government staff, are known to be careful about criticising the government (Kristiansen & Santoso, 2006). Thus, the assurance of confidentiality was needed to enable the respondents to freely provide information, especially information that is seen as sensitive or critical. Bell and Bryman (2007) stress the importance of anonymity and the elimination of any type of information that might lead to recognition of the respondents. Therefore, certain ethical considerations include obtaining consent from the participants; ensuring the participants are not harmed; and ensuring discretion, privacy and anonymity for the participants were adopted by the current research.

To ensure that interviews and discussions with participants were conducted with the free will of the respondents, they were asked to sign a consent form prior to being interviewed - if they agreed to be interviewed. Consent for using a tape recorder was also asked of the respondents in this consent form. During the interviews, all participants agreed that their identity be kept anonymous and only identified by codes retrieved from the summary of their institution's name (Appendix 3). In addition, the participants were informed that the information gathered from the interview would only be used for the purpose of this study and stored safely until the research was finished and then it would be deleted.

4.8 Validity, reliability and generalisability

Validity and reliability are fundamental factors in any research, since these factors decide between good and poor research. Generalisability in qualitative study is still a debate among scholars and means that the findings or recommendations can be generalised to other studies or samples (Ryan & Bernard, 2000). Validity means the accuracy of the findings resulting from a research (LeCompte & Goetz, 1982), where the researcher verifies the information in accordance with the depiction of reality and applicability across a group (Brink, 1993). Reliability is the consistency and accuracy of the method to be used in other research, which will generate the same result (LeCompte & Goetz, 1982). In other words, reliability is the degree to which the findings can be replicated in other research (Ali & Yusof, 2011).

There are eight approaches to checking the validity and reliability of research, as suggested by Creswell (2014). (1) Triangulation means examining different information sources to improve the validity of the information. (2) Member checking means referring back to the themes or information obtained from an earlier interview with the respondent, in order to check the accuracy of the information. (3) By providing a detailed depiction (called a thick description), the reader is guided to understand the themes or stories behind the information. (4) An explanation regarding the positionality of the researcher can be provided, in order to reduce bias. (5) Information that does not coalesce with the major findings or information can be put forward. (6) More time can be spent during the field work. (7) In order to determine the consistency of the answer, another person can conduct the same interview with the same respondent. (8) An external auditor can be used to review the final report or project, once it has been completed.

Creswell (2014) asserts that using several approaches will enhance the validity of the research and the researcher's ability to judge the accuracy of the recorded information. The current research utilises triangulation and thick description to describe information gathered from the respondents. Triangulation is utilised to check the consistency of the information between one interview and another and to cross-check between interviews and documentation, such as government reports, government websites and newspaper articles. Since the implementation of the NAP is undertaken collaboratively by stakeholders, any discrepancy of the information gathered between interviews and documentation would be the basis of further questions put to the participants at a later date. Detailed descriptions were used to provide additional information regarding the content of the information obtained from the interviews and documents and to also explain the themes used to categorise the data.

In order to determine the reliability of the approach used in this research, Yin (2009) suggests documenting the procedures used in conducting case study research, so that these can be followed by other researchers. In addition, Miles, Huberman, and Saldaña (2014) suggest explaining the researcher's role, in order to increase the reliability of the research. For the current work, the steps used to conduct the research are well documented in this

chapter. Furthermore, the framework used in the research was explained in Chapter 3, and this framework can be used for other studies, especially those focussing on the implementation of the NAP to eliminate mercury in other areas in Indonesia.

Generalisability in qualitative research is still debated among scholars. Many assert that qualitative study lacks generalisability, due to small sample sizes and differences in time and location, and the role of researchers who conduct a study (Creswell, 2014; Silva & Fraga, 2012; Stake, 1978). Despite this assertion, Yin (2009) believes that the results from a qualitative study can still be generalised to a broader context, while Patton (2002) offers a way out of generalisation through extrapolating the findings. Extrapolation means that the findings could possibly be applicable, or found in similar conditions, in another case study under careful examination. Similar to the ideas of Yin and Patton, several findings from this research could be generalised in a broader context under careful investigation, for example, in regards to regulations and resources. However, it is difficult to generalise several findings in this study that are associated with specific factors, such as geographical conditions, location, and socio-economic differences.

4.9 Researcher's positionality

Unlike quantitative research that uses instruments to conduct the research, the main instrument for qualitative research is the researcher (Patton, 2002). Positionality refers to the role and status of the researcher, in relation to the participants of the study, that can shape the research (Bettez, 2015). Since a researcher is the equipment, then the researcher's knowledge, gender and position might influence the objectivity of the research (Creswell, 2014). Creswell (2014) and Patton (2002) suggest there is a need to clearly define any type of information, from the researcher's viewpoint, that might create bias and thus influence the data collection, analysis and interpretation.

Initially, the researcher's interest to conduct this research began in 2013, when he was asked to join a meeting to revise the draft of the NAP for mercury reduction in ASGM. At that time, when the researcher was delving into the information on mercury, he felt that

mercury is an environmental and health threat to the next generation, especially in areas in the vicinity of ASGM. This interest towards mercury in ASGM led the researcher to gain a scholarship from New Zealand Aid (NZAID), to study a Master in Environmental Management at Massey University and to conduct research into the implementation of the NAP to eliminate mercury (with funding from NZAID).

The most important factor that might benefit the researcher in conducting this research is the researcher's professional background. He has been working in the MoEMR for six years as a mine inspector. Despite the researcher's work not being connected fully to ASGM in the past, the researcher has connections with several ministries and local governments related to his work as a mine inspector. This relationship has supported the researcher in arranging meetings with ministries and agencies, and also in obtaining unpublished government reports. In addition, with the help of several respondents from the MoEMR and local governments, the researcher obtained email addresses and phone numbers of other respondents of which the researcher was not aware. Several ministries and local governments responded positively, in regards to contributing to the research and showed a great interest to participate. Several respondents were also willing to be asked questions again after the first interviews were done, in order for the researcher to clarify some information. Nevertheless, not all ministries responded positively to the invitation to contribute to this study, for example, a potential respondent from a ministry did not respond at all to the invitation, despite the researcher sending a text message and calling the person on the phone.

Moreover, since the researcher was born in a Javanese environment, he benefited through his understanding of the local language in Banyumas regency and Central Java province, which is the Javanese language. Some interviews with local governments, local cooperatives and a local village head were conducted in the Indonesian and/or Javanese language. By using the local language, the researcher believes that he has given another interpretation towards the implementation of the NAP, through discussions using the local language, which appears to have been very comforting to the respondents. However, difficulties with interviewing ministries have been the limitation of time and the 'busyness'

of those respondents. Several interviews were rescheduled, when the respondents were suddenly assigned by their supervisor to attend meetings, or to conduct supervision outside the office. There was one occasion when the interview could not be completed, since the respondent was suddenly ordered to do another task, such as providing a report or making a presentation to the minister.

Separating professional work in the past from the current status of the researcher is another challenge in this study. There were several occasions where the respondents gave unclear answers, knowing the status of the researcher as a government staff member in the past. For example, a respondent states: “You must have known what it is like, the situation inside the government, since you have been there for a long time”. Some respondents already knew the researcher from past relationships and they provided many positive comments about the NAP implementation and only made a few negative comments about the implementation. Therefore, in order to reduce bias, the researcher always emphasised his role as a researcher and student at Massey University and emphasised that he was not a government staff member when interviewing the respondents. Moreover, the researcher also created strategies for asking questions, for example, by asking questions in different forms of the language, which might then result in clearer answers.

4.10 Limitations

There are some limitations of this research. A key limitation is the lack of time for research¹¹, which meant that several stakeholders, including academics and ministries could not be interviewed. In addition, only a small number of respondents interviewed in this research worked in local government institutions. Furthermore, institutions with connectivity to the availability of the budget or funds could not be interviewed, since building a contact with them would need more time, due to the processes of bureaucracy. Several respondents needed to get consent from their supervisor, if they wanted to offer any type of information. In addition, time constraints also resulted in the case study being

¹¹ Time management guidelines for the Masters of Environmental Management 90 credit thesis were followed; the research conducted for this thesis was appropriate based on Massey University guidelines.

conducted in only one location. It would have been better if more locations could have been added to the case study and thus, the results could be compared and contrasted, in order to add to the generalisability of the results and recommendations.

Interviews for the current research were limited to stakeholders of the NAP and this was another limitation of the study. Responses from miners regarding the implementation of the NAP could not be obtained, since most miners in Banyumas regency do not have legal permits. Thus, interviewing them would have required further ethical considerations and another review from Massey University's Human Ethics Committee. The location of the respondents also contributed to this limitation. Several NGOs relevant to the NAP are located outside of the island where this research was conducted. More time would have been needed to reach these locations.

With the limitations as stated above, the results from this research cannot be generalised fully to other areas with similar problems. Further research to address the limitations described here is required, in order to gain a better understanding of the implementation of the NAP and its barriers, so that the implementation can be seen from both sides; the implementer (government institutions) and the target group (the miners). Nevertheless, this study offers a new and meaningful insight into the implementation of the NAP, including barrier identification, since no other studies have previously investigated the implementation of the NAP in Indonesia.

4.11 Case study of Banyumas Regency

4.11.1 Geographical information

Banyumas district is located in the southwest of Central Java province, Indonesia (Figure 4.2), with a total area of 1,327.60 square kilometres and a total population of 1.6 million people (Pemerintah Kabupaten Banyumas, 2015). Banyumas regency is divided into 27 districts that covers 301 villages and is situated between the mountainous area and the valleys around the Serayu river (Setda Provinsi Jawa Tengah, 2014). According to data from Indonesian Central Bureau of Statistics (BPS), processing industries (such as the cement industry) is the main contributor to the economy of the district, followed by trading,

farming, construction and mining, respectively. The percentage of income generated from the various sectors during 2013 to 2015 in Banyumas regency can be seen in Table 4.3

Table 4.3: Income distribution per sector in Banyumas regency, 2013-2015

Sector	2013 (%)	2014 (%)	2015 (%)
Farm, forestry and fisheries	14.88	14.29	14.29
Mining	5.21	5.42	5.92
Processing industry	22.16	23.38	23.85
Construction	12.15	12.11	12.05
Trading	17.22	16.42	15.88
Other sectors	28.38	28.38	28.01
Total	100	100	100

Source: BPS Kabupaten Banyumas (2017)

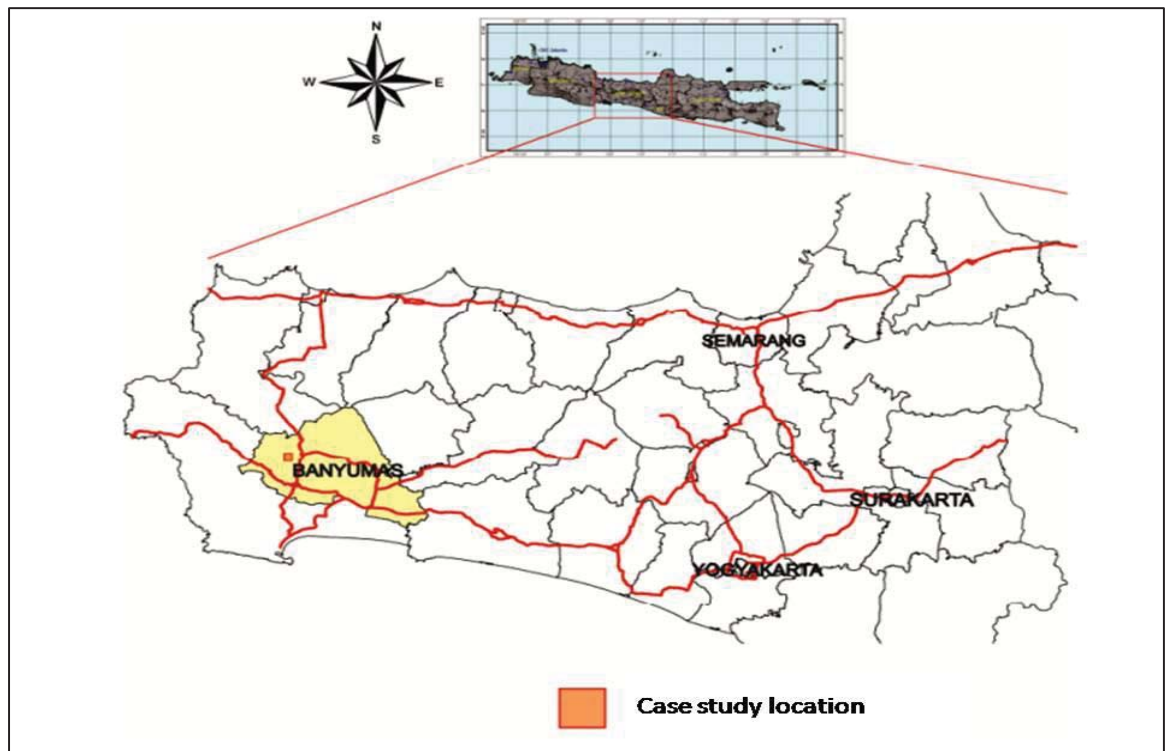


Figure 4.2: Map of Banyumas regency

Source: Fahmi et al. (2014)

4.11.2 Mining areas

There are several ASGM mining sites in Banyumas regency. Fahmi et al. (2014) identified ASGM activity in Cihonje and Paningkaban villages. Mining activity follows gold veins from the west to the east side of the villages (Fahmi et al., 2014). Based on geological studies described by Idrus et al. (2015), the primary gold deposit is hosted in a low sulphidation epithermal ore body, with base metal sub-types of sulphide associates and carbonate (calcite and ankerite). Due to the abundant gold deposits found in and around the mining villages, ASGM miners are attracted to mine gold found in the river bed of the Tajum river and in several locations around Cihonje village (Fahmi et al., 2014).

4.11.3 Mining activities

There are several estimations of the number of the miners working in the Banyumas mining villages. Idrus et al. (2015) estimate the number at approximately 500, while Sari et al. (2016a) estimate the number of miners in just Cihonje village to be approximately 72. Research from Aziz (2014) identifies that most miners are local people who work in a group and they do not have a legal licence to mine. The miners exploit underground mining methods by making tunnels (adit) and holes (shaft) in areas of mineralisation, as well as conducting traditional panning in the river (Aziz, 2014). The mining activities run 24 hours a day in Cihonje, with work divided into three shifts. Each shift produces in the order of 5.54 grams of gold with the estimated total gold production per day in Cihonje village being around 1 kg (Sari et al., 2016a). In order to open a new 'gold hole' in the mining area, a new miner will need a social licence to mine, which is issued by the local leader or elder in the village (Aziz, 2014) and generally the mining workers are coordinated through a local cooperative.

Amalgamation is the primary processing technique used by miners to extract gold. Gold amalgamation is done in the vicinity of the mining sites, or in the yards of surrounding houses (Aziz, 2014). Gold ore processing is usually done by putting the ore inside a trommel and then mixing it with mercury. The product of several hours of grinding panned

to remove amalgam and then inserted back into the trommel several times (Aziz, 2014). Tailings contaminated with mercury are dumped into the river, which pollutes water and sediment in the vicinity of the mining areas. The mercury level in the river water near the mining activities averages 1.003 mg/L (Fahmi et al., 2014), which is higher than the threshold standard (0.005 mg/L). The tailings also contains a substantial amount of residual gold, with the concentration of precious metal in the waste between 31 and 129 mg/kg (Aziz, 2014).

4.12 Summary

Research design is an important phase of a research project. Without a proper plan or design regarding the procedure to conduct research, the research will not generate useful findings. This current research utilised a qualitative study as the research method, in order to obtain detailed information regarding the implementation and barriers associated with the Indonesian NAP. This research utilised a single case study approach to scrutinise the implementation of the NAP. Banyumas regency was identified as the case study, since most of the miners in that area continue to use mercury and there is evidence of an increasing rate of mercury pollution. The researcher's familiarity with the conditions of the area was another consideration when identifying Banyumas regency as the research study area.

The selection of participants for the research used two approaches. Purposive sampling was used to select participants who are involved in the implementation of the NAP and who were willing to be interviewed, while snowball sampling was used to obtain information from respondents that are not listed in the NAP but who are involved in implementation. These participants came from central government institutions, local government agencies, NGOs, village heads and local cooperatives. In total, 20 respondents were interviewed.

The study utilised interviews and documentation as the sources of data. Interviews were undertaken using a semi-structured interview method that offered flexibility in the information that could be gathered from the respondents. Documentation, such as government reports, newspaper articles and government websites were used to obtain

secondary data. Data was analysed using established procedures, such as data preparation, data familiarisation, and theme identification. Data obtained from the interviews was transcribed and re-read, in order to reduce bias or misinterpretation.

The research was notified by the Human Ethics Committees of Massey University as a low risk research. However, the confidentiality of the respondents was still considered for this research. All respondents agreed for their identity not to be shown and their names were coded based on their institution's abbreviation. Several interviews were not recorded, as requested by those respondents.

To ensure the validity of the current research, information from one respondent was compared to other respondents or compared with information from documentation. This is important, in order to check the consistency of the answers. To ensure reliability of the research, the positioning of the researcher is disclosed. The researcher is an Indonesian, coming from a Javanese environment with a professional background as a government officer. By explaining the positionality of the researcher, bias towards the data collection and presentation can hopefully be reduced, which then increases the reliability of the research.

The results of the findings and the recommendations for this research cannot fully be generalised to other studies or areas in Indonesia, due to several limitations, such as lack of time, and location. Further study is needed, in order to gather more data and complete answers not only from the implementers of the programme, but also from the miners. However, despite the limitations, this study offers an initial understanding of the progress of the NAP to eliminate mercury in Indonesia and the barriers that currently hinder the implementation of the NAP.

Chapter 5

Findings

5.1 Introduction

This chapter focuses on the action plan that has been implemented by the stakeholders in 2014 until 2016 to eliminate mercury in ASGM. In particular, this research examines the action plan undertaken by stakeholders in Banyumas regency. This chapter also identifies the perceptions of stakeholders towards barriers to the implementation of the NAP, in order to eliminate mercury in ASGM, which will be categorised by using a four barrier category, as explained in Chapter 3. The data obtained from the interviews and document analysis attempts to answer the questions: What progress has been made during the implementation of the NAP from 2014 until 2016? And what barriers occur during the implementation of the NAP and how those barriers influence the implementation of NAP?

5.2 Progress to date of NAP to eliminate mercury

Since the Indonesian Government enacted the NAP in 2013, several ministries have made progress in implementing the NAP Programmes. The monitoring and evaluation of the NAP is achieved through NAP indicators. However, monitoring the progress of the NAP is complicated, since the NAP only provides general indicators, without mentioning the target in detail and the percentage of achievement, if the stakeholders have already fulfilled their programmes. In addition, no report has been made to measure the overall progress of NAP. Therefore, any progress of the NAP will only be found through interviews and review of documents provided by stakeholders and by reviewing news on stakeholder official websites, or newspapers. In this study, review of progress findings are categorised based on the indicators of the key components delivered in Table 2.5.

5.3 First component: Legal framework and institutional strengthening

5.3.1. Regulations to support mercury elimination and prohibit mercury in ASGM

Policy and regulations are the supporting tools for the government to act on and reduce environmental problems, in this case mercury. Therefore, several policies and regulations have been identified by the government, not only to eliminate mercury by banning the use of it, but also to support the elimination of mercury, for example, by cutting the supply trade of mercury or providing long term plans for improving the health of miners and people surrounding the ASGM activities.

According to a respondent from the MoEMR, several policies have been established to support the elimination of mercury:

“Ministry of Health is working on its National Action Plan, [while] Ministry of trade has reviewed [and] enacted the Ministry Decree regarding the trade of toxic materials in 2014. It [the Ministry Decree] manages the trade of mercury for mining activity” (interview, MEM01).

The Trade Ministry Decree Number 75, year 2014, regarding the trade of toxic materials such as mercury, prohibits the importation and distribution of mercury to the gold processing industry, as stated in article 17. Moreover, this regulation has been disseminated to ministries, local government agencies and industries in several places, such as Jakarta and Manado (Amisan, 2015; Kementerian Perdagangan, 2014).

Another policy to support the elimination of mercury in ASGM comes from the health sector. Recently, the Ministry of Health enacted the national action plan (NAP) for the control of health impacts due to mercury exposure 2016 to 2020 (interview, OH1). One of the purposes of this control is to provide standard methodology to measure the exposure and effect of mercury in the miners and their communities. The dissemination of the national action plan, in regards to the control of health impacts due to mercury exposure, 2016 to 2020 (NAP of Health), involve several ministries with the help of the MoEF

(Kementerian Lingkungan Hidup dan Kehutanan, 2016). However, the NAP for the Ministry of Health does not focus solely on the ASGM sector. A respondent from the Ministry of Health states: “There are two major concerns in this action plan [NAP of health]. Firstly, [health impact due to] mercury used in ASGM. Secondly, [health impact due to] mercury that is widely used in the health facility” (interview, OH1). Therefore, the focus of the Ministry of Health is divided into those two sectors.

Other ministries also drafted some regulations with a focus on banning the use of mercury. The MoEMR drafted a revision of one ministerial decree and one presidential instruction, while the MoEF drafted the revision of Government Regulations Number 74, year 2001, regarding Hazardous and Toxic Substances Management.

“For MoEMR, we have reviewed Ministerial Decree number 1211 year 1995 [regarding the Prevention and Control of Environmental Destruction and Pollution in General Mining Activities], there will be one article about the restriction of mercury use in gold processing, but until now it is still on progress. [and] For President Instruction [for mercury prohibition], we have prepared the draft, however those [regulations] have not been enacted” (Interview, MEM01).

“[Currently] we are revising the Government Regulation number 74 [year 2001] regarding Hazardous and Toxic Substances Management. Mercury is included in the [industrial] limited list. Hopefully, this year [2017] will be enacted since it already became a national priority. [And] the restriction is only for mercury [used] in the mining sector. For other sectors, mercury can still be used only [in] limited [number]” (interview, OH01).

In order to control mercury usage in ASGM, formalisation of the miners also becomes an important issue. Formalisation of ASGM is managed by Law number 4, year 2009, where people’s mining licences are issued by the government of the regency, or in this case the Banyumas regency. However, with the implementation of the new Law number 23, year

2014, regarding regional government, the authority to issue the people's mining licences for ASGM is moved to the provincial government and not the regency government anymore (Yusyanti, 2016). Until now, there have been no regulations from provincial governments regarding the formalisation of ASGM. When the respondents from the provincial government were asked about regulations or policies to manage the ASGM, the three respondents (PR01, PR02 and PR03) just simply answered that there were none.

“We have not prepared [the regulation] because the delegation [of authority] is just received at the end of 2014. While some of the regencies have submitted to us the [people's mining] document, other regencies have not submitted it [the people's mining document]” (interview, PR03).

Moreover, there are several factors that slow the progress of formalisation. Firstly, according to Law number 4, year 2009, people's mining permits can only be issued to mining inside a designated area called the people's mining area. Paningkaban and Cihonje villages, where most of ASGM is located, are not included in the Banyumas people's mining area (WPR year 2014). Therefore, the local government has submitted a proposal to add those villages into the Banyumas WPR in 2016, which needs approval from central government (interview, PR01; interview, PR03). However, until now, the central government has not approved the WPR.

Secondly, most of ASGM activities in Banyumas and other places do not comply with ASGM criteria based on Law number 4, year 2009¹². For example, the mining location is far away from the river or river bank and the depth of the mining hole is more than 25 metres (interview, PR01; interview MEM04). Thus, many local governments, such as the Central Java province and Banyumas Regency governments are afraid that they might break the law, if they issue people's mining licences to small scale miners (interview, GA02; interview, PR01).

¹² See chapter 2 regarding the criteria of ASGM based on the Law number 4, year 2009

5.3.2. Information on mercury trade and illegal mercury distribution

Mercury is used not only in the mining sector, but also in several industries including the production of lamps/lights. In addition, the health sector also uses mercury in their products. The national demand for mercury in 2014 was approximately 500-600 kg per year, which is used for lamps/lights, health and battery industries (Interview, CM01; Interview, MEF01; Kementerian Koordinator Bidang Maritim, 2017). Moreover, since the Trade Ministry Decree Number 75, year 2014, regarding the trade of toxic materials enacted in October 2014, the Indonesian government has prohibited the importation of mercury for mining sectors, including ASGM. Respondents from two ministries claim that, in 2016, no mercury has been imported from other countries (interview, CM01; interview, MEF01). Data from the Indonesian Central Bureau of Statistics (BPS), as seen in Figure 5.1 below, supports the claims from both respondents. However, illegal mercury is still freely traded and distributed to ASGM: “So if we [want to] buy mercury from bukalapak¹³, just [one] click, [it will show the price] four hundred thousand rupiah, two hundred thousand rupiah, [then] pick, all [available] in bukalapak” (interview, CM01). It is estimated that a group in one location uses approximately 100 kg/day of mercury in their production (Kementerian Koordinator Bidang Maritim, 2017).

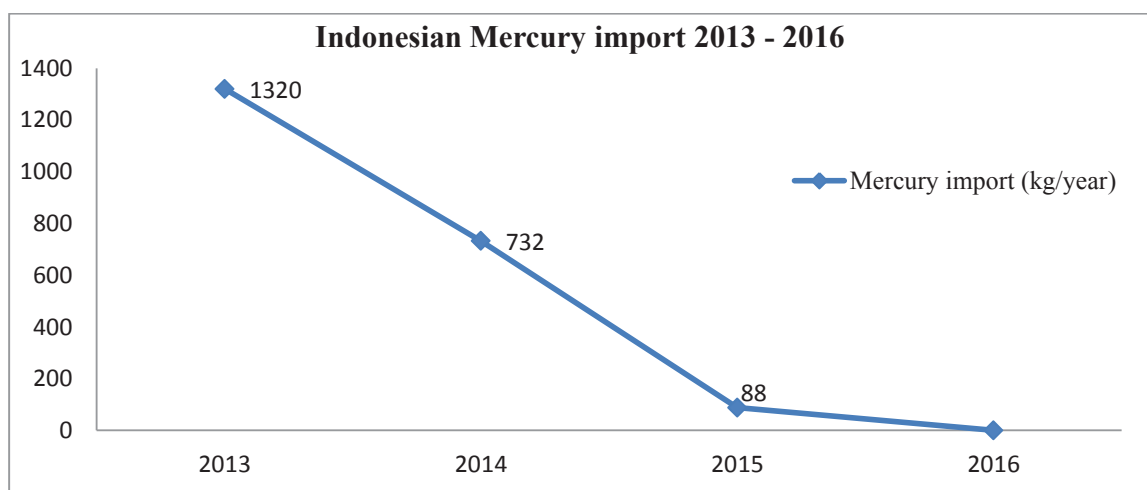


Figure 5.1: Indonesian mercury imports 2013 – 2016

Source: Badan Pusat Statistik (2014, 2016, 2017)

¹³ Bukalapak is one of the Indonesian online shops. For further information, see www.bukalapak.com

Mercury can be obtained from cinnabar by roasting the ore. The vapour that results from the ore roasting is condensed, in order to obtain the elemental mercury (Bell, DiGangi, & Weinberg, 2014). Several respondents indicate that most of the mercury distributed to ASGM miners comes from local cinnabar mines (interview, CM1; interview, MEF01; interview, MEM01; interview, MEM04). Furthermore, all cinnabar mining in Indonesia is illegal, since the MoEMR never releases mining business permits for cinnabar mining (Agrawal, 2015; Interview, MEM01; Interview, MEM04). A source from the MoEF provides a rough calculation of mercury produced from illegal cinnabar mining:

“[...] Because we just investigated [illegal cinnabar mining] in Seram Island [...] Usually per day they [produce] 30 tons [of cinnabar ore] and the ores are sent to Java island. If those [cinnabar ores] are processed, around 1.5 tons [of cinnabar ore] will become 600 kg [of mercury]” (interview, MEF1).

When calculated from the estimation above, 30 tons of cinnabar will become 12 tons of mercury. In addition, the respondents did not offer any further information, regarding the reserves of cinnabar ore in Indonesia, since no cinnabar or mercury reserve report has been published. The findings above show that, despite a prohibition on the importation of mercury and the need for mercury nationally being only approximately 500 – 600 kg in 2014, mercury distribution only in ASGM is indicated to be almost the same as the national need (600 kg). Interviews with several respondents indicate that the supply of mercury to ASGM comes from cinnabar mining. Moreover, cinnabar mining in Indonesia is considered illegal mining, since no mining permits have been released for cinnabar mining.

In order to cut the distribution of mercury from illegal cinnabar mining, the Indonesian government stated that it would close all cinnabar mines. Furthermore, the Indonesian president instructed a team, comprised of ministries and agencies, such as the MoEMR, MoEF, Indonesian police, Indonesian army, Attorney General of Indonesia and local governments, to close cinnabar mines (Dapunta, 2017). This team started to investigate illegal cinnabar mining in April 2017 (Kementerian Energi dan Sumber Daya Mineral,

2017). They have targeted several cinnabar mining sites and the first location is Cinnabar Mining in West Seram regency (the map can be seen in chapter 2).

5.3.3. Establishment of stakeholder's forum at national and local levels

Prior to the establishment of the NAP, there were no forums or formal meetings to solve the mercury problem in ASGM. Since the enactment of the NAP, stakeholders at national level established a national ASGM forum in 2014, which met approximately three times a year from 2014 to 2016, as explained by a respondent from the MoEMR:

“The [national] forum is established in 2014 [...] there is a member from each [relevant] ministry. The meeting is held every year, in average 3 times. This forum is not only [held] by MoEMR. MoEF also held this forum since MoEF is the national focal point¹⁴. [...] The first meeting [in 2014] is about the NAP socialisation. [then] The next meeting, [...] is discussing where should we go [next] to conduct a socialisation, [then] what is the task [for every ministry, agency and NGO]? And then in 2015 we had a meeting, for example to follow up [...] the activity that has been done and what kind of evaluation [of an activity] that needs to be done” (Interview, MEM01).

At the regional level in Banyumas, no regional forum has been created. When staff members (PR02 and PR03) from the province were asked about the forum, both at provincial level and regency level, they answered that no forums related to ASGM or mercury had been established: “[The forum] has not established yet, to be honest, we have not touched people's mining and the forum” (interview, PR03). Moreover, coordination at local level especially in the Banyumas regency is faltering, due to the implementation of Law number 23, year 2014 (further explanation regarding the law can be seen in chapter 2). Prior to this law being enacted, several agencies from environment, health and mining used

¹⁴ MoEF is the national focal point of mercury elimination toward in all sectors, since the Minister of Environment and Forestry has been appointed as the signatory of Minamata Convention on Mercury

to coordinate several times a year to examine the progress of mercury usage in ASGM. One respondent informs:

“Now the Energy and Mineral Resources Agency of Banyumas Regency has gone. It [The authority] is moved to [Central Java] Province, so my partner in here is only the Environmental Agency [of Banyumas regency]. In the past, when the [Energy and Mineral Resources] Agency of Banyumas Regency still existed, [...] I still cooperated [easily] with the Energy and Mineral Resources Agency. But now, it is hard to coordinate with them [Energy and Mineral Resources Agency of Central Java Province]” (Interview, HA01).

5.3.4. Implementation of competency improvement programme for government staff

Not all government staff understands the importance of replacing mercury and using alternative technology that fits with their location. Therefore, in order to improve the knowledge of local government staff, several ministries and agencies conducted workshops and technical guidance in several locations. Workshops activities usually involve both the miners and government staff, especially government regency staff, while technical guidance usually involves solely government staff from the province and regency, which is similar to training. The activities were undertaken several times in different locations, as seen in Table 5.1 below.

Table 5.1: Government staff improvement programmes 2014 - 2016

Year	Activities	Location (regency)	Source of Information
2014	Workshop	Banyumas and Lebak	• Interview: BI01, HA01, MEM01, PR01
2015	• Workshop	• West Sumbawa, Pacitan, Wonogiri	• Interview: MEM01 • Document: Direktorat Teknik dan Lingkungan Mineral dan Batubara (2015a, 2015b)

Year	Activities	Location (regency)	Source of Information
2016	Technical guidance	Batam	Document: Direktorat Pengelolaan Bahan Berbahaya dan Beracun (2016)
	Workshop	Lebak	- Interview: BP01, MEM01 - Document: Direktorat Teknik dan Lingkungan Mineral dan Batubara (2016)

In Banyumas, there was only one government competency programme, which was held on 15/16 August 2014. Several ministries and agencies involved in the programme are the MoEMR, MoEF, MoH, MCSME, Ministry of Social, BPPT and the head of the energy and Mineral Resource Agency of Banyumas Regency. Total participant was approximately 50 – 60 participants, comprising a combination of miners and government staff from Banyumas regency (interview, MEM01). There are several reasons why, in 2015 and 2016, no ministries or agencies conducted socialisation or training in Banyumas regency. Several respondents (MEM01, OH1, PR03) mentioned a lack of budget availability as the main cause that results in programmes not working according to plan. One respondent states: “In 2016, [we] should have done this [training], however, it [the training] was not inserted into the [ministry’s] national budget [in 2016]” (interview, OH1).

It is difficult to gather information regarding the implementation of the competency programme for government staff. When the researcher asked the training report for the government staffs, no reports regarding the training workshop in 2014 were found during the field research. Moreover, the results from this research show no continuity in training for government staff, which prevents top-down dissemination of information from central government to local governments.

5.3.5. Evaluation of NAP activities and voluntary activities

Evaluation of NAP activities is an activity to evaluate the action plan done in the past, while evaluation of voluntary activities is an activity to evaluate programmes or activities relating to a key component that are done by other institutions or NGOs. The programme could be different from NAP but still connected to the mercury elimination. The example of the initiative is like one of the program from Global Environment Facility that will start in the middle of 2017 by an international donor or the introduction of technology like sluice box in the past (interview, MEM01; interview, MEM04). However, it is unclear how the ministries assess the NAP activities and voluntary activities. This unclear situation occurs due to no standard criteria being available to evaluate the NAP activities and voluntary activities, as stated by one of the respondents:

“The evaluations [of NAP activities and voluntary activities] were done only by evaluating whether every activity [of the key components and from voluntary activities] has been done or not. [However] we do not have the checklist forms or evaluation forms [...] as we only evaluate whether the activities have been done? If there is no progress, then it will be reminded in the NAP forum” (interview, MEM01).

5.4 Second component: Research and development

5.4.1. Database on mercury usage

Data is an important tool used to support the implementation of the NAP. Each ASGM location will consume different amounts of mercury. Therefore, to simplify the reporting of mercury usage in ASGM, in 2014 the MoEMR put in place a database information system in the form of a website (interview, MEM01), as seen in Figure 5.2. Government staff at provincial level is responsible for investigating and inserting mercury usage data into this website (Direktorat Teknik dan Lingkungan Mineral dan Batubara, 2015a; Interview, MEM01; Interview, MEM04).

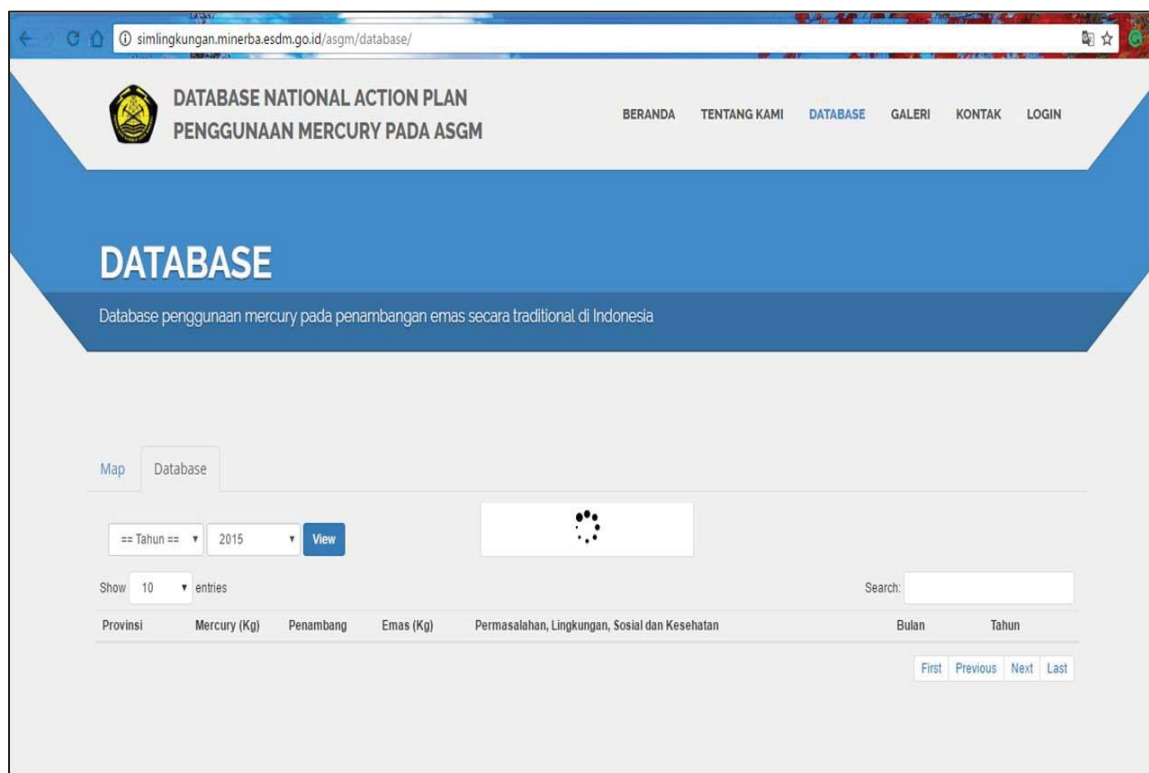


Figure 5.2: Mercury database system information.

Source: Direktorat Jenderal Mineral dan Batubara (n.d.)

The MoEMR gave a username and password to provincial government staff in 2015, in order for them to add data to the website (Direktorat Teknik dan Lingkungan Mineral dan Batubara, 2015a). However, until now, the database is still empty, as seen in Figure 5.2. A respondent raised a concern about the blank data in the website above:

“We have online reporting system, but it is not working. It is because local government staff is the one that should fill it. However, when the province staffs were asked to fill it [the database], they do not fill it. If they [the province staff] fill the mercury usage in [this location] here, [and] the number of miners, [then] we can set a prioritization for the locations to act” (interview, MEM04).

When this problem was put to one of the government’s provincial staff, he replied: “No monitoring programs were done from 2014 to 2016, because we do not have the budget.

Beside, from the government side, it cannot be done since this [people's mining] is illegal" (interview, PR01).

While the government cannot obtain data on mercury usage in ASGM, several NGOs have been able to conduct surveys with ASGM miners. For example, one NGO, Yayasan Tambuhak Sinta, has released data of mercury usage in Banyumas regency in one of their reports, as seen in Table 5.2 below:

Table 5.2: Mercury usage data in ASGM in Banyumas regency

Information	Number(s)
Average gold production per tromol/day	1 gram of gold
Estimation of the numbers of tromols	2,000 tromols
Mercury inputs per tromol/day	200 grams of mercury
Mercury loss per tromol/day	10 grams (at minimum 5% rate of loss)
Estimation of mercury annual emissions	2000 tromols x 10g x 300 days = 6,000 kg

Source: Agrawal (2015, p. 15)

In Yayasan Tambuhak Sinta's report, they also compile mercury usage in several locations. For example, in Mangkahui village, Central Kalimantan province, with an average daily consumption of mercury approximately 2 kg per day. While in Karang Jawa town, South Kalimantan province with an average 400 grams of mercury per day and Kebon Sari village, East Java province with an average 100 grams of mercury per day (Agrawal, 2015). Nevertheless, this data is not found in the government's mercury database website, since only provincial government staff can add mercury data to the website.

5.4.2. Study on alternative technology

There have been several researches regarding alternative technology undertaken by the BPPT. However, this technology, in the case of miners, may be different from one mine site to another.

“According to the NAP, BPPT is assigned to [identify] the alternative technology [...] However, in the technology development, mineral processing should be ore characteristic-based. [For example] The characteristic of ore A is suitable for technology A and the characteristic of ore B is suitable with technology B” (interview, BP01).

Therefore, prior to BPPT conducting their study on alternative technology, they undertook geological surveys and metallurgical testing, in order to identify suitable technology to replace mercury. In 2014 and 2015, the BPPT and MoEF took ore samples from five regencies: Ketapang, Pacitan, Lebak, Banyumas and West Sumbawa (Direktorat Pengelolaan Bahan Berbahaya dan Beracun, 2016; Interview, BP01; Interview, MEF01). From this metallurgical testing, BPPT offers different technology concepts that could be used in ASGM in Indonesia, as seen in Table 5.3 below. The BPPT identifies that the ore characteristics from ASGM locations in Banyumas regency mostly consist of oxide minerals and low sulphide in several places, which is similar to the ore identification mentioned in Chapter 4. Thus, the BPPT suggests the technology suitable for ASGM in Banyumas regency is cyanidation or cyanide leaching (interview, BP01).

Table 5.3: BPPT's concept of gold processing technology for ASGM

Ore Type	Technology
Alluvial ore	Gravity concentration: panning, sluice box, shaking table, Knelson concentration, etc.
Primary deposit – oxide	Cyanide leaching
Primary deposit – sulphide	Flotation → roasting → thiosulfate leaching

Source: BP01

Not every stakeholder agrees on cyanide use. Some of them have also tried to find other technologies that do not use cyanide or mercury. For example, Yayasan Tambuhak Sinta, a national NGO, undertook several ore production testings in Banyumas regency, by using various gravity concentration techniques (Agrawal, 2015). The results of this testing show that further gravity concentration is possible followed by flotation method.

The alternative technology available is not only about processing technology. The MoEF and BPPT have also conducted research regarding the tailing from gold processing, if miners are going to use technology, such as cyanidation. Respondents from the MoEF and BPPT state that they are still doing the research, while preparing the guidelines for cyanidation processing for ASGM (interview, BP01; interview, MEF01). Moreover, they have a plan for the tailing in the future, as informed by one respondent:

“Cyanide is dangerous, so we cannot give the cyanide permit to a person. There should be a group that manage the cyanide and the same with the tailing management. We are going to build a communal pond for the tailing [of cyanide]” (interview, MEF01).

In 2017, the BPPT and MoEF have a plan to construct a pilot project processing centre using cyanide technology (interview, BP01; interview, CO01). At the moment, the BPPT is still preparing the details of the engineering design, while also identifying a strategic location to place the processing centre (interview, BP01). This processing centre will have a capacity to process 1,500 kg of ore per day (interview, BP01; interview, CO01).

5.4.3. Study on health effects due to mercury

Based on the NAP study on health effects undertaken by the universities have been released in the form of journal articles, for example Sari et al. (2016a), based on research in 2012 in Banyumas regency; and Arifin et al. (2015), based on research in Gorontalo Utara regency between 2012 and 2013. The result of their study can be seen in chapter 2. Several ministries continued the research in Banyumas in 2014, 2015 and 2016 (Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit Yogyakarta, 2016; Direktorat Pengelolaan Bahan Berbahaya dan Beracun, 2016; Kementerian Lingkungan Hidup dan Kehutanan, 2014).

Not all health tests between 2014 and 2016 used the same method. The health tests in 2015 and 2016 used blood tests as their method to identify the mercury level in miners' bodies,

while the health test in 2014 utilised hair, nail and urine tests to measure the mercury and they did not do blood test in 2014. Thus, comparison of the average mercury level in blood from ASGM miners in Banyumas can only be seen through blood sampling, which is done in 2015 and 2016, as seen in Table 5.4 below.

Table 5.4: Health assessment result in Banyumas

Year	Mercury in Blood (µg/L)			
	Minimum	Average	Maximum	WHO standard
2015	11.66	85.48	221.1	15
2016	2.386	28.13	117.85	15

Source: Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit Yogyakarta (2016) and Direktorat Pengelolaan Bahan Berbahaya dan Beracun (2016)

Health assessments in 2014 and 2016 show a decreasing level of mercury in miners' bodies. However, the average mercury in blood in the miners still exceeds the recommendation from WHO. Moreover, a decreasing rate is also seen in the comparison of neurological and physical symptoms from the examination of miners that shows the effect of mercury, as seen in Table 5.5 below.

Table 5.5: Results of neurologic and physical examination of ASGM miners in Banyumas

Symptoms	2014 (50 miners)	2016 (60 miners)
Tremor	18%	10%
Insomnia	24%	7%
Gingivitis	46%	7%

Source: Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit Yogyakarta (2016) and Kementerian Lingkungan Hidup dan Kehutanan (2014)

Despite several ministries and agencies undertaking continuous health tests from 2014 to 2016, not all ministries obtain those health test results. For example, the MoH, as the lead ministry conducting health assessment tests, does not have the report from Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit Yogyakarta (2016). A

respondent from the MoH states: “We have not successfully collected the health study [done by other stakeholders], hopefully this year [2017] we will be able to collect all of the data, including from universities” (interview, OH01). Without better data storage and collection, knowing the health progress of the miners from year to year will be very difficult. In addition, the MoH cannot give immediate medical help to miners already affected by mercury, if they do not have the health test reports.

5.4.4. Study on mercury level in the environment

From 2014 to 2016, a number of ministries and agencies undertook several studies on mercury level in the environment in Banyumas regency, as seen in Table 5.6. However, environmental monitoring reports in 2015 do not provide complete data. They simply report that, in general, the mercury level in one of the rivers in Banyumas regency is still below environmental threshold values for contamination, without mentioning the numerical result. Therefore, a comparison of the result from the monitoring report can only be made by using the environmental monitoring report of 2014 and 2016.

Table 5.6: Monitoring test for mercury in the environment in Banyumas

Year	Sample(s)	Documents
2014	River sediments in river, water from well, benthos, tailing sludge, soil and air	Kementerian Lingkungan Hidup dan Kehutanan (2014)
2015	River	Direktorat Pengelolaan Bahan Berbahaya dan Beracun (2016)
2016	River sediments, well, tailing sludge, soil and plant	Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit Yogyakarta (2016)

A summary of mercury levels in the environment, from 2014 to 2016, in Banyumas can be seen in Table 5.7 below.

Table 5.7: Mercury content in the environment in Banyumas from 2014 to 2016

Media	2014	2016	Maximum standard level
River (mg/L) ¹⁵	0.0014 – 0.0029	0.0001 – 0.0002	0.005
Well (mg/L) ¹⁶	0.0005 – 0.0006	0.0001 – 0.0002	0.005
River sediment (mg/L) ¹⁷	0.12 – 0.28	0.012 – 0.178	1
Tailing sludge (mg/kg) ¹⁸	0.10 – 0.18	0.148 – 0.186	0.2
Soil (mg/kg) ¹⁹	0.05 – 0.10	2.415 – 26.821	6.6
Air (µg/Nm ³)	< 0.06	-	-
Papaya fruit ²⁰	-	0.238 – 4.361	0.03
Cacao fruit	-	0.184 – 2.448	0.03

Source: Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit Yogyakarta (2016) and Kementerian Lingkungan Hidup dan Kehutanan (2014)

Government staff from Banyumas regency did not conduct any monitoring between 2014 and 2016, due to limitations on equipment and budget (interview, EA01; interview, HA01). However, regency government staff undertook an innovation by cooperating with other agencies to do the monitoring in 2016, which the result can be seen in Table 5.7. For example, the health agency of Banyumas regency cooperated with a laboratory from the Centre for Environmental Health Engineering and Disease Control, Yogyakarta, to undertake environmental monitoring, which produced an environmental monitoring report in 2016 (interview, OH01).

Based on these reports, it can be noted there are several problems that prevent progress for this indicator. Firstly, stakeholders did not undertake environmental monitoring

¹⁵ The standard for mercury in the river is based on the Indonesian Government Regulation no.82/2001

¹⁶ The standard for mercury in the well is based on the Indonesian Government Regulation no.82/2001

¹⁷ The standard for mercury in river the river sediment is using the Indonesian standard (SNI)

¹⁸ The maximum standard for mercury in tailing is using mercury standard as stated in Indonesian Government Regulation number 85 year 1999 regarding Change on Government Regulation number 18 year 1999 regarding Management of hazardous and toxic waste materials

¹⁹ The maximum standard for mercury in soil is using the mercury standard in residential/parkland from Canadian Council of Ministers of the Environment (2007)

²⁰ The maximum standard for mercury in fruit is using the Indonesian Standard for the maximum heavy metal in food (Standar Nasional Indonesia, 2009)

continuously and therefore, there is no continuity in the data monitoring. Secondly, not all stakeholders receive environmental monitoring reports, for example, respondents from the MoEF and MoH, have not yet received the 2016 monitoring report (interview, MEF01; interview, OH01). These data are important not only to monitor the decreasing or increasing level of mercury in environment, but also to fulfil one of the president's instructions regarding mercury.

5.4.5. Study on mercury lifecycle

A study on mercury lifecycle has a purpose to identify and understand the cycle of mercury in Indonesia from the beginning, for example mercury importation or mercury production until it reaches the end user: the miners. One respondent states:

One of the purposes of study on mercury's lifecycle is to know the amount of mercury in Indonesia. At first we do not know that there is a potency of cinnabar in Indonesia. One of the result of this study is to know how much illegal mercury is circulating in Indonesia, because [at first] all [stakeholders] assume that it [illegal mercury] comes from import" (interview, MEM01).

However, no study has yet been done to identify the life cycle of mercury. The MoEMR, as the lead agency for this indicator, cannot implement this study due to limitations in budget and a lack of expertise. Therefore, in 2017, they will coordinate with other ministries or agencies that have the capability to conduct the study (interview, MEM01; interview, MEM04).

5.5 Third component: Improvement of awareness and communication

5.5.1. Workshops, training and demonstration of alternative technology

Most gold processing in ASGM in Banyumas regency still uses mercury, as observed during the field trip. Therefore, it is important to disseminate information and demonstrate

alternative non–mercury technology to the miners. In 2014, ministries, such as the MoEMR, BPPT and MoEF have conducted socialisation and training to improve the knowledge of miners in Banyumas regency. In the same year, several NGOs, such as Yayasan Tambuhak Sinta and the Blacksmith Institute, demonstrated non-mercury and cyanide technology to the miners. Table 5.8 shows a summary of these activities.

Table 5.8: Training and demonstrations of alternative technology in Banyumas 2014-2016

Year	Activity	Information	Source(s)
2014	- Workshops and training - Demonstration on free mercury and cyanide technology	- Information about NAP, - Health effects due to mercury - Tailing management - Alternative technology - Cyanidation practice - Demonstration of gravitation method using “Ijuk”²¹ technology called the manado method	- Interviews: BP01, HA01, MEM01, PR01 - Document: Direktorat Teknik dan Lingkungan Mineral dan Batubara (2015a) - Interview: BI01 - Document: The Blacksmith Institute (2014) and Agrawal (2015)
2015	-	-	-
2016	-	-	-

In 2015 and 2016, there were no training or socialisation programmes in the Banyumas regency. This is mostly because there were budget cuts in the ministries and agencies in 2015 and 2016. A respondent states: “Because of budget limitation, [when] we want to run [the socialisation], then [suddenly] the budget is cut, for example in 2016” (interview, MEM01). Another respondent also supports the information above: “BPPT surely does not have the budget [for demonstration activities]. Even in 2016 our budget is zero for small scale mining” (interview, BP01). Thus, since 2015, there has been no continuity in

²¹ Ijuk is a natural fibre from coconut tree to filter the gold from the slurry. This fibre also separates lighter minerals from the heavier minerals whilst detaining the microscopic gold in the concentration (Agrawal, 2015)

improvement awareness for miners, which makes it difficult to measure the level of miner's knowledge and awareness regarding non-mercury alternative technology.

5.5.2. Media Cooperation

Information dissemination regarding the danger of mercury is very important, not only for miners but also for the public. Several media outlets deliver the message about mercury, including television, radio and newspapers. In 2015 and 2016, the MoEMR, BPPT and MoEF did several interviews through RRI, one of Indonesia's national radio stations (interview, MEF01; interview, MEM01). Several ministries and agencies also used local and national newspapers to disseminate information. In the case of national newspapers, the MoH ran an interview with Media Indonesia regarding the danger of mercury to human health (Fauzi, 2017); and the BPPT did an interview with Kompas, informing about the development of non-mercury technology (Ikawati, 2017). In the case of local newspapers, the BPPT cooperated with Radar Banyumas, a local newspaper in Banyumas regency, to disseminate information about the development of non-mercury technology ("BPPT dan Fisip Kaji Pertambangan Emas Bebas Merkuri," 2015). Overall, this indicator shows good progress, since there is continuous information being disseminated from year to year.

5.5.3. Alternative livelihood training

According to several respondents, in the past most people in Banyumas regency were farmers. When gold was found in the late 1990s, many people changed their livelihood to become miners, due to the fast income compared to farming (interview, CO01; interview PV01). A respondent stated: "[Now] Miners are afraid to go back to farming since many of them are afraid to try and they do not know where to sell their products" (interview, CO01). Therefore, the president instructed ministries to create a plan for alternative livelihoods for the miners, as informed in Chapter 2; and this instruction is also in line with one of the components in the NAP.

The Energy And Mineral Resources Agency of Central Java province has conducted several trainings for alternative livelihoods in several locations, such as Wonogiri regency and Kebumen regency (Dinas Energi dan Sumber Daya Mineral Provinsi Jawa Tengah, 2014a; 2014b; Interview, PR02). However, from 2014 to 2016, there were no alternative livelihood training programmes undertaken in Banyumas due to several reasons. Some respondents inform that a lack of budget is one of the reasons why alternative livelihood training is not progressing (interview, BI01; interview, PR02). Other reasons include difficulties in finding suitable alternative livelihoods for the miners and markets to sell their products (interview, CO01; interview, PR02; interview, PV01).

5.5.4. Inclusion of the danger and risk of mercury in the national curriculum

Education is one of the important ways to introduce early awareness about mercury's danger, especially for children. Thus, the MoEMR prepared a draft of a mercury syllabus to be inserted into the national curriculum for elementary schools (interview, MEM01; interview, MEM04). Nevertheless, the MoEC cannot simply put a syllabus about mercury into the national curriculum, as a respondent informs:

“We have given the [mercury's] syllabus [to the Ministry of Education and Culture], we want mercury's information to be shared in the elementary school's lesson. However, [...] the curriculum has changed to become creative teacher's curriculum. [...] For example, a lesson about natural resources. The teacher should develop themes about natural resources by themselves. [...] Thus, they recommend us to create posters or books and distribute it to the schools in the vicinity of ASGM site. [or] Enter the school [...] and socialise the mercury's information to the schools” (interview, MEM01).

Several respondents from the MoH, MoEMR and MoEF also raise similar information regarding the difficulties of inserting a mercury syllabus into the national curriculum. Therefore, in the future, the MoEMR, MoEF and MoH have a plan to enter schools in the

vicinity of ASGM sites and disseminate information regarding mercury (Interview, MEM01; interview, MEM04; interview, MEF01; interview, OH01).

5.5.5. Evaluation of awareness raising improvement

Based on the NAP, the MoEC is in charge of conducting an evaluation of mercury awareness-raising in miners specifically and for the public generally (Kementerian Energi dan Sumber Daya Mineral, 2013). However, several stakeholders mention the lack of involvement from other agencies, in this example the MoEC. Moreover, the MoEC is not an active member of the ASGM forum. One respondent states: “From MoEMR, we still try our best [to coordinate with MoEC]. Nevertheless, [...] the barrier is that we have not met the [right] department [in MoEC] and they [the right departments] are rarely invited to the meeting” (interview, MEM01). Thus, no progress has been made for this indicator.

5.6 Summary of the NAP’s progress from 2014 to 2016

Based on the findings above, progress of the NAP to achieve: (1) the implementation of policy regulations associated with ASGM; (2) implementation of research and development of non-hazardous and non-mercury technology in ASGM; (3) awareness improvement in stakeholders knowledge regarding the risks of mercury; and (4) total mercury elimination in ASGM, can be summarised based on the achievement of each of the indicators. Moreover, from this achievement, the action plans already implemented and the unfinished progress of other action plans can be identified, as seen in Table 5.9 In addition, from the unfinished progress of action plans within NAP, barriers that prevent or slow down the implementation can be identified, as seen in the next sub-chapters.

Table 5.9: Summary of implementation of NAP and unfinished plan of NAP

No	Key component	Implementation in 2014-2016	Unfinished plan
1	Legal frame and institutional strengthening	- Enactment of mercury import regulation - Draft regulation on mercury prohibition in mining sector - Establishment of stakeholder forum at national level - Investigation on mercury importing and cinnabar mining	- Enactment on mercury prohibition regulation - Formalisation of ASGM - Establishment of stakeholder's forum at local level - Evaluation and standard evaluation on NAP activities and voluntary activities
2	Research and development	- Establishment of online database of mercury usage in ASGM - Concept of technology for ASGM in Indonesia - Health tests in area of ASGM from 2014 to 2016 - Environmental monitoring in the area of ASGM from 2014 to 2016	- Online mercury database fulfilment - Implementation of pilot project Gold processing centre for ASGM in Banyumas - Standardisation of health and environment test methods - Collection and distribution of health and environmental test results - Regular environmental and health monitoring - Study on mercury lifecycle

No	Key component	Implementation in 2014-2016	Unfinished plan
3	Improvement of awareness and communication	- Dissemination of alternative technology in 2014 in Banyumas - Demonstration of non-mercury and cyanide technology for gold mining in 2014 - Information dissemination regarding mercury's toxicity and alternative technology in radio and newspapers from the BPPT, MoF and MoEMR	- Regular demonstrations of alternative technology to replace mercury in Banyumas - The implementation of alternative livelihood training - Inclusion of mercury in the national curriculum - Evaluation of awareness-raising improvement on mercury

5.7 Identified barriers for NAP

The information gathered from interviews with stakeholders, shows there are several barriers that hinder the implementation of the NAP. Some of these barriers appear in many stakeholders' statements and other barriers only appear in a few respondents' statements. Figure 5.3 shows the frequency of barriers that appear during the implementation of the NAP.

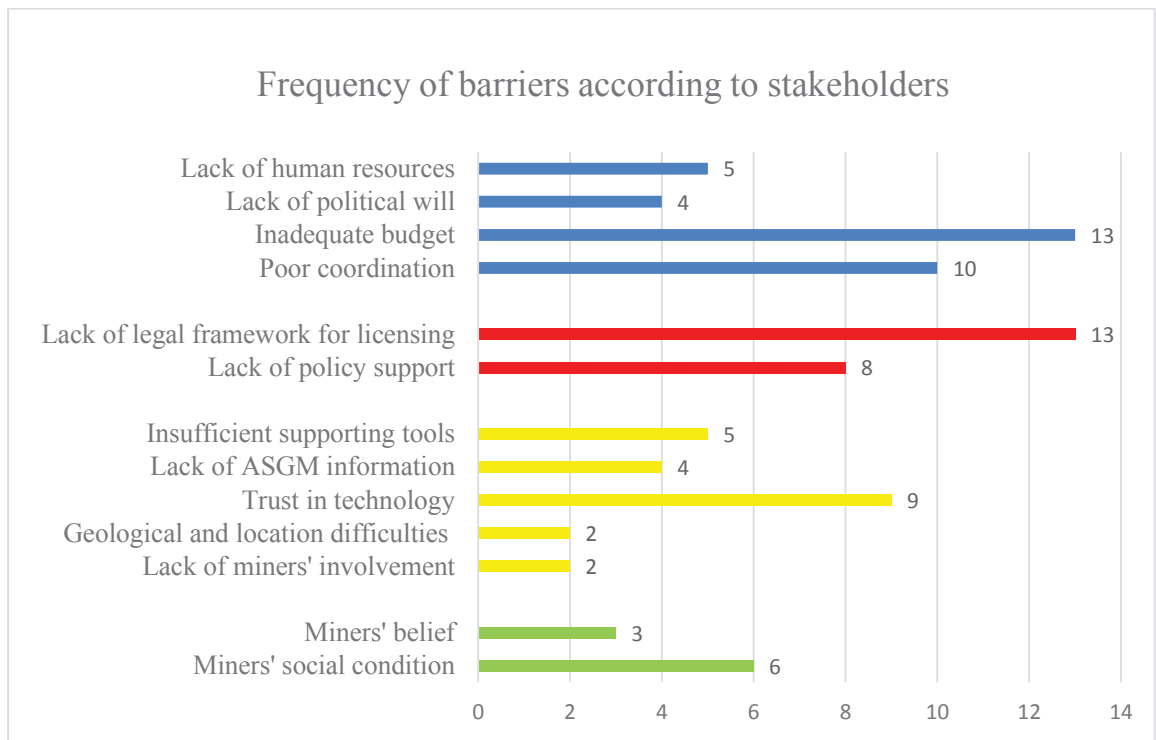


Figure 5.3: Frequency of barriers from the implementation of NAP

(Information: institutional barrier in blue, legal barrier in red, technical barrier in yellow and socio-economic barrier in green)

5.7.1. Institutional barriers

Lack of human resources

Several local agencies complained that they do not have sufficient personnel to conduct the monitoring of environment and health (interview, EA01; interview HA01), while other ministries do not have the experts to conduct studies on the mercury lifecycle (interview, MEF01; interview, MEM01; interview, MEM04). Moreover, a lack of numbers in human resources is also another problem that hinders the progress of regular technology demonstrations for the miners (interview, BP01). Therefore, several action plans cannot be implemented properly, due to this barrier.

Lack of political will

A lack of political will is one of the contributors to the slow progress of the formalisation of ASGM in Indonesia. Despite Banyumas regency's already proposed people's mining area,

several respondents criticise the political will from the local government agency, especially the will to formalise the miners and to provide a location for ASGM (interview, MEM01; interview, MEM02; interview, MEM 04). They raise a question regarding why the local government did not propose the right location for WPR in 2013? Moreover, respondents from central government said that it is because of the reluctance from the local government to allocate the fund and time to manage the ASGM (interview, MEM01, interview, MEM04). The slow response from local government, due to a lack of political will, has made the formalisation progress become slower. Moreover, a respondent from an NGO also raises a concern regarding the lack of will from the government to push the formalisation of ASGM in Indonesia. However, when asked further regarding the reason why government is lacking of will to push the formalisation, the respondent did not give an answer as they do not want to speculate.

Inadequate budget

Thirteen out of twenty respondents identify the lack of budget availability in the implementation of the programme, as seen in Figure 5.3. Almost all respondents are affected by insufficient budgets, including NGO and local and national government budgets that affect the sustainability and continuity of the action plan, as stated by a respondent: “Coordination and implementation [of NAP] should be supported by [sufficient] budget. [...] Budget cutting is a usual thing. When MoEF wanted to do an activity [with us], it is forced to stop because of the [budget] cutting” (interview, BI01). Moreover, there are several action plans that could not be implemented because of budget insufficiencies, as seen in Table 5.10.

Table 5.10: Connection between budgets and barriers to action plans

Action Plan	Information	Source
Online mercury database fulfilment	Budget availability hinders survey activities of several respondents from local governments and NGO. Thus, no online data of mercury usage and ASGM available on website. This prevents updating data of ASGM in Indonesia	BI01, PR01, PR02

Action Plan	Information	Source
Regular health and environmental monitoring	Several health and environmental monitoring plans by local and national agencies are not supported by sufficient budgets or budgets cut mid-year	BI01, EA01, GA02, HA01, MEF01, MEM01, MEM04, OH01
Demonstration of alternative technology	BPPT as agency in charge of demonstration of alternative technology does not have sufficient budget to conduct the activity. The same condition also occurs in one NGO in Indonesia	BI01, BP01
Alternative livelihood training	No training has been undertaken for miners to change their livelihoods. Budget cutting is generally the reason according to several respondents	PR02, MEM01

Poor Coordination

Poor coordination is the second largest barrier in regards to institutional barriers. From 2014 to 2016, several ministries and agencies implemented environmental and health monitoring tests in Banyumas regency. However, no stakeholders compiled or coordinated the results of these tests (interview, CM01; interview, MEM04; interview, OH01). A lack of coordination also resulted in several ministries not following up the evaluation from the NAP progress (interview, BI01; Interview, BP01; interview, BP02). In addition, the slow progress of inclusion of mercury information in the school curriculum is also the result of poor coordination between the MoEMR and MoEC. Therefore, a respondent mentions the importance of leading ministries that can coordinate these data collections and coordinate the entire activities of the NAP: “it seems [among the national stakeholders] there is no leader [that can lead the ministries] for the [implementation of] NAP. The nearest ministry that has [a leadership skill and level to do] a coordination task is the Coordinating Ministry of Maritime Affairs.” (interview, BP01). Therefore, the Coordinating Ministry of Maritime

Affairs has just recently added in the implementation and coordination to NAP activities: and for this ministry to push the involvement of other ministries or agencies (interview, MEM01; interview, BP01).

Another effect of poor coordination is the establishment of a local stakeholder's forum. Since the task of the mining agencies in regional provinces has been moved to provincial level, no regular meetings among the local stakeholders occurred in 2016 (interview, HA01). Therefore, many programmes in the local government agency in Banyumas, associated with ASGM, are not working properly, for example, the ASGM data collection and alternative livelihood training programme.

5.7.2. Policy barriers

Lack of legal framework for formalisation

Formalisation is fast becoming a scourge in ASGM, especially in the Banyumas regency. Along with the budget deficiency, an absence of formalisation is the largest barrier in the NAP implementation according to 65% of the respondents. Until now, no small-scale mining licences have been issued to small-scale miners in ASGM (interview, CO01; interview, MEM01). Several ministries have also raised their concerns regarding the slow progress of formalisation. They were afraid that either they are seen as helping illegal activities, or their efforts will be useless, since the government will take other steps that are contradictory to the ministry's plan (interview, BP02; interview, EA01). For example, one respondent states: "The problem is in the formalisation of people's mining [...]. We afraid that we might have done a lot of technological study, [then] suddenly the government decides to do law enforcement and close all of the people's mine" (interview, BP02). This barrier also influences progress for the implementation of a gold processing pilot project in Banyumas regency.

Lack of policy support

Several drafts of mercury regulation within the mining sector, especially in ASGM, have not yet been enacted. This regulation is important not only to reduce mercury trading, but to

also reduce mercury usage in ASGM. However, according to some respondents, from 2014 to 2016, those regulations were not considered as one of the government's priorities and they were set aside from any enactment regulation proposal (interview, MEF01; interview, MOM01; interview, MOM04). Later, after the Indonesian president gave instructions for the elimination of mercury in March 2017, those regulations above are being reviewed with a view to being enacted. The inclusion of mercury in the school curriculum is also a part of a lack of policy support, as mentioned by several respondents (interview, MEM01; interview, MEM04). Unless there is a policy to support the inclusion of mercury in the elementary school curriculum, it is going to be difficult to realise this action plan.

A lack of policy support is also connected with the progress of formalisation. As explained in sub-chapter 5.3.1, the miners' working environment in Banyumas regency has already exceeded the provision in Law number 4, year 2009 (interview, GA02; interview, PR01). However, this law does not offer a solution for the miners who already exceed the provision. Therefore, another policy is needed to regulate the working condition of miners, so the local government can give the miners a legal licence (interview, MEM04; interview, PR01).

Several demonstrations of technology undertaken in the past are not working effectively and they have not changed the miners' mind. Miners still think that mercury is legal to be used in gold processing (interview, MEM04; interview, PR01). Therefore, several respondents also consider the absence of policy support, similar to the mercury prohibition regulations above, as a barrier to the effective, alternative technology development (interview, MEF01; interview, PR01).

5.7.3. Technical barriers

Insufficient supporting tools and/or infrastructures

Several local agencies in Banyumas regency cannot undertake health and environment monitoring in ASGM locations. In the interviews, the respondents explain the limitations with equipment needed to conduct the tests (interview, EA01; interview, HA01). This

situation also occurs in one of the ministries (interview, MEF01). With limited equipment, they need a third party to conduct the tests, which then consume more of their budget. Since several ministries have experienced budget cutting, as mentioned previously, these ministries can only conduct a few monitoring tests, especially in Banyumas regency. Thus, there is no continuity for monitoring the data, which will then make it difficult to evaluate the result. Another supporting tool needed to support progress is the standard or guidelines of health tests and monitoring methods, in addition to a standard evaluation to evaluate the NAP activities and voluntary activities and mercury improvement awareness (interview, BI01; interview, MEM01).

Lack of information regarding ASGM

This barrier has a connection with the slow progress of alternative livelihood training. Several respondents mention the difficulty in finding suitable livelihoods in the Banyumas regency and how to connect these livelihoods with markets (interview, CO01; interview, PR01; interview, PV01). A respondent from Central Java Province comments: “We have not done the alternative livelihood training in Banyumas, because we have not found the suitable livelihood pattern for the people [in Banyumas]” (interview, PR01). In addition, a source from BPPT states:” There should be a survey regarding the social condition of the miners, their family, and their community that should be done [for example] by Social Ministry [...] to provide the suitable livelihood [for the miners]” (interview, BP01). Therefore, insufficient information regarding ASGM, especially in regards to social conditions, will hinder the progress of alternative livelihood training in the action plan.

A lack of information regarding the location of ASGM also hinders the progress of regular monitoring. Some respondents inform that some miners are moving towards a new location that has not previously been identified as an ASGM location (interview, PV01). Therefore, environmental monitoring should be undertaken in the new mining area. The importance of data updating is also raised by a respondent: “We should update the map of ASGM activity every year. Because, probably the gold reserve is already gone and they will move to another place” (interview, GA01).

Trust in technology

In order to replace mercury, the BPPT has proposed cyanidation technology. Nevertheless, not all stakeholders believe that cyanide is a suitable solution to replacing mercury. Six out of twenty respondents disagree with that proposal. During the interviews they emphasise the danger of cyanide. For example:” Pilot project [from BPPT] is like [the miners are] coming out from tiger’s mouth, [then] enter the crocodile’s mouth, which means that they [the miners] are still using toxic [chemical]” (interview, PR01). Another respondent even suggests keeping the use of mercury:

“[...] the question is whether the tailing from cyanide is safe or not? Amalgamation is a physical process, while cyanidation is a chemical process. So, in the amalgamation process no metal that are decomposed [unlike cyanidation]. So it [the metal] will be dumped in its original form. Still in compound [form] and in stable form” (interview, GA01).

In the case of free cyanide and mercury technology, the technology demonstration using a gravitation method and Ijuk is not showing the results expected by several stakeholders, who state that the method does not give a better result (interview, CO01; interview, MEM01; interview, PV01). In addition, according to a resource from the BPPT, the gravitation process will be too complex. Moreover, the production from the gravity method cannot be sold directly, since the result from the gravity method is still in a concentrated form that needs to be processed further and geological characteristic of various ore also affect the selection of technology (interview, BP01).

Location difficulties

Location is another barrier for the implementation of the pilot project action plan. The pilot project from the BPPT and MoEF should be constructed in the area of people’s mining. However, according to a respondent from the BPPT, the location proposed in Banyumas regency is not very large and there is only sufficient space for the processing facilities (interview, BP01). Thus, there will only be a small space to create the cyanide tailing pond. Furthermore, the MoEF has requested a communal tailing be made for several small scale

gold cyanidation processing facility owned by the miners in Banyumas regency, which is difficult, if the location is still in the area of people's mining (interview, MEF01). The local miners have also experienced difficulties with the tailing pond construction. A respondent from an NGO made an observation in the past and states: "Many miners only made small tailing pond for their cyanide processing. When the rain comes, the volume of the tailing will increase and overflow to the nearby environment" (interview, BI01). Therefore, there is a need to add the size of the people mining area to accommodate the need of tailing pond.

Lack of miners' involvement

The implementation of the NAP is a top-down policy. The weakness of this policy is a lack of involvement from the bottom actors and target group. Therefore, a miner who is also a manager of the ASGM cooperative in Banyumas regency raises a concern about the lack of involvement from the miners in policy decision-making (interview, CO01). For example, the BPPT has a plan to construct a gold-processing centre with the capacity of 1.5 tons per day. The cooperative manager states:

"People are working in a different group in here and they do not want their ore to be mixed with other groups, because the result [gold production] will be different. That is why if they want to make a pilot project in here, they should lower the capacity, for example 100 kg but they [BPPT] make it into several lines of production" (Interview, CO01).

When asked further regarding the management of the gold processing centre, such as the number of people that will be involved and the units needed for the miners, several respondents state that there have been no discussions about these issues (interview, BP01; interview, CO01). In addition, the head of Paningkaban village also comments on the lack of involvement from the miners in decision-making, while noting the reluctance of the miners to go to the pilot processing centre, if its capacity is too large and the line production is limited (interview, PV01). Therefore, despite only two people commenting on the lack of miners' involvement, it is important to note this barrier, if the BPPT and MoEF want to implement the pilot project.

5.7.4. Socio-economic barriers

Miners' beliefs

One barrier to health monitoring, according to several respondents, is miners' beliefs which, in this case, means these beliefs are related to superstition miners. A respondent from the MoH states: "Taking blood [sample] is difficult, including hair samples. In certain area, taking hair from someone is considered as a witchery activity. Therefore, we have to read [the culture of] the area" (Interview, MOH1). In certain places, miners are also reluctant to have a sample of their hair and nails taken for the health tests, as they consider the health tests are not an important thing (interview, EA 01; interview, HA01). Therefore, the health sample test is undertaken several times by direct visits to the mine site.

Miners' social conditions

According to several respondents, miners see gravity concentration and cyanidation as a complex process and both of the processes will take a long time (interview, CO01; interview, PV01). In addition, miners need fast money to recover their capital and therefore this condition also makes the miners more reluctant to change their method (interview, BP01). Unless the alternative technology offers them short term production and a less complex process of production, the miners will be difficult to accept alternative technology offered.

5.8 Summary of Barrier

Based on the findings above, Table 5.11 below summarises the barriers that affect the progress of the NAP. A single barrier mentioned above can influence several actions in the plan, or vice versa.

Table 5.11: Unfinished action plans and barriers affecting action plans

No	Key component	Unfinished plan	Barriers
1	Legal framework and institutional strengthening	- The enactment of mercury prohibition regulation - Formalisation of ASGM - Establishment of stakeholders' forum at local level - Evaluation and standard evaluation on NAP activities and voluntary activities	- Lack of policy support - Lack of legal framework for formalisation - Lack of policy support - Poor coordination - Lack of political will - Insufficient supporting tools
2	Research and development	- Online mercury database fulfilment - Implementation of pilot project gold processing centre for ASGM in Banyumas - Standardisation of health tests and environment methods - Collection and distribution of health and environmental test result	- Lack of political will - Inadequate budget - Lack of policy support - Formalisation - Inadequate budget - Trust in technology - Location difficulties - Lack of miners' involvement - Lack of legal framework for - Insufficient supporting tools - Poor coordination

No	Key component	Unfinished plan	Barriers
		- Regular environmental and health monitoring - Study on mercury lifecycle	- Insufficient supporting tools - Inadequate budget - Lack of human resources - Miners' beliefs - Miners' social conditions - Lack of information regarding ASGM - Inadequate budget - Lack of human resources
3	Improvement of awareness and communication	- Regular demonstration of alternative technology to replace mercury in Banyumas - Implementation of alternative livelihood training - Inclusion of mercury in school national curriculum - Evaluation of awareness-raising improvement on mercury	- Inadequate budget - Lack of human resources - Lack of information regarding ASGM - Inadequate budget - Poor coordination - Lack of policy support - Poor coordination - Insufficient supporting tools

Chapter 6

Discussion

6.1 Introduction

This chapter discusses the progress of the NAP to eliminate mercury, by utilising a framework for the effective implementation of the NAP. Barriers to the implementation of the NAP and their influence on the action plan are also discussed. As the final objective for the current study is to propose recommendations for the implementation of the NAP and to reduce barriers to the implementation of the NAP, this chapter also discusses what should be done by the Indonesian government, in order to improve the implementation of the NAP.

Chapter 6 is divided in three general sections. Firstly, there is a general discussion regarding an assessment of the implementation of the NAP. Secondly, Chapter 6 presents discussion regarding barriers to the NAP to eliminate mercury in Indonesia. And thirdly, recommendations are made towards improvement of the implementation of the NAP, which include barrier elimination.

6.2 Assessment towards progress of the NAP to eliminate mercury in Indonesia

There are several action plans that are working well (and not working well), as indicated in Table 5.9, Chapter 5. By using the framework proposed by Spiegel et al. (2015), this study examines the progress of implementation of the NAP, in accordance with Article 7 and Annex C of the Minamata Convention on Mercury.

6.4.1 Local knowledge and capacity building

Finding alternative technology to replace mercury is one of the priorities, as stated in the NAP. Technology selection undertaken by the BPPT has already considered the suitability of geological conditions, which have been obtained from several geological and

metallurgical testing studies. From these tests, BPPT chose cyanidation leaching as the alternative technology to be used by miners in Banyumas regency (chapter 5). The technology selection by the BPPT is in line with the findings of several scholars, that the technology needs to be fitted with the geological conditions (Hilson, 2007; Hinton, Veiga, & Veiga, 2003; Spiegel & Veiga, 2010).

Cyanidation leaching is not a new innovation in Banyumas regency. One of the respondents states: “Currently for Paningkaban village, there are approximately twelve [small] cyanide processing plants [owned by local miner]” (interview, CO01). With this number of cyanide processing plants, it shows that miners are already familiar with the technology (further discussion about the knowledge of the miners regarding cyanidation will be discussed in sub-section 6.3.3). Therefore, the selection of this technology by BPPT has not solely considered the suitability of geological conditions, but also the familiarity of the technology among the miners. The next step, following the selection of the technology, was the implementation through a pilot plant project, which has the capacity to process 1,500 kg of ore per day.

Information regarding the danger of mercury, and information on alternative technology and livelihoods was disseminated among the miners. This was done through a workshop conducted in 2014 in Banyumas by several ministries and agencies like MoEMR, MoEF, MoH, BPPT, MoS, MoCSME and local government institutions. In the same year, information regarding mercury was also disseminated among communities in the vicinity of ASGM activities, especially for women and children by an NGO (The Blacksmith Institute, 2014). However, the present findings indicate that the method of communication and information dissemination has not been adopted into the culture of the local community. As a respondent states: “When I followed the workshop in Banyumas [in 2014], if the language and the presentation [from the speaker] is like this [too technical], it will be difficult to be understood by the miners” (interview, OH1). Thus, capacity building for the miners needs to be conducted based on a cultural approach, as suggested by Metcalf and Veiga (2012) and Spiegel et al. (2015).

Capacity building for local government staff is as important as that for miners. Not all local government staff members have knowledge or understanding about mercury or alternative technology, according to several respondents (interview, EA01; interview, PR03). This lack of knowledge about the danger of mercury is also experienced by government health staff dealing with the ASGM sector in Bolivia (Appel et al., 2015). Nevertheless, even with limited resources, several stakeholders conducted a workshop in Banyumas regency in 2014. At that time, several ministries divided the budget to cover the cost of the workshop and to bring a limited number of staff to help establish the workshop (interview, MEF01; interview, MEM01). Therefore, the good intentions for creating the workshop, especially for government staff, needs to be appreciated, particularly since capacity building for public staff (and especially health-care workers) is mentioned in Annex C of the Minamata Convention (UNEP, 2013b); and it is suggested in this framework. In addition, it is hoped that, with a proper training for local government staff, there will be a continuation of information dissemination or training for the miners, without being dependant all the time on central government.

6.4.2 Social and economic livelihood empowerment

The current research shows that effort towards social and economic empowerment is very limited in Banyumas regency. During the workshop in 2014, MoCSME and MoS joined the workshops to offer explanations regarding cooperative and micro-credit, and alternative livelihoods, respectively (Interview, MEM01). At the time, micro-credit for miners was to be financed by MoCSME. However, financing of ASGM is difficult, since MoCSME needs a legal assurance from the ASGM sector, which is a result of formalisation (Agrawal, 2015). The need for legal assurance therefore triggers another challenge. Firstly, since MoCSME is using the government's budget that is audited professionally by a government agency, any loan default from non-licenced miners will indicate a budget misuse in the government budget. The consequences of this are serious. Cases of budget misuse in Indonesian ministries or local government that lead to the financial loss to the country can be seen by the government auditor as a as a violation of the law (Butt, 2009). Furthermore,

financing non-licenced miners could also be seen as supporting an illegal activity, as stated by one of the agencies. Thus, the need for legal assurance is understandable.

The Sumber Rejeki Cooperative, a miner's cooperative that acts as a place to coordinate the whole group of ASGM in Banyumas, especially in Paningkaban village, is reluctant to offer micro-credit to the miners. The manager of the cooperative responded to the question regarding loans to miners:

“Currently, [Sumber Rejeki] Cooperative does not have a loan program yet. [since] we organise the money from different miner's group. We afraid that if we lend the money to one group [...], can they return the money? Because it is a bit risky for gold [mining] activities [...] where at times these group produce gold, and at times not. What if we lend the money to a group then [suddenly] the group disband?” (interview, CO01)

Based on the information above and despite the miners in Banyumas regency being involved in the cooperative, the cooperative itself still lacks of confidence to provide loans. In addition, the study shows that the management of the cooperative also has fears about non-repayment of loans to the miners, which can be seen in the case of a micro-finance failure due to non-repayment in Africa, by Hilson and Ackah-Baidoo (2011). Therefore, there is a need for further study by stakeholders, in cooperation with academics, on the forms of micro-finance that are suitable for artisanal and small-scale gold miners.

The workshop in Banyumas in 2014 did not differentiate between men and women miners. The stakeholders focussed on the alternative technology and did not discuss any type of training for women's empowerment (interview, MEM01). Furthermore, according to the village head, women miners are relatively small in number compared to men miners (interview, PV01). Therefore, women's participation is viewed as low in ASGM in Bayumas regency. However, additional study is needed to confirm the statement from the village head. Despite women miners being seen as relatively small in number, several health awareness campaigns have been disseminated targeting women and children in

Banyumas, by a local NGO (interview, BI01). This shows that stakeholders still recognise the need for educating women and children, as emphasised by one of the points in Annex C of the Minamata Convention on Mercury.

6.4.3 Reformation in mining policies

Regulations are one of the important components needed, in order to reduce and control the usage of mercury. One of the strategies, as stated in Annex C in the Minamata Convention on Mercury Agreement, is the establishment of regulations towards formalisation and mercury control (UNEP, 2013b). The results of the study show that central government has put in a vast amount of effort to push regulations regarding mercury usage in ASGM and mercury trading. However, no progress has been achieved regarding the formalisation of the miners. Local governments (both provincial and regency) do not have any regulations or guidelines associated with ASGM licencing. Interestingly, regulations for formalisation or ASGM licencing is also a common issue among countries, such as Cambodia and Ecuador, which have already signed the Minamata Convention on Mercury (Sánchez-Vázquez et al., 2016; Spiegel, 2016; UNEP, 2017).

The slow formalisation of ASGM has also been triggered by the preference of local government agencies in the past. The Banyumas government regency prefers to give the mining area occupied by artisanal and small-scale gold miners to a large mining company. A respondent informs:

“We gave a recommendation to the regency head that mining is a high capital [activity], high risk and has a potency to damage the environment [...] thus, we agreed to offer it to [medium or large] investors [...] and in 2014, Minister of Energy and Mineral Resources has given the consent for the area to be given to medium and large mining company” (interview, PR01).

However, no mining company is willing to mine the area, since the reserve is not profitable, according to several respondents (interview, PR01; interview, PR02). Thus, with the increase in ASGM activities, the local government has changed its mind and proposed a revision of the area to be given to ASGM. In 2016 this proposal was sent to central government. To date, no consent has been given by the central government towards the proposal. This research indicates there is still inequity within the ASGM sector. The sector is viewed as an unimportant sector, since local governments prefer large mining companies.

The preference towards large mining can be indicated by several factors. Firstly, based on mining laws, local government has to provide an additional budget to manage the environmental effects from ASGM, such as like undertaking reclamation and ensuring the miners have proper equipment for mining. Due to a limited budget, it is going to be difficult to provide these necessary items. Secondly, tax from the ASGM sector is not as high as that from large-scale mining. One respondent states: “Why the government should provide the fund to help the miner [to cover the environmental and safety issues]? It is because [likely] the tax from them is not going to cover the cost [for those issues]” (interview, PR02). At the present time, a method for taxing miners is very unclear, since there are no regulations regarding tax for the ASGM sector or whether a miners’ tax could cover the costs at both national and local level, especially in Banyumas regency. Thus, this study indicates that these two factors above have resulted in the government’s preference for large-scale mining.

The finding above is in line with a finding in a past study by Peluso (2017) and Spiegel (2012a), where ASGM in West and Central Kalimantan province had been underestimated and not given access to licencing. Therefore, the local government does not have any intention to release a regulation regarding ASGM, which is similar to the condition in Banyumas regency.

Based on the findings from this research, reformation of mining policies has not been undertaken by local governments. However, the local government has promised that once the issue about WPR allocation is cleared and a budget for supervising ASGM has been

given, they will establish the regulation (interview, PR02; interview, PR03). Moreover, since the Indonesian President has already given instructions regarding ASGM activities, local governments should also be able to act faster, in order to fulfil his order.

6.3 Barriers to the Implementation of National Action Plan

Various barriers have been stated by respondents regarding the implementation of the NAP to eliminate mercury. As seen in Figure 5.3, Chapter 5, institutional and technical barriers represent the highest barriers to implementation, followed by policy and socio-economic barriers, respectively.

6.3.1 Institutional barriers

Insufficient human resources

Several programmes in the action plan cannot be undertaken properly, due to human resource limitations. These are a function of both a lack of staff but lack of expertise. The findings of the current research show that this barrier hinders the continuation of action plan strategies, such as technology demonstrations and monitoring of both human health and the environment. Despite the fact that several action plans are planned at the beginning of each year, they cannot be smoothly implemented due to resource limitations, and this is made worse by the requirement of stakeholders to handle not only ASGM issues, but also other issues outside ASGM. Thus, with limited numbers of staff, it is not possible to implement all intended components of the action plan. At local government level, several agencies do not have staff with the expertise needed to demonstrate alternative technology to the miners, or to analyse samples from health and environmental tests.

A similar lack of human resources in government institutions can also be seen in several countries in Africa and Latin America (Burke, 2006; Hilson & Vieira, 2007; Jönsson et al., 2009; Meech et al., 2014; Miserendino et al., 2013; Spiegel & Veiga, 2005; Veiga, Angeloci-Santos, et al., 2014). The majority of scholars assert that the monitoring of miners is limited, due to a lack of staff numbers and limited capability from the government.

A lack of staff, both in number and expertise, has resulted in the action plan not being conducted properly and this means that the desired result is not going to be achieved. With only one workshop presented in 2014 in Banyumas regency, there is little guarantee that the miners and people in the surrounding area have a better understanding of the danger of mercury. Despite the test in 2016 showing a mercury reduction in the miners' blood, which indicates an improvement in mercury usage among miners, the environment surrounding the miners still records a high concentration of mercury, especially in fruit around mining sites. The numerical result can be seen in the last test in Banyumas in 2016 (Chapter 5). This result could be coming from a lack of knowledge in mercury management in other areas.

Several respondents assert that the high mercury content is coming from the tailings from mercury gold processing, which was overflowing into the vicinity of the environment during the rainy season (many gold processing activities are located in the middle of a village) and several people are using the sand from the tailings to harden the road (interview, EA01; interview, HA01). Therefore, with only one workshop presented in 2014, miners (and possibly people living in the vicinity of the mining site) still have a low level of awareness on the management of tailing and the danger of mercury. If the workshop or socialisation to the people had been done properly and had been followed by regular monitoring, the conditions mentioned here would possibly not have occurred.

Lack of political will

Four respondents mention a lack of political will to formalise the miners, establish formalisation regulations and provide a location for ASGM, especially from the local government. Managing ASGM is different to managing large-scale mining. As explained in Chapter 2, local government must allocate its resources, in order to supervise and give training to artisanal and small-scale miners. Taxation from ASGM will only provide a small income, which might not cover the local government's expenditure (interview, PR02). Therefore, at the beginning, the local government prefers to offer locations to large-scale mining, as previously explained. When a location does not attract a large-scale mining company, the local government then offers the location to ASGM. Based on the

explanation above, it can be asserted that a lack of political will has resulted in reluctance from local government to push formalisation and the establishment of regulations towards formalisation.

This barrier impedes the progress of other action plans, such as baseline data collection and demonstration of alternative technologies. Several scholars also identify a lack of political will as one of barriers to mercury reduction programmes in several countries, such as Ghana, the Republic Democratic of Congo, Guyana, and Brazil (Hentschel & Hruschka, 2002; Hilson & Gatsinzi, 2014; Rajaei et al., 2015; Roopnarine, 2006; Sousa et al., 2011; Teschner, 2012). These countries have problems, such as a lack of political will to establish regulations, to implement policy, and to enforce the law.

Despite the fact that local government in Indonesia is lacking in political will, the results of this study show that the central government has put in a good effort to support local governments. A respondent states:

“We already talked to local government and asked them to propose the new people’s mining area [by considering the status of the area] to central government in their region, if they found an area that already have a lot of miners [...] That is why we [always] push the regency during the workshop to hurry and propose the WPR, despite their mandate to regulate ASGM is already given to the province government, they [regency government] can still propose a new WPR area through province and then submit it to central government. We [central government] can only suggest that [since the authorisation to manage ASGM is in the hand of province]” (interview, MEM04).

Central government has conducted several trainings for local government staff in several regencies, in order to disseminate knowledge of mercury. This effort undertaken by central government suggests that central government has the political willingness to address the ASGM issue in the regencies. This could also mean that the central government fully

supports local government to regulate the ASGM sector, which contrasts with a past study of ASGM in Indonesia by Spiegel (2012b). This author correctly asserts that there had been a conflict between central and local governments in the past, regarding the authority of local governments. However, this conflict only relates to dispute between large-scale mining and the ASGM sector. The finding of the current study is that central government has worked side by side to support local government decisions, in order to hasten the implementation progress of the NAP.

Inadequate Budget

A lack of a sufficient budget is one of the barriers experienced by all stakeholders. Several programmes, such as data collecting, environmental and human health tests, demonstrations of alternative technology and training or workshops cannot be implemented due to a deficient budget. In order to overcome this issue, stakeholders in central government (the BPPT, Coordinating Ministries of Maritime Affairs and MoH) have made an approach to the National Development Planning Agency (Bappenas), a national agency that has a responsibility to draft strategic mid- and long-term planning for ministries and agencies (Datta et al., 2011). This includes planning for the budget and programmes that need to be prioritised by the government (Datta et al., 2011). However, the stakeholders have only just started to involve Bappenas, as one of the stakeholders for the NAP in 2016, which means that Bappenas can prioritise the programmes in the NAP starting in 2017 (interview, BP01; interview, CM01). It is hoped that, with the involvement of Bappenas, there will be no more budget cutting, especially to government programmes relating to mercury reduction.

Local government also experiences budget limitation as a barrier. Several action plans, for example training for alternative livelihoods and regular monitoring of ASGM for data collection, cannot be done properly by local government. At the moment, according to respondents from local government, a budget in local government is available. However, similar to ministry budgets, the budget for ASGM activities has been reduced, due to deficiencies. Moreover, budget deficiencies hinder the progress of other barriers, such as the completion of a mercury data base and the identification of a market for alternative livelihood training. Even if the local government (in this case the provincial government)

has a budget, it will not be sufficient to be used in all ASGM areas (interview, PR02). Consequently, it is difficult to provide similar programmes, such as an alternative livelihood programme, for other regencies; and this situation has been experienced by Banyumas regency.

The findings above are consistent with studies on mercury reduction by scholars in the past few years (Mutagwaba, 2006; Roopnarine, 2006; Sousa et al., 2011; Spiegel, 2009b). They found that budget limitation impedes the distribution of retorts to capture mercury, the monitoring of ASGM, and knowledge improvement of the miners. Thus, budget availability is always a critical component of efforts to reduce mercury in ASGM.

Poor Coordination

The elimination of mercury through the NAP will need collaboration between ministries, or collaboration between central and local government (Chapter 1). Collaboration without proper coordination will hinder the transfer of knowledge among stakeholders and also hide information regarding actions done in ASGM sector that are not publicly shared (Buxton, 2013). The current study shows that many reports are not distributed properly due to this barrier, and this is a result of a lack of communication between local and central government. The examples are seen in the distribution of a report about health and environmental tests undertaken in Banyumas regency in 2016, in addition to alternative livelihood training (regardless of whether similar test have also been held in other areas), which were both conducted by local government. Several ministries do not know that the local government completed these activities. Without knowing what other agencies have done, in regards to ASGM, stakeholders (especially ministries and national agencies) could assume that others have not progressed planned or targeted programmes. Thus, other stakeholders may run similar programmes as the local government, at the same or near time. This will create a redundancy for the programme, which not only consumes more time, but also consumes more resources, both financial and human.

With regard to inter-ministerial coordination, despite having regular meetings in an ASGM forum, there is no technical ministry that can lead the implementation of the NAP. This

leads to poor coordination among stakeholders in central government. The study reveals there have been several geological metallurgical and environmental tests carried out in the past in Banyumas regency. However, the results are kept (and not shared) by the ministries or agencies that undertook the activity. A respondent states:

“I’m sure that every ministry holds their own data [...] because, when I asked the result [for example the result of health test in ASGM] to the Ministry of Environment and Forestry, they asked back, what data? Therefore, now, we have to collect all of the existing data [or result] and meet together. [if] We should do the action plan, [then] we must run it together” (interview, CM01).

The Coordinating Ministry for Maritime Affairs, as the supervisor of the MoEMR, has recently been added to the stakeholders of the NAP. However, not all technical ministries are under the supervision of the Coordinating Ministry for Maritime Affairs. The MoEF is under the Coordinating Ministries for Economic Affairs, while BPPT, MoH and MoEC is under the Coordinating Ministries for Human Development and Cultural Affairs (Dirhamsyah, 2016). Moreover, since these ministries are under different coordinating ministries, there is a potential to reduce coordination between ministries. An example can be seen in the action plan to include mercury in the curriculum for elementary schools. The MoEMR has tried to contact the department in the MOEC that has the responsibility to add teaching material into the curriculum, since 2014. However, the response from the MoEC stated that the inclusion could not be done (interview, MEM01). Unless there is a leading ministry that can give order to technical ministry like MoEC to find a solution, this issue is going to be difficult to be resolved.

Several scholars also identify poor coordination as one of the barriers towards mercury reduction in AGSM (Buxton, 2013; Collins & Lawson, 2014; Nyame, 2010; Spiegel, 2009a). However, the majority only identify the lack of communication effort that occurs among stakeholders. In the case of implementation of the NAP, there are two factors. Firstly, a lack of communication between local and central government hinders the

distribution of data collection. Secondly, a lack of leadership in the ministries can also trigger poor coordination, as mentioned above.

6.3.2 Policy barriers

Lack of legal framework for formalisation

As mentioned in Chapter 5, sub-section 6.2.3, no regulation towards formalisation has yet been established. This study highlights that, without formalisation for the miners, several respondents are in doubt as to whether the NAP can be implemented. These respondents worry that their efforts will be useless if the government decides to act to contradict action plans, such as enforcement by the authority to close the mine. Alternatively, the NAP could even be seen as an act to help an illegal activity. Despite these concerns, there is an agreement among the stakeholders that priority for mercury reduction will be focussed on miners who are working inside WPR areas (interview, BP01; interview, MEF01; interview, MEM01), but this is not a guarantee, as the mining law obliges that all miners should have a licence if they want to mine.

The impediments of a lack of formalisation in ASGM recorded in the current research support studies by several scholars, such as Debrah et al. (2014), Hilson and van der Vorst (2002), Hilson and Vieira (2007), Hinton, Veiga, and Beinhoff (2003), Miserendino et al. (2013), Rajaei et al. (2015), and Sulaiman et al. (2007). These authors also identify the lack of a legal framework for formalisation as a barrier in ASGM mercury reduction efforts in countries, such as Africa and Latin America. The scholars above assert that, with the correct formalisation, taxation towards the ASGM sector can be implemented, which can then help the government to develop and introduce alternative technologies for the ASGM sector. Formalisation means that no enforcement will be made by the authorities to close down ASGM activities, since ASGM would have legalisation in regards to their activities (Hilson et al., 2007; Hilson & Vieira, 2007). Thus, this study shows that, with formalisation, the result would be a legal assurance for ASGM activities, which would then ensure the stakeholders to implement the NAP without having to worry about law enforcement.

Lack of policy support

Regulations are important not only to give guidance in regards to stakeholders and miners, but also to support the activities of the NAP. Eight respondents mention the lack of regulation support, such as regulations to include mercury toxicity in the educational curriculum; the working conditions of artisanal and small-scale miners; environmental permits for ASGM; and mercury usage in ASGM. Promoting knowledge of mercury through education in schools is an excellent idea and very important. As one respondent states:

“According to me, everybody has [the right] to know, because it [mercury in ASGM] is not solely national issue, it has already an international issue. All children must know the danger [of mercury], because [...] the effect of mercury will only be seen after five years or more, even [in some cases] it can be seen after 10 years of exposure” (interview, OH01)

By educating children, a broader audience can be reached and this education will not solely focus on the miners. Hopefully, the children, who have already gained knowledge regarding mercury, will not play near mining sites and their understanding about the dangers of mercury will create a reduction in mercury usage in the future. Similarly, Spiegel (2009b) also asserts the importance of disseminating mercury information during school activities or religious activities. Furthermore, he emphasises the importance of various efforts not only focussed on miners but also on communities.

Some respondents mention the importance of mercury prohibition and trade regulations in ASGM, not only to reduce mercury usage but also to make the price of mercury become more expensive. Mercury prohibition and increasing the price of mercury are factors that assisted in a successful case of mercury reduction in Colombia, as stated by García et al. (2015). The regulation of mercury sales to the miners is also one of the concerns from a GMP activity in Zimbabwe (Metcalf & Spiegel, 2007). Therefore, steps taken by the Indonesian government to propose regulations on mercury usage and trade in ASGM are already in line with the recommendations from international experts.

However, not all scholars agree with the conclusions that can be drawn from the findings in this study. Hruschka (2011) asserts that prohibition of mercury use will only make miners become more clandestine in their activities. A study by Nyame (2010) also shows how the law to prohibit the usage of mercury has not been successfully applied in Ghana, largely caused by difficulties in monitoring and law enforcement. Therefore, if Indonesian stakeholders want to apply prohibition regulations, they must consider the readiness and accessibility of alternative technology and also ensure that regulations are disseminated properly to the miners.

No regulations regarding formalisation have been established at the local government level. This includes regulations or guidelines relating to an environmental impact assessment (EIA) in ASGM. This lack of guidelines has added more to the reluctance of local government staff to formalise ASGM and confusion as to how they should implement a proper EIA to the miners. A respondent states:

“For small holder mining permit [according to law 4, year 2009] government must be responsible toward the environmental and technical security of ASGM. However, there is no technical guideline on how to create a reclamation bond, [...] how to make an EIA [report] for these miners? Who should make the report [...] can government help the miners to design their EIA? Or is it miners’ cooperative that should make it? Can they make it? There has to be guidelines [regarding the questions] that need to be discussed [further] between central and local government [...] because [the spirit of] smallholder mining permit according to the law is for the people who cannot afford to comply with the obligation that is similar to regular [medium and large scale] mining” (interview, PR02).

These questions are understandable, since artisanal and small-scale miners have limited knowledge regarding mining. Several studies in the past by other scholars also support the view above (Spiegel et al., 2015; Spiegel, 2009a). These studies identify that complex procedures relating to the EIA and licencing for ASGM, have made artisanal and small-

scale miners become reluctant to obtain a licence. If the miners intend to obtain a licence, they will give false information, just to get the licence (Miserendino et al., 2013). Thus, simple and understandable procedures need to be designed for artisanal and small-scale miners, in order to simplify the bureaucracy of the EIA process.

6.3.3 Technical barriers

Insufficient support tools and/or infrastructures

Monitoring mercury usage in ASGM needs to be associated with environmental and human health, in order to measure the reduction of mercury from year to year, or even monthly. However, several respondents, especially from local government, state they do not have proper equipment/tools to conduct these monitoring activities (interview, EA01; interview, HA01). If they have proper equipment/tools and are supported by the availability of budget, they will not be dependent on other ministries or agencies. Central government (in this case the ministries) can delegate environmental tests to local governments, which will save more time, especially for ministries that do not have sufficient time and resources to conduct monitoring.

The findings of this study add new information regarding technical barriers, especially the lack of supporting tools and/or infrastructure. Several studies in the past have only identified a lack of infrastructure to train the miners; obsolete monitoring facilities; and a lack of supporting tools, such as retort or other technological processing tools for miners (Hilson & Vieira, 2007; McDaniels et al., 2010; Roopnarine, 2006; Spiegel, 2012b). However, previous studies do not mention a deficiency in monitoring tools or equipment within government, as those studies mainly focussed on miners' needs and paid little attention to the specific needs of the government.

Evaluation guidelines are also tools that can help stakeholders measure the performance of an action plan, for example, an evaluation of the NAP activities and voluntary from other institution to conduct a program that is similar with the action plan in NAP (see chapter 5) and mercury improvement awareness. However, the findings of the current research show

that there are no guidelines to evaluate the NAP activities and voluntary activities or to quantify improvement of awareness. The results of this study are similar to the study of GMPs in several countries by McDaniels et al. (2010). They assert that a lack of evaluation guidelines makes quantification of the implementation progress of a GMP very difficult. Therefore, without guidelines to evaluate the action plan, there will be confusion on how to conduct the evaluation (Chapter 5). As a result, this barrier results in a minimum effort being made in the evaluation of the NAP activities and voluntary activities and mercury improvement awareness.

Lack of information regarding ASGM

Several projects for mercury elimination have not been successfully implemented, due to a lack of information about the ASGM sector. Heemskerk (2005) and Hilson (2006) argue that data regarding socio-economic conditions, culture and the amount of mercury usage is important information that can help government agencies, when deciding on appropriate approach policies for different ASGM communities. In addition, the findings of this research show that the MoEMR has already started an initiative to collect data by establishing an online database for ASGM. Data collection, as an initial stage for baseline information collection, is an important phase, as stated in the NAP. This initiative is a step towards not only monitoring ASGM activities, but it also helps the government to decide on a better approach for different ASGM communities. Moreover, with the openness of the data, this shows a positive action, since data transparency²² levels in Indonesia are low (Nugroho, Zuiderwijk, Janssen, & De Jong, 2015), which makes data, especially data regarding ASGM, appear to be highly useful.

However, a problem with this database is that no local government staff members are willing to upload the data, due to their reluctance to go to the ASGM site or their lack of budget for monitoring and collecting data at the ASGM site. While several NGOs have data regarding the conditions of miners and mercury usage and they have already sent this to the government, the data has not been uploaded onto the website. It appears that the

²² Data transparency here means that data can be viewed, acquired and presented easily for public consumption (Zuiderwijk, Gaseó, Parycek, & Janssen, 2014)

government is still trying to find data by themselves. The current study also reveals that a lack of information regarding the social conditions and market availability for alternative livelihoods, in the vicinity of the miners, has hindered efforts to switch the livelihoods of the miners in Banyumas regency. Despite the fact that most miners in the Banyumas region come from farming backgrounds, the government is still in doubt as to whether farming is the correct livelihood for these miners. This doubt has occurred as a result of insufficient ASGM information, which derives from the stakeholders' scant efforts to identify the socio-economic conditions of the miners and feasible options for alternative livelihoods.

A lack of information regarding the conditions of ASGM, as one of the technical barriers, is consistent with the findings from Echavarria (2014), Hilson (2006), Hilson (2007) and Ledwaba (2017). They found that a deficiency in information on ASGM has made the government and international donors make wrong decisions in the selection of policy, approach and technology for different ASGM communities, in order to reduce mercury usage. This type of inappropriate approach can be seen in the current study, when an NGO tried to introduce a technology (gravity concentration), which is a new technology to the miners (and might not be suitable for the geological conditions in Banyumas regency). Thus, miners in Banyumas regency did not adopt the technology, due to the low results of gold production, compared to using mercury. However, this view comes from the stakeholder (institution and local cooperative) actually involved in the implementation of the NAP. Further study, including extensive interviews with miners is needed, in order to clarify the issue regarding the failure of gravity concentration.

Trust in technology

Technology is an important part of the NAP, in order to eliminate mercury usage in ASGM. The selection of technology is dependent on the geological characteristics of various ores; the social conditions of the miners; and the level of knowledge of the miners (Veiga, Angeloci-Santos, et al., 2014). Despite the fact that BPPT has already released information regarding suitable technology, which is cyanide for Banyumas regency, several stakeholders (ministries and local government) still find it difficult to accept the technology. This is due to an incorrect view and/or poor understanding of cyanide. The current research reveals that

the majority of respondents, who have a low level of trust in cyanidation, always emphasise the danger of the cyanide process and its tailing. The findings of this study are in contrast with the successful case of mercury reduction in Colombia, where stakeholders, especially from the government side, fully supported the use of cyanide to replace mercury (García et al., 2015).

As described in sub-section 6.2.1, there are approximately 12 cyanide processing plants in Banyumas regency. During a visit to a respondent (from a local cooperative), who owns a cyanidation plant, the researcher had the opportunity to ask questions regarding cyanidation techniques in his processing plant. Surprisingly, the respondent showed a good knowledge of the cyanidation process. Nevertheless, data regarding production per day from the cyanide facility could not be obtained, as the respondent was reluctant to answer the researcher's questions. One cyanide processing plant in Banyumas regency can employ between three to four workers (interview, CO02), which means there are approximately 36 – 48 miners who already know about the cyanidation process. However, further study needs to be conducted, in order to ascertain the exact number of miners who are familiar with cyanidation technology in Banyumas regency. The results of this study support the argument of Veiga et al. (2009) that artisanal and small-scale gold miners in several countries already know about the cyanidation process, since it only requires a basic knowledge of chemistry and a small investment in equipment.

Due to the number of cyanide processing plants and the local knowledge of miners regarding cyanidation technology, switching from mercury to cyanidation might not be a problem. Thus, the trust issue is mainly located in the stakeholders. If several stakeholders still insist on using another technology, rather than cyanide, these stakeholders need to ensure that this technology is not going to face failure, such as the gravitation technology previously described. Similarly, several studies in the past have shown that the ineffectiveness of a particular technology has brought failure to several mercury reduction projects in the past (Hilson, 2006; Hilson & Vieira, 2007; Miserendino et al., 2013; Veiga, Angeloci, et al., 2014). This failure might reduce trust in alternative technology, both from miners and government. Therefore, unless there is a technology that is simple and able to

produce gold in larger amounts than production from cyanide leaching and mercury amalgamation, cyanidation remains the most viable option for artisanal and small-scale gold miners in Banyumas regency.

Location difficulties

Several respondents state that the new WPR location, recently proposed by Banyumas regency, creates difficulties for the establishment of a pilot plant project. The location is not large enough, according to a respondent. This infers that the design of the pilot plant project and the placement of the tailings pond are not correct. Due to space limitations, the placement of the tailing should be designed carefully, since there is a risk of overflowing of the tailings, similar to past experiences, as mentioned by several respondents (BI01, CO02 and PV01).

The current study reveals that the distance to reach the ASGM site is not a problem in Banyumas regency. Thus, this study contradicts several studies which mention that distance or remoteness of an ASGM site can act as a barrier, since it complicates the distribution of logistics and equipment (Davies, 2014; Echavarria, 2014). In Banyumas regency, most of the gold processing plants are located in the middle of villages, which can be accessed easily. Similarly, the location of the pilot plant project is also accessible, since it is also located near the village and mine site (interview, BP01). However, space limitation is the main barrier regarding the establishment of a pilot plant project and tailing pond.

Lack of miners' involvement

One action plan in the NAP is to establish a pilot plant project near an ASGM site. The BPPT and MoEF plan to establish this pilot plant project in Banyumas regency. However, capacity selection for the project has not considered the production from local miners using the amalgamation method, nor the miners who are already involved in the cyanidation process. A respondent argues:

“They [miners] use cyanide without knowing the right procedure for cyanidation process. It’s different [with the process in pilot plant]. We

[BPPT] have studied on what the optimum parameter [for cyanidation] looks like, [while] they just put it [cyanide] without awareness. And how to monitor [for the process and tailing]? They [miners] already know that cyanide is dangerous, but how to monitor [or] knowing the safe condition, they do not know that” (interview, BP01).

The current study shows that the selection of technology by BPPT used a top-down approach. This can be seen where central government points out what is best for the implementer or target group and accommodating little information from the target group (Barrett, 2004). However, this approach by BPPT is in contrast with the suggestion from several scholars, such as Buxton (2013), Køster-Rasmussen et al. (2016) and Spiegel et al. (2015) that local miners also need to be involved in the selection of technology and decision-making; in this case, the decision about the production capacity of the pilot plant project and management of the infrastructure for this project.

Several respondents have raised their concerns over the size of the production being too large (1,500 kg per day) for the miners, where their daily ore production is between 500 and 800 kg per day (interview, CO01). This plant, with only have a one-line capacity, exceeds the miners’ normal production and the long processing time (up to two days) will result in a long queue. Despite a respondent arguing that the miners should increase their production, store their gold ore and process their ore every two or three day – and not every day - to avoid the long queue (interview, BP01), there is no guarantee that the miners will accept that suggestion. Increasing gold ore production will need more capital, while storing the ore will not bring direct cash for the miners. Therefore, a suggestion from the cooperative manager to reduce the capacity and add more production lines should be considered by the BPPT. If the BPPT still continues to build the project plant without listening to the needs of the miners, it is possible that these miners again will start to use mercury, due to long queues and a limited line production, since these miners need fast cash.

Similarly, a study by Hilson (2007) showed a lack of miners’ involvement in determining the capacity of a pilot plant project in Zimbabwe called the Shamva Mining Centre. This

resulted in a long queue that resulted in the miners leaving the processing centre and going back to using mercury. Eventually, all miners left the Shamva Mining Centre and the processing centre was abandoned. Therefore, if the stakeholders in Indonesia want their pilot plant project to work properly, they must learn from the experience of Zimbabwe.

6.3.4 Socio-economic barriers

Miners' beliefs

Culture is one factor that influences miners' beliefs. According to a respondent, several miners are reluctant to be involved in health tests, since they are afraid that the sample (hair and nail) would be used for another purpose that contradicts their culture. Findings of the current study support to studies in the past (Heemskerk, 2005; Nyame, 2010; Soemarwoto & Ellen, 2010; Sulaiman et al., 2007), where customs, miner's traditions and false beliefs acted as a barrier to a mercury reduction effort, especially for miners to switch the method. While belief that complicates the health tests among the artisanal and small scale miners, as revealed in the findings is not discussed in the studies above. Despite the fact that only one respondent mentions this barrier, it should be noted that a clear explanation should be clearly given at the beginning of environmental and human tests, in order to provide the miners with factual information.

According to several respondents, the miners view health tests as not being important for them. When the health test is conducted, local government medical staff members sometimes need to go directly to the mining site, in order to obtain the sample. Running the environmental test directly at the mine site is a good idea, in order to get more participants. However, it consumes more time and not all ASGM sites can be safely visited by staff. The mine site could be located in a conflict area or even in an area where there is a high level of mercury in the air (Cordy et al., 2011; Heemskerk, 2005). This shows that not all miners understand the importance of the tests. This reluctance of miners to undergo tests will create a difficulty in ascertaining the level of mercury in their bodies and it will hinder the distribution of aid for miners who already have dangerously high levels of confirmed mercury exposure.

Miners' social conditions

Several respondents see miners' reluctance to adopt gravity concentration and cyanidation as due to the complexity of these processes and the longer time needed for gold recovery, compared to mercury. This reluctance to adopt the alternative technology has been predicted, due to the lack of capital among the miners. A respondent states: "According to me, [gold] mining [in here] is like a gambling, sometimes they get the result [as expected], sometimes not. Some miners even need one week to get the gold" (interview, PV01).

Miners need instant money to cover their expenditure. This need for instant money hinders the switch to other technology, as seen in several past studies (Debrah et al., 2014; Hilson & Ackah-Baidoo, 2011; Hilson & Pardie, 2006; Miserendino et al., 2013; Spiegel, 2009b). However, much of the published research asserts that poverty is a barrier that results in the miners continuing to use mercury. In the case of ASGM in Banyumas regency, due to a lack of baseline data regarding ASGM, further study needs to be conducted to gain knowledge on whether poverty or other factors keep miners using mercury.

6.4 Recommendations for improvement of the NAP

Based on the findings and discussion above, there are several recommendations that could be adopted by the stakeholders to improve the progress of the NAP and to reduce the inherent barriers to implementation. The following recommendations have been organised based on the frequency of each barrier, from high frequency to low frequency.

6.4.1 Improving financial availability for the implementation of NAP

Budget always becomes a problem for the stakeholders, whenever they want to implement the action plan. There are several recommendations that can be taken, in order to overcome the budget issue. Firstly, at national level, Bappenas should be the agency that has the task to plan budget availability for ministries and/or agencies. Bappenas has the authority to select programmes from ministries or agencies at national level that need to be prioritised

(Arvirianty, 2016). Classification as a prioritised programmes means that the programmes will have a special budget allocation and the budget to run the program will not be deducted as a result of subsequent budget cuts (Arvirianty, 2016). Thus, Bappenas should be included as an active stakeholder and regularly invited to the ASGM forum meetings. With the active involvement of agencies that have a responsibility for the budget, it is hoped that the budget for the implementation of the NAP will not be reduced in the middle of the year, or even at the beginning of the year due to budget deficiencies.

Secondly, any deficiency in the budget can be reduced by sharing the budget for the NAP implementation among the stakeholders. At the beginning of the year, each ministry or agency should inform their available budget for the implementation of the NAP. Moreover, by mapping budget availability among the stakeholders at national level, the stakeholders can then allocate the available budget to parts of the action plan that need more attention, such as ASGM data baseline collection, trainings or technology demonstrations.

Thirdly, local stakeholders involved in the NAP should undertake similar activities as those recommended for the national government. They should identify the actor responsible for allocating the budget and cooperate actively with that actor. In addition, local government should allocate more funds towards the formalisation of ASGM. Additional funds should also be used for investment in the equipment needed for health and environmental tests.

6.4.2 Improving the regulation of formalisation and mercury usage

The general finding of this research is that central government has made a good effort to support local government to formalise artisanal and small-scale miners. However, support to date should be followed up by an understanding of the issues faced by local governments. Lack of political will from local government to formalise the ASGM sector, aside from budget constraints, is due to a lack of support from the polices regarding the environment and safety for ASGM. For example, confusion on how to create guidelines for environmental licencing, or the formalisation of miners working within an area, contrast with the provision of ASGM within existing mining laws.

In order to resolve this situation, it is recommended that central and local government sit down together and discuss the problems related to formalisation and the observed lack of policy support towards ASGM. Despite this situation, the Indonesian government has already initiated a national forum for ASGM. However, in order to solve the formalisation issue, it is recommended that this be discussed separately from the forum, to ensure more time for the discussion. It is hoped that by focussing solely on the formalisation issue, solutions will be found on how to create a legal framework for formalisation, and on the type of policy that is needed to support formalisation in ASGM. Thus, it is hoped that these solutions can also be used by other regencies that have similar issues as Banyumas regency.

6.4.3 Strengthen stakeholders' participation and coordination

Based on the discussion presented in this chapter, there are several recommendations to strengthen stakeholder participation and coordination. (1) At national level, the role for the Coordinating Ministry for Maritime Affairs should be expanded into several ministries, with specific focus on the MoEF. Moreover, the Indonesian president should issue a presidential instruction regarding the delegation of supervision and coordination to technical ministries, such as MoEC, BPPT and Bappenas, in the case of the NAP to eliminate mercury in ASM in Indonesia. By expanding the task and supervision responsibilities, the Coordinating Ministry for Maritime Affairs could lead implementation, which would help to improve the horizontal coordination among the ministries and push the enactment of policy needed to implement the NAP.

(2) Central government and local government should conduct regular meetings, in order to review what has been achieved at local level. At the beginning of the year, there should be a meeting between central and local government, in order to harmonise the action plan programme and decide what programmes will be undertaken by local government, in order to reduce redundancy in the implementation of the action plan programme. Thus, at the end of the year, the results from the programmes undertaken by local government can be collected and evaluated together.

(3) Local government should establish a local ASGM forum to enhance coordination among the different agencies at local level. By establishing a local ASGM forum, local stakeholders can determine other agencies or academics that need to be involved with local stakeholders, in order to help implementation of the NAP.

(4) The involvement of various stakeholders at national and local level needs to be encouraged. At the present time, the involvement of national and local academics is scarcely seen in the implementation of the NAP, especially in the Banyumas regency. Academics are only involved in the early meetings of the ASGM forum and they are not fully involved in the field activities. With the involvement of various stakeholders to help the implementation of the NAP, several barriers, such as the lack of human resources at local government level can be reduced. In addition, academics could help to investigate not only suitable alternative livelihoods for the miners but also market availability, by conducting research into such alternative livelihoods; and this would be especially helpful for the miners in Banyumas regency. The results of the research could be collaborated with the training for an alternative livelihood programme, thus helping the ministries and local agencies to improve the progress of implementation of the NAP.

(5) There is a need to improve the role of other stakeholders in ASGM data collection, including the completion of the ASGM database and technological development. The current research shows that NGOs and academics have the potential to fill the gap in data collection and completion of the ASGM database. The government (in this case the MoEMR) can cooperate and offer more authority to NGOs and academics to conduct data collection and improve the mercury database. Moreover, the Indonesian government can create a Memorandum of Understanding (MoU) with NGOs and academics regarding their responsibility and obligation in regards to data collection and completion. Thus, the data obtained by NGOs and academics can be taken into account based on its validity and reliability.

(6) Miners are also considered stakeholders in the implementation of the NAP. Several scholars have made recommendations as to how to best approach artisanal and small-scale

gold miners (e.g. Veiga, Angeloci-Santos, et al., 2014). However, gathering knowledge about the needs of miners is very important. BPPT, as the technological agency, should involve miners or miners' representatives (arising from cooperation) in discussions about a pilot plant project. Through better understanding working conditions, the daily ore production and social conditions of the workers, hopefully the failure recorded for the Shamva processing centre in Zimbabwe will not occur in the pilot plant project in Banyumas regency. BPPT and other stakeholders should adopt a bottom-up policy implementation approach, in order to accommodate the needs of the miners.

Miners could also be potential trainers in switching from mercury amalgamation to an alternative technology. With the amount of the cyanide processing plants in Banyumas regency, BPPT or academics could cooperate with the workers who have worked and gained experience in the cyanidation process. The selection process of trainers must be undertaken at an early stage, so that the knowledge level of the cyanidation process among the miners can be determined. Alternatively, BPPT could cooperate with the cyanidation processing plant owned by local miners, in order to demonstrate the process of the cyanidation plant to other miners.

6.4.4 Developing approaches and tools for information dissemination

At the present time, data regarding health and environmental tests, geological tests and/or social conditions of the miners are scattered within each ministry, agency or NGO, which undertook such research in the past. It is recommended that this information is uploaded into a single database or online document. Alternatively, MoEMR can add another feature to its mercury database website, in order to store baseline data information that can be accessed by stakeholders.

Disseminating information to artisanal and small-scale gold miners should also be done by using an approach that considers the cultural context of the miners. This study shows that the workshop presented in Banyumas regency was considered to be too formal by one respondent. A cultural approach should be used to disseminate the information, either by

using a theatrical play or a cultural show, such as a leather puppet (wayang) that is used to convey moral messages or criticisms to communities in Java island (Pausacker, 2004). Thus, by using an approach that is close to the culture of the community, it is expected that the message on the dangers of mercury and the importance of health tests etc. will reach a wider audience - that is not only the miners but also people and children living in the surrounding communities.

Improving knowledge of alternative technology for the miners can be done in several ways. In the past, several mercury reduction projects have utilised a Transportable Demonstration Unit (TDU), which is a mobile classroom that offers the miners a flexible time of training in technological practices (McDaniels et al., 2010). In addition, if possible, the stakeholders can modify the TDU to become a mini-processing facility, in order to demonstrate to the miners how the alternative technology works. For example, it can show how cyanidation works, by involving the miners directly in the processing plant process and thus helping the miners to become accustomed to the alternative technology. Most importantly, the TDU can be used to convince the miners about how the alternative technology is able to produce better results, compared to amalgamation.

The characteristics of artisanal and small-scale gold miners is that they 'will not pay out a dollar for a piece of equipment or technique that does not return two dollars' (Hinton, Veiga, & Veiga, 2003, p. 102). Therefore, theoretical classrooms or workshops are not going to work unless there is a technology demonstration, such as the TDU. Furthermore, the TDU can help miners to see how they should practise the alternative technology process, for example cyanidation, and how they can produce more gold by using the cyanidation than when they use the amalgamation technique.

The current study has revealed that a lack of information regarding the management of cyanide in ASGM has made stakeholders reluctant to support cyanide technology. In order to increase trust in alternative technology among stakeholders, continuous discussions or workshops should be presented by and for different stakeholders. This discussion should involve academics who can offer ideas on how to manage better cyanide use in ASGM.

6.5 Summary

Based on the framework used to assess progress in the implementation of the NAP, several action plans have been progressing well and in line with Article 7 and Annex C of the Minamata Convention. However, there are several action plans that need to be improved, such as formalisation and alternative livelihood programmes for miners. This discussion chapter also shows that there are several barriers that need more attention, such as a legal framework for the formalisation of the miners and further data collection and coordination among the stakeholders, since these actions are priority listed in Annex C of the Minamata Convention on Mercury.

Several barriers identified in this study have also been found in several studies in the past, for example limitation of resources; a lack of political will; a lack of policy support; and lack of knowledge about miners' socio-economic conditions. Moreover, other barriers identified in this study are new barriers not found in other studies, such as a lack of trust in alternative technology and inadequate equipment provided by local government.

Based on the discussion in this chapter, several recommendations are offered to improve the implementation of the NAP and to reduce barriers. Firstly, financial availability needs to be improved. This can be done by involving the agency responsible for budget planning. With the involvement of this agency, it is expected that the NAP will be listed as a government priority programme with budget that will not be reduced in the middle of the year. Budget sharing can also occur among the stakeholders implementing the NAP.

Secondly, regulation of formalisation and mercury usage needs to be improved. This can be done by creating a discussion event between local and central government. Moreover, NGOs and academics could also be asked to join the discussion, in order to gather new ideas regarding formalisation in ASGM.

Thirdly, stakeholders' participation and coordination needs to be strengthened. This could be done in several ways. The appointment of one coordinating ministry as the leader for

implementation of the NAP could improve coordination among stakeholders and especially at national level. In order to harmonise the implementation of the NAP, local and central government should conduct regular meetings, which can provide clarity on what tasks should be done by local government and how central government can supervise. Coordination at local level is not sufficiently intensive (at this time) and thus, in order to improve coordination at local level, the establishment of a local forum, as a communication media hub among local stakeholders, should be done immediately. In addition, encouraging the involvement of various stakeholders, such as academics and miners, could also potentially strengthen participation and coordination among stakeholders.

Lastly, it is necessary to develop an approach and tools for information dissemination. The workshop in Banyumas recorded during the current research was seen as being too formal and therefore, another method that accommodates the culture of the miners' community needs to be used, in order to disseminate information. This action could also be undertaken by the use of a TDU or mini-processing plant, to ensure that the miners understand the options for alternative technology to replace mercury. Information dissemination among stakeholders is needed to improve the level of trust in alternative technology. This can be done by creating continuous discussions between stakeholders to clarify information for everyone - especially for local government staff and ministry or agency's staff, who often have a low level of trust in alternative technology.

Chapter 7

Conclusion

7.1 Introduction

Mercury is one of the threats to human health and the environment. The largest contributor towards mercury pollution in Indonesia comes from the ASGM sector. Indonesia is a signatory to the Minamata Convention on Mercury and thus has established a NAP, in order to eliminate mercury from its ASGM sectors between 2014 and 2018. Insufficient information has been available regarding the progress of implementation of the NAP and the barriers that hinder its implementation. Therefore, the aim of this research was to investigate the extent to which Indonesia is ready to implement its NAP and, in so doing, identify the potential barriers that have affected the implementation of plans to eliminate the use of mercury in ASGM. Several frameworks, such as barrier categorisation and assessment towards the implementation of the NAP, have guided the analysis in this research. This chapter describes how the research meets the aims and research objectives defined in Chapter 1 (section 1.3), and presents recommendations for future research.

7.2 The implementation progress of NAP

From 2014 until 2016, a number of actions to eliminate the use of mercury were undertaken by ministries, agencies, NGOs and local government, based on plans set out in the NAP. Based on the research conducted for this thesis, it can be asserted that the Indonesian government has dedicated a good effort towards implementation of the NAP. As there is no standard to quantify progress, the researcher concludes that implementation of the NAP is progressing reasonably well, although improvements should be made to several action plans. Therefore, signs of good progress in the implementation of the NAP can be indicated from this research:

- A Forum of the ASGM has been established, in order to improve collaboration between stakeholders at national level. This forum has led to the implementation of a number of action plans in the NAP that were undertaken by several ministries, NGOs and local government. However, no forum for ASGM at local level has been established. Thus, coordination among local government institutions involved in the implementation of the NAP is currently not strong.
- A number of regulations regarding the management of mercury in ASGM have been proposed. These regulations include the prohibition of mercury and its trade in ASGM. However, regulations for formalisation have not been enacted yet by local government. This research highlight that the reluctance of the government to establish regulations for formalisation is due to several factors, such as, budget availability and the small amount of tax that is paid to the government by the miners (i.e. there is no financial incentive for local government to enact the regulations).
- Several investigations of the geology, environment and miners' health have been conducted in Banyumas regency. These tests, in association with information gathered on the geology of the area, have resulted in a technological recommendation by the BPPT that cyanidation be used in Banyumas regency. Several environmental and health tests in Banyumas regency indicate that mercury in the environment is still at a high level. Based on health tests conducted in Banyumas between 2014 and 2016, the symptoms of mercury intoxication, such as tremor, insomnia and gingivitis, are still seen in miners, although the number of symptoms has slightly decreased over the period 2014 to 2016 among the miners.

However, not all the action plans are running according to plan and there are several action plans that cannot be fully implemented. Formalisation of miners and the collection of baseline information regarding miners and mercury usage in ASGM remains a large and unachievable workload, especially for local government. These issues have generally arisen due to the lack of a legal framework and deficiencies in the set budgets. Other action plans that are not progressing well include training for alternative livelihoods; demonstrations of

technology; inclusion of mercury in the national curriculum for schools; and an evaluation of the NAP activities and voluntary activities. These action plans show inadequate progress. The deadline for full implementation of the NAP is 2018, and government agencies need to create a new strategy to deal with the current situation.

There is one important programme that has not been addressed by the NAP. The lack of microfinance for miners to invest in mercury-free technology has not been addressed by the NAP. Despite the willingness from one ministry to provide 'soft loans', formalisation is still the obstacle that prevents ministries from offering loans. In addition, the focus of the NAP is still very general and there is no focus or strategy towards opportunities for women, as listed in the NAP. Inclusion of local knowledge in the implementation of the NAP is currently limited.

7.3 Barriers affecting implementation of NAP

The current research has shown that there are four main barriers towards the implementation of the NAP. Firstly, institutional barriers, which are barriers inside the stakeholder institutions. These barriers are caused by a lack of resources, both human and financial. Based on these limitations, several action plans cannot be implemented, including baseline data collection and training, especially alternative livelihood training. Other factors that contribute to these barriers are poor coordination and a lack of political will. Despite regular meetings in the ASGM forum, there is a lack of communication among stakeholders. Consequently, this has resulted in an unequal distribution of reports and knowledge among government institutions. In addition, there is no ministry that acts as a leader for the implementation of the NAP. Currently, a specific technical ministry might not implement a component of the NAP, as the order to implement is coming from another technical ministry. If a coordinating ministry was to be appointed that could manage and give orders to other ministries, this barrier might disappear. The lack of political will is most strongly apparent at the local government level through their unwillingness to formalise the miners, due to the low income and low revenue base that these miners represent. This situation has made progress towards formalisation run slowly.

Secondly, there are policy barriers that represent deficiencies within the legal framework towards formalisation of miners and policy support. The legal framework for formalisation is a strategy that will not only provide clear opportunity for taxation of the miners, but also give legal assurance to the institutions that want to implement the NAP. This formalisation should be supported with other policies, such as the inclusion of mercury awareness in the school curriculum and a guideline policy relating to environmental licencing in the ASGM sector.

Thirdly, respondents state that there are technical barriers to implementation, such as deficiencies in tools or guidelines, lack of information regarding ASGM, lack of trust in technology, location difficulties; and a lack of involvement from the miners. Miners' beliefs and behaviour, such as cultural beliefs, social conditions and the need for instant money to cover their expenditure, contribute to these barriers. Therefore, knowing and understanding the local culture and the reasons for why miners still use mercury is a key requirement for ongoing progress.

These barriers are general barriers that are likely to be apparent in other ASGM areas. Thus, the barrier categories as seen in the framework (Chapter 3) could assist the government to classify the barriers in other hot spots around Indonesia. Understanding the barriers that hinder the implementation of the NAP in the Banyumas case study area, and comparison of these barriers with the findings of similar research in other ASGM area will support the implementation of the Indonesian NAP to eliminate mercury.

7.4 Summary of recommendations

Several recommendations can be made to improve the implementation progress of the NAP and to reduce the barriers to its implementation. Institutions should improve their financial strength in the implementation of NAP. One way to achieve better economic sustainability would be to appoint an agency that is responsible for the budget planning and setting priorities. For example, at national level, Bappenas has the role for the task above and therefore, Bappenas should be included as an active member or stakeholder in the ASGM

forum. The same condition should apply to local government. Alternatively, government institutions can create budget sharing, which then reduces the burden of cost to implement action plans.

Formalisation is one of the main barriers to the implementation of the NAP. A solution towards this issue is strengthening current and potential stakeholder participation and coordination. Formalisation must be discussed between central and local government. In order to assist the discussion and coordination between local and central government or among ministries, a coordinating ministry should be appointed to lead the implementation of the NAP. The author suggests the Coordinating Ministry of Maritime Affairs as the coordinator for the implementation of NAP, since the ministry has an active participation for the implementation of NAP. In addition, by involving participation from other actors, such as academics, other technical issues, such as guidelines for environmental licencing, could also be solved.

Strengthening current and potential stakeholders' participation, by increasing the role of current institutions, could also help to hasten progress of the action plan. With more tasks divided among more institutions, the limitation on human and financial resources could be reduced. Improvement in local coordination should also be done by creating a local ASGM forum, where action plans that should be done by local government can be collaboratively implemented.

The last recommendation is to establish strategies and tools to support the implementation of the NAP. Several reports from the implementation of the NAP have not been distributed evenly to stakeholders, such as ministries and NGOs. Adding an online database to store reports that can be accessed by stakeholders can be a solution to successfully disseminating information. Workshops should also be held using a cultural approach and language that can be understood, not only by the miners but also by the government staff who attend. Moreover, a workshop offered only once a year is not going to be sufficient to increase the level of trust in alternative technology, especially for stakeholders. Continuous discussion should be occurring between all stakeholders. Through the use of demonstration tools, such

as a Transportable Demonstration Unit (TDU), the miners could improve their knowledge regarding alternative technological options. However, the technology shown in the TDU should be adapted towards the geological conditions of a target mining area, for example the ore in Banyumas regency.

7.5 Suggestions for future research

The findings of this study offer a varied range of research for the future. The implementation of the NAP should be seen from the viewpoint of both the implementers and the target of the NAP (in this case, the miners). The author recommends an increase in the respondent sample size, by adding more stakeholders, such as academics and NGOs, and other ministries, such as Bappenas. The inclusion of additional case study areas is also recommended to allow comparison of the state of implementation and barriers to implementation recorded in Banyumas to be compared to other ASGM areas. In addition, investigation of the perception of the miners towards the implementation of the NAP would be useful research for the future. By comparing what has been done so far by the implementers, and the miners' reactions and feelings regarding the implementation, progress of the NAP could be more accurately measured. For example, a workshop for the miners should also be followed by a study that records improvements of mercury awareness and technological knowledge. In this way recommendations could be specifically tied to the needs of the miners.

Investigating alternative livelihoods for the miners and linking this to the NAP programme is another suggestion for future research. At the moment, only limited research has been done towards the identification of alternative livelihoods in ASGM (Anderson, 2013; Hilson & Banchirigah, 2009; Suhartini & Abubakar, 2017). No study has specifically identified potential livelihoods that can run in parallel with or replace ASGM activities in Banyumas regency or other Indonesian ASGM mining areas. Despite the farming sector contributing 14% of the total income in Banyumas regency, research is needed to identify whether the livelihoods of the miners can be integrated with agricultural options, such a

metal farming (phytoextraction²³) (Anderson, Meech, Veiga, & Krisnayanti, 2014; Anderson, 2013), horticulture, or animal husbandry (Suhartini & Abubakar, 2017). New livelihoods will require investment in capital and consumables. As identified in this research, microfinance is not generally available to miners at the present time. One existing microfinance programme offered by the Ministry of Cooperative and Small Medium Enterprise is not sufficient for the needs of the miners. Therefore, in future studies, options for increased availability of microfinance from relevant institutions, leading to microfinance programmes for the miners, will further support implementation of the NAP.

7.6 Conclusion

Progress towards the implementation of a NAP to eliminate mercury from ASGM throughout Indonesia, and particularly in Banyumas regency, demonstrates that the Indonesian government has taken seriously its responsibility to eliminate mercury use. However, implementation of the NAP is not without flaws. There are several action plans that cannot be progressed, due to barriers that impede implementation. The Indonesian government and international donors (if they wish to cooperate with local and national governments) need to understand these barriers, if implementation of the NAP, and other mercury elimination projects in the future, is to continue. Aside from the need for a single ministry to become the leader for implementation, support from other national actors, together with international donors and international experts, is necessary, if the identified barriers are to be permanently removed. Several barriers, such as financial and technological limitations cannot be solely removed by local or national governments. Wider cooperation is necessary between the Indonesian government and international donors and/or experts to secure funding for implementation of the NAP; and to provide mercury-free technological solutions for the miners. Moreover, cooperation between experts and government could provide viable options for alternative income for ASGM miners. This is a critical issue which has yet to be solved by the Indonesian government. As a result of better cooperation between the government and national or international actors, it is hoped

²³ Phytoextraction is a method to eliminate contaminants from soil by using plants (Anderson, 2013). On a larger scale, metal farming could be done, not only to remove contaminants, but also to extract fine gold from the soil

that a more sustainable solution can be proposed, which will eventually reduce mercury usage and save future generations from the dangers of mercury in the environment.

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Appendix 1: Stakeholder in NAP for mercury elimination in ASGM

1. Stakeholders listed NAP to eliminate mercury

No	Key components	Programmes	Responsible stakeholders	Relevant stakeholders
1	Legal Framework and institutional strengthening	Regulation review to eliminate and ban the use of mercury ASGM	Ministry of Energy and Mineral Resources (MoEMR),	Ministry of Environment and Forestry (MoEF), Ministry of Health (MoH), Ministry of Trade (MoT)
		Develop policy and regulation framework in management of mercury	MoEMR	MoEF, MoH, MoT, Customs, Criminal Investigation Agency (CIA)
		Assessment of current trade (import and export) of mercury (legal and illegal) for ASGM		MoEF, MoH, MoT, MoEMR, CIA, Customs

No	Key components	Programmes	Responsible stakeholders	Relevant stakeholders
2	Research and development	Establishment of multi stakeholders communication forum related with ASGM activity	MoEMR	MoEF, MoH, MoT, Ministry of Communication and Informatics (MoCI), Indonesian Institute of Science (LIPI), Ministry of Home Affair (MoHA), University of Indonesia (UI), CIA, Ministry of Education and Culture (MoEC), NGO, and Agency for Assessment and Application of Technology (BPPT)
		Capacity building for government officer to improve ASGM management	MoEMR	MoEF, MoH, MoHA
		Assessment of NAP activities and voluntary activities	MoEMR	MoEF, MoH, BPPT
		Assessment of NAP activities and voluntary activities	MoEMR	MoEF, MoH, BPPT

No	Key components	Programmes	Responsible stakeholders	Relevant stakeholders
		Mercury and ASGM system information management	MoEMR	MoEF, MoH, MoT, Customs, MoT, MoHA, MoCI, Local government
		Development of Alternative technology and technique for tailings storages	MoEMR and MoEF	BPPT, LIPI, BPPT, LIPI, University
		Research to determine the impact of mercury in ASGM to human health	MoH	MoEMR, MoEF, University
		Periodic monitoring and research of mercury exposure to environment in ASGM	MoEF	MoEMR, LIPI, Local government
		Research on life cycle of mercury in ASGM activity in Indonesia	MoEMR	MoEF, LIPI, BPPT, UI, MoT, Customs
3	Improvement of Awareness and communication	Training for ASM to introduce non-mercury technology alternative Information dissemination regarding mercury and alternative technology using available information media	MoEMR MoCI	MoEF, LIPI, BPPT MoEMR, MoEF, LIPI, MoH, BPPT

No	Key components	Programmes	Responsible stakeholders	Relevant stakeholders
		Training to provide option of alternative income to local people in the vicinity of ASGM sites	MoEMR	MoHA, Ministry for Cooperative And Small and Medium Enterprise (MCSME), local government
		Inserting the information regarding the danger of mercury in the national education curriculum	MoEC	MoEMR, MoEF, MoHA, MoH
		Evaluation of awareness improvement in the ASM miners	MoEC	MoEMR, MoEF, MoHA, MoH

2. Stakeholders not listed in the NAP to eliminate mercury

No	Name	Level
1	Coordinating Ministries of Maritime Affairs	National
2	Bappenas	National
3	Local village office	Local

Appendix 2: Components of NAP for mercury elimination and time frame

No	Sub key components	Programmes	Indicators	Sub indicators	Timeline
Legal framework and institutional strengthening					
1	Management of mercury distribution and usage in ASGM	Regulation review to eliminate and ban the use of mercury ASGM Develop policy and regulation framework in management of mercury	Regulations to support mercury elimination and prohibit mercury in ASGM ASGM	Existence of regulation and policy to support mercury elimination and restriction in ASGM Draft regulation of mercury restriction in ASGM and President Instruction on NAP to phase out mercury in ASGM Information on mercury national demand Assessment of mercury black market and prevention procedure	2014-2015 2014-2016 2014-2018

No	Sub key components	Programmes	Indicators	Sub indicators	Timeline
2	Institutional strengthening	Establishment of multi stakeholders communication forum related with ASGM activity	Establishment of stakeholders' national and regional forum	Establishment of national and regional forum	2014-2018
				Regular meeting of national communication forum	2014-2018
		Capacity building for government officer to improve ASGM management	Implementation of competency improvement programme for government staff	-	2014-2016
		Assessment of NAP activities and voluntary activities	Evaluation of NAP activities and voluntary activities	Existence of evaluation criteria to assess the NAP activities and voluntary activities	2014-2016
				Result of assessment toward the initiatives	

No	Sub key components	Programmes	Indicators	Sub indicators	Timeline
Research and development					
1	Information development	Mercury and ASGM system information management	Database on mercury usage	Data of mercury use in district and province	2014-2018
				Baseline data of ASGM	2014-2018
		Development of Alternative technology and technique for tailings storages	Study on alternative technology	Information on alternative technology	2014-2018
				Feasibility test result of the alternative technology	
				Assessment of alternative technology pilot project	
				Information and guidelines on alternative method and technique for tailing and hazardous waste storage	2015-2018

No	Sub key components	Programmes	Indicators	Sub indicators	Timeline
2	Mercury information management	Research to determine the impact of mercury in ASGM to human health	Study on health effects due to mercury	Availability of primary and secondary data	2015-2016
		Periodic monitoring and research of mercury exposure to environment in ASGM	Study report on mercury levels in the environment	Availability of primary and secondary data	2016-2018
		Research on life cycle of mercury in ASGM activity in Indonesia	Study report on mercury lifecycle	Availability of primary and secondary data	2014-2016
Improvement of awareness and communication					
1	Capacity building	Training for ASM to introduce non-mercury technology alternative	Implementation of workshops, training and demonstration of alternative technology	Information on ASM site target and the number of miners The number of training implementation	2015-2018

No	Sub key components	Programmes	Indicators	Sub indicators	Timeline
		Information dissemination regarding mercury and alternative technology using available information media	Media cooperation	The number of implemented campaign	2014-2018
		Training to provide option of alternative income to local people in the vicinity of ASGM sites	Alternative livelihood training	Information on ASM site target and the number of participants	2016-2018
				The number of implemented campaign	
		Inserting the information regarding the danger of mercury in the national education curriculum	Inclusion of the danger and risk of mercury in the national education curriculum	Availability of teaching materials plan Teaching materials are included in the national curriculum	2015-2018
				Result of the evaluation	

Appendix 3: Respondent's code

Organisation name	Number of Informants	Position within organisation	Interview date / Sampling method	Identification Code
Directorate General of Mineral and Coal – MoEMR	4	Mine inspector	20 February 2017 PS	MEM01
		Policy analyst	22 February 2017 SS	MEM02
		Planning officer	23 February 2017 SS	MEM03
		Section head	30 March 2017 PS	MEM04
Geology Agency – MoEMR	2	Senior staff	20 March 2017 SS	GA01
		Division head	20 March 2017 SS	GA02
Coordinating Ministry for Maritime affairs	1	Division head	20 March 2017 PS	CM01
MoEF	1	Division head	6 March 2017 PS	MEF01
MoH	1	Section head	7 March 2017 PS	OH01
BPPT	2	Research officer	9 March 2017 PS	BP01
		Director	9 March 2017 SS	BP02
The Energy and Mineral Resources Agency of Central Java Province	3	Mine Inspector	28 February 2017 PS	PR01
		Senior staff	14 March 2017 SS	PR02
		Section head	13 March 2017 SS	PR03
Environmental Agency of Banyumas Regency	1	Section head	1 March 2017 PS	EA01
Health Agency of Banyumas Regency	1	Section head	1 March 2017 PS	HA01
Paningkaban Village	1	Headman	28 February 2017 SS	PV01
The Blacksmith Institute Indonesia (NGO)	1	Director	21 February 2017 PS	BI01
Sumber Rejeki Cooperation	1	Manager	1 March 2017 SS	CO01
Sumber Rejeki Cooperation	1	Staff	1 March 2017 SS	CO02
PS: Purposive sampling; SS: Snowball sampling				

Appendix 4: Participants' consent form



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Progress and Barriers to eliminate mercury in Artisanal and Small Scale Gold Mine (ASGM)

INFORMATION SHEET

Dear Sir/Madam,

My name is Hernandi Albeto Octaviano and I am from Bekasi City, West Java province, Indonesia. I am working for the Directorate General of Mineral and Coal, Ministry of Energy and Mineral Resources the Republic Indonesia. I am an environmental management master candidate in the Institute of Agriculture and Environment at Massey University in Palmerston North, New Zealand. I am currently conducting a study toward mercury elimination in ASGM, initiated by the Ministry of Energy and Mineral Resources. In particular, I am studying toward the progress of National Action Plan to mercury elimination in ASGM, as implemented in Central Java Province. As a part of the study, I am conducting field work in Banyumas Regency.

Description of study and invitation to participants of this study

As one of signatory to an international legally binding treaty called the Minamata Convention on Mercury, In 2013, Indonesia through the Ministry of Energy and Mineral Resources (MoEMR) of the Republic of Indonesia launched National Action Plan for the

phase out of mercury (NAP) in ASGM 2014 – 2018. The programme aims to protect the human health and environment from the adverse effect of mercury. The NAP programme has been implemented by the MoEMR in collaboration with other ministries such as Ministry of Environment and Forestry, (MoEF), Ministry of Health (MoH), Agency for Assessment and Application of Technology (BPPT), the provincial and district governments and other actors, such as universities, and Civil Society Organization (CSO), and other related parties. The performance of the NAP is indicated by how the implementations of the programs are undertaken by these stakeholders. However, there is a limitation of information on how the NAP has been understood and applied by associated stakeholders. While each actor provided report based on their roles and responsibilities, the progress report is scattered in each stakeholders. This situation creates difficulties in identifying types of programmes that have been implemented and how successful they are. This study will research the progress toward the implementation of the program inside NAP. Moreover, this study aims to investigate the performance of the NAP programmes in Indonesia and potential barriers that affect the implementation of these programmes to reduce the use of mercury in the ASGM during the period between 2014 and 2016. In order to achieve this aim, this study will examine the NAP implementation by stakeholders in national, provincial and regional level and in the miners to get their insight regarding the performance of the NAP. This study intends to provide insight on what NAP program that has the most and the least performance and identify barriers that influence the implementation of the program. In order to obtain data and information as stated above, I would like to conduct interviews with people with knowledge of and/or involvement in the programme at the national, provincial, district and mine level. Participants will be drawn from Ministries, CSOs, province and regency officer, and miners. In relation to this, I would like to invite you to participate in this study since you are in a position relevant to the administration of the programme or have been identified as having knowledge about the programme relevant to the research. If you decide to participate in this study, I would like to ask your permission to audio tape our one-on-one interview session. Your rights as a participant of this study are listed below.

Participant rights:

- Decline to answer any particular question.
- Withdraw from the study at any time during participation.
- Ask any questions about the study at any time during participation.
- Provide information on the understanding that your name will not be used unless you give permission to the researcher.
- Be given access to a summary of the project findings when it is concluded. Ask for the voice recorder to be turned off at any time during the interview.

Data management

In this study, the confidentiality of all participants will be kept assured by anonymizing all respondent's identity. However, for those who are in the position of responsibilities or in a specific role related to this, it is likely that your identity may be able to be ascertained because the district is going to be identified. The interviews will be protected under lock at Massey University and it can only be accessed by me. Data will be stored for five years and then destroyed. The final published thesis will be available at the Massey University library and can be accessed through the online catalogue.

Project contacts

In order to provide you with information regarding the contact persons of this study, below is my full contact along with the contact of the supervisor of this study.

Name	Position	Organization	Contact
Hernandi Albeto Octaviano	Researcher	Institute of Agriculture & Environment, College of Sciences, Massey University	81 Cook Street Palmerston North New Zealand Telephone: +64 22 0283967 Email: hernandi_ao@yahoo.com

Name	Position	Organization	Contact
Assoc. Prof. Chris Anderson	Chief Supervisor	Institute of Agriculture & Environment, College of Sciences, Massey University	Palmerston North Telephone: +64 (06) 356 9099 ext 84850 Email: C.W.N.Anderson@massey.ac.nz

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researchers named in this document are responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher, please contact Dr Brian Finch, Director (Research Ethics), email humanethics@massey.ac.nz.



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***Identifikasi kemajuan dan hambatan penghapusan merkuri di
pertambangan emas artisanal dan skala kecil (ASGM)***

LEMBAR INFORMASI

Salam,

Nama saya Hernandi Albeto Octaviano dan saya berasal dari Kota Bekasi, Provinsi Jawa Barat, Indonesia. Saya bekerja pada Direktorat Jendral Mineral dan Batubara, Kementerian Energi dan Sumber Daya Mineral Republik Indonesia. Saya adalah seorang kandidat Master di bidang Manajemen Lingkungan pada Institut Pertanian dan Lingkungan di Universitas Massey, Palmerston North, Selandia Baru. Saat ini saya sedang melakukan penelitian mengenai penghapusan merkuri di ASGM yang di prakarsai oleh Kementerian Energi dan Sumber Daya Mineral (KESDM). Dalam studi ini, saya meneliti terkait kemajuan penerapan program rencana aksi nasional penghapusan merkuri di ASGM di Provinsi Jawa Tengah. Sebagai bagian dari studi ini, saat ini saya sedang melaksanakan pengambilan data di Kabupaten Banyumas.

Deskripsi studi dan undangan kepada calon peserta studi

Sebagai salah satu negara penandatangan perjanjian internasional, Konvensi Minamata mengenai merkuri, pada tahun 2013, Republik Indonesia melalui Kementerian ESDM

meluncurkan Rencana Aksi Nasional (RAN) penghapusan merkuri di ASGM 2014-2018. Program ini bertujuan untuk melindungi kesehatan manusia dan lingkungan dari dampak buruk merkuri di pertambangan emas. RAN dilaksanakan oleh Kementerian ESDM bekerjasama dengan Kementerian terkait sebagai contoh Kementerian Lingkungan dan Kehutanan, Kementerian Kesehatan, Badan Pengkajian dan Penerapan Teknologi (BPPT), Pemerintah Daerah baik di provinsi maupun kabupaten, dan stakeholder lain seperti Lembaga Swadaya Masyarakat (LSM), universitas, dan pemangku kepentingan terkait lainnya. Pencapaian program-program RAN diukur dari sejauh mana pemangku kepentingan diatas melaksanakan program yang telah ditetapkan dan/atau direncanakan. Namun demikian, sepanjang tahun 2014 – 2016, belum terdapat informasi baik itu laporan resmi yang terpusat maupun jurnal terkait sejauh mana program RAN di di laksanakan oleh para pemangku kepentingan. Saat ini para pemangku kepentingan melaksanakan program-program tersebut berdasarkan peran, tugas dan tanggung jawabnya masing-masing, sehingga laporan pelaksanaan RAN tersebar di setiap pemangku kepentingan. Hal ini menyulitkan identifikasi program mana saja yang telah dilaksanakan dan seberapa jauh tingkat penerapannya. Studi ini bertujuan untuk mengidentifikasi sejauh mana pelaksanaan program di dalam RAN dan hambatan-hambatan apa saja yang berpotensi mempengaruhi penerapan program tersebut. Dalam rangka mencapai tujuan tersebut, studi ini akan meneliti pelaksanaan program RAN baik di sektor publik maupun sektor swasta di tingkat nasional, provinsi, kabupaten dan tingkat penambang. Studi ini bermaksud untuk memperoleh gambaran yang mendalam mengenai program yang memiliki penerapan paling tinggi dan paling rendah serta mengidentifikasi hambatan-hambatan yang mempengaruhi pelaksanaan program tersebut.

Dalam rangka memperoleh data dan informasi sebagaimana disampaikan diatas, saya bermaksud untuk menyelenggarakan wawancara dengan orang-orang yang memiliki pengetahuan dan atau terlibat dalam program RAN di tingkat nasional, provinsi, kabupaten maupun di sisi penambang. Peserta studi akan diambil dari sektor publik dan sektor swasta. Sehubungan dengan hal tersebut, saya bermaksud untuk mengundang Bapak/Ibu untuk berpartisipasi dalam studi ini karena posisi atau kedudukan Bapak/Ibu saat ini terkait dengan implementasi program RAN atau Bapak/Ibu telah diidentifikasi

memiliki pengetahuan tentang program RAN yang relevan dengan penelitian ini. Apabila Bapak/Ibu menyatakan berpartisipasi dalam studi ini, saya akan meminta ijin untuk merekam wawancara yang akan kita laksanakan. Berikut dibawah ini adalah hak-hak Bapak/Ibu sebagai peserta studi ini.

Hak peserta penelitian:

Berhak untuk menolak menjawab pertanyaan.

Berhak untuk mengundurkan diri sebagai peserta selama penelitian berlangsung.

Berhak untuk mengajukan pertanyaan terkait dengan penelitian selama kegiatan penelitian berlangsung.

Memberikan informasi dengan catatan nama Bapak/Ibu tidak akan dicantumkan kecuali Bapak/Ibu memberikan persetujuan.

Berhak untuk mendapatkan akses terhadap ringkasan hasil penelitian.

Berhak untuk meminta peneliti mematikan alat perekam selama proses wawancara.

Data management

Dalam studi ini, kerahasiaan seluruh peserta akan dijamin dengan tidak mencantumkan nama/identitas peserta. Namun, untuk Bapak/Ibu yang memiliki jabatan terkait dengan implementasi program RAN, ada kemungkinan bahwa jabatan Bapak/Ibu akan dicantumkan mengingat nama kabupaten dalam studi ini akan ditampilkan. Data wawancara akan disimpan ditempat yang aman di Universitas Massey dan hanya dapat diakses oleh saya. Data hanya akan disimpan dalam jangka waktu 5 tahun dan setelah itu akan dihancurkan. Publikasi final tesis ini dapat dijumpai di perpustakaan Universitas Massey dan dapat diakses melalui katalog online.

Kontak yang dapat dihubungi

Dalam rangka untuk menyediakan informasi lengkap mengenai kontak saya dan dosen pembimbing saya di studi ini, berikut adalah kontak kami:

Nama	Posisi	Organisasi	Kontak
Hernandi Albeto Octaviano	Peneliti	Institute of Agriculture & Environment, College of Sciences, Massey University	81 Cook Street Palmerston North New Zealand Telephone: +64 22 0283967 Email: hernandi_ao@yahoo.com
Assoc. Prof. Chris Anderson	Supervisor	Institute of Agriculture & Environment, College of Sciences, Massey University	Palmerston North Telephone: +64 (06) 356 9099 ext 84850 Email: C.W.N.Anderson@massey.ac.nz

Studi ini telah direview dan dinilai sebagai studi beresiko rendah. Oleh karena itu, studi ini tidak dievaluasi oleh komite etika universitas. Peneliti yang namanya tertera diatas bertanggung jawab terkait dengan etika dalam studi ini. Jika Bapak/Ibu ada pertanyaan terkait dengan pelaksanaan studi ini yang ingin disampaikan selain kepada peneliti, Bapak/Ibu dapat menghubungi Dr Brian Finch, Direktur Etika, email humanethics@massey.ac.nz.



Massey University

Department of Environmental Management
Institute of Agriculture & Environment
Massey University
PO Box 11 222
Palmerston North 4442
New Zealand

**Progress and Barriers to Eliminate Mercury in
Artisanal and Small Scale Gold Mine (ASGM)**

***Identifikasi kemajuan dan hambatan penghapusan merkuri di
pertambangan emas artisanal dan skala kecil (ASGM)***

PARTICIPANT CONSENT FORM-INDIVIDUAL

FORM PERSETUJUAN PESERTA

I have read the information sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

Saya telah membaca lembaran informasi dan telah mendapatkan informasi lengkap yang sudah dijelaskan. Pertanyaan yang saya berikan telah dijawab dengan memuaskan dan saya mengerti bahwa saya dapat mengajukan pertanyaan kapan saja.

I agree/do not agree to the interview being audio taped²⁴.

Saya setuju/tidak setuju terhadap proses rekam suara selama wawancara²⁵.

I agree to participate in this study under the conditions set out in the information sheet.

Saya setuju untuk berpartisipasi dalam penelitian ini sesuai dengan kondisi yang disampaikan dalam lembaran informasi.

Signature
(tanda tangan) _____

Date
(tanggal) _____

Full name-printed
(nama lengkap) _____

²⁴ Circle one of the options

²⁵ Lingkari bagian yang anda setujui

Appendix 5: List of questions for interviews

(N.B not all questions were questioned)

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
1	Ministry of Energy and Mineral Resource a. Deputy director of technique and environment mineral and coal b. Section head of environmental protection in mineral c. Staff in section of environmental protection in mineral	Mercury distribution in ASGM	Review of existing regulation to eliminate mercury in ASGM	- Current regulations that are associated with ASGM - Current regulations that need to be reviewed - Additional regulation needed to support the elimination - Formalisation of the ASM miners	- What are the regulations need to be reviewed? - How is the planning time frame to review the regulation - What are the regulations that have been reviewed? - What are the regulations that have not been reviewed? - How many times the responsible agent conduct meeting with other ministries? How is the coordination among stakeholders? - What outcomes have been generated from 2014-2015 - What is the barrier toward this sub program? Why the barrier happens? - Is formalisation of miners still becomes a problem? If yes, why? - Any recommendation to improve the program?

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
2	Ministry of Energy and Mineral Resource a. Deputy director of technique and environment mineral and coal b. Section head of environmental protection in mineral c. Responsible Staff		Policy and regulation framework in mercury management	• Outcome of the framework • The progress of draft regulation of mercury restriction in ASGM including the President Instruction to phase out mercury in ASGM	• What is the planning time frame for the programs and how is the implementation progress? • Who is the actor who really involved in this program? And how is the interaction? • Is the draft and President Instruction has already done and finished? If not why? And what are the barriers?
3	• Coordinating ministry of Maritime affairs • Ministry of Energy and Mineral Resource a. Deputy director of technique and environment mineral and coal b. Section head of environmental protection in mineral c. Responsible Staff • NGO's	Institutional strengthening	Multi stakeholder forums	• The existence of the forum • Participants of the forum • Past and future meeting • Result of the meetings • The usefulness of the meeting	• Has the forum existed • Who are the participants? • What is the result of the meetings? • How useful is the meetings? • Are there any barriers to gather the participants? • What are other barrier in conducting the forum

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
4	- Ministry of Energy and Mineral Resource - Ministry of Environment and forestry - Ministry of Health - NGOs		Training for government officer	- The existence of the program - Participants that attended the training - Number of trainers and the source (human and financial) for the program - Curriculum of the training - Training that have been delivered - Training for creating AMDAL document	- Has the training existed? If yes when and where? - Who are the participants? - Who are the trainers? - Who provide the financial resource? - Who made the curriculum? - How useful is the training? - Are there any barriers to gather the participants? - Are there any barriers in the source (human and finance)? - What are other barriers in conducting the training? And why it happens?
5	- Ministry of Energy and Mineral Resource - Local government officer - NGO's	Information and technology development	Mercury and ASGM system information management	- Existence of system information on mercury usage and ASGM location - Data for mercury use in district/regency and province - Data of ASGM location - Geological data for mining site - Characteristic of miners in Banyumas	- Has government created system information for mercury usage in ASGM and its location? - Who has the authority to insert the data? - Has data for mercury and ASGM location inserted into the system information? - What are the barriers for inserting the data? And why is it happening? - Is there any data for geological condition of ASGM mining?

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
6	- Ministry of Energy and Mineral Resource - BPPT - NGO's		Alternative non-mercury technology for ASGM	- Information on alternative technology - Feasibility test result - Assessment of alternative technology pilot project	- What is the available technology for ASGM - Is there any mapping for the suitability of the technology based on the ASGM sites or geological condition? - What is the feasibility test result? - What technology has been demonstrated? - What is the assessment result for the technology pilot project? - What are the barriers for the technology development? How the barriers are affecting the technology development?
7	- Ministry of Environmental and Forestry - Ministry of Energy and Mineral Resource - BPPT - NGO's		Development of safe tailings and hazardous waste storage technique for ASGM	- Information on alternative method and technology - Existence of guidelines for tailing and hazardous waste storage method in ASGM	- What is the available method for tailing and waste storage for ASGM activities - Is there any mapping for the suitability of the method based on the ASGM sites or geological condition? - What are the barriers for the designing the guidelines? How the barriers are affecting the designing of the guidelines?

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
8	- Ministry of Health - NGO's - Village head - Local cooperative	Mercury awareness information Management	Study to identify the impact of mercury to human health in ASGM community	- The number of planned study in different site - Existence of the primary data - Availability of report or journal	- How is the programme being rolled out by the ministries? - What study has been done and where? - Is the data for the health survey of health available? - Is there any report or journal available? - What is the barrier for conducting this program and why is it happening?
9	- Ministry of Environmental and Forestry - BPPT - Local government - Local village chief - Local cooperative		Mercury pollution or exposure in environment	- The number of monitoring site - Existence of the primary data - Availability of report or journal - Supervision, monitoring, and evaluation activity	- How is the programme being rolled out by the ministries? - What study has been done and where? - Is the data for the mercury exposure - Is there any report or journal available? - What are the barriers for conducting this program and why is it happening?

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
10	- Ministry of Environmental and Forestry - Ministry of Energy and Mineral Resource - BPPT - NGO's - Local government - Local cooperative	Capacity building for miners	Training to miners regarding hazardous chemistry, alternative technology and alternative income	- Availability of curriculum and training material - The number of training implemented and going to be implemented - The number of the participants in the past and in the future - The information in ASM location target and the number of miners involved - Miners and local government perception regarding the effectiveness of the training - Source of human and financial resources - Training for creating AMDAL - Training for alternative livelihood	- How is the programme being rolled at the regency level? - What is the number of the training already implemented and going to be implemented? - Who provide the source? - How is the training affecting the miners? - What are the barriers for conducting this program and why is it happening? - What are the barriers for miners to change the method and/or technology and/or living? Why is it happening?

No	Actors	Theme	Topic	Information to be covered by the interviewee	Questions
11	- Ministry of Health - Ministry of Environmental and Forestry - Ministry of Energy and Mineral Resource		Campaign to raise awareness toward mercury's adverse effect	- Availability of the program - Information on the site target and number of participants - Information on the availability of resource to conduct the program - The number of campaigns implemented and going to be implemented - Barriers	- How is the programme being rolled at the national level and regency level? - Who provide the source? - How is the campaign affecting the miners? - What are the barriers for conducting the programs and why is it happening?
12	- Ministry of Energy and Mineral Resources - Ministry of Environment and Forestry - NGO's		Mercury education awareness through curriculum	- Availability of the teaching material plans - Feasibility to put the material in the curriculum - Barriers	- How is the programme being rolled at the national level and regency level? - What are the barriers for inserting the education material to curriculum and why is it happening?
13	- Coordinating ministries of maritime affairs - Ministry of Energy and Mineral Resources - MoEF	Monitoring and evaluation	Evaluation of the program performance both from the implementation and effectiveness	- Planning for the evaluation - Guidance to evaluate and monitor the program - Barriers to all of the programs	- How is the programme being rolled at the national level and regency level? - What are the barriers for monitoring and evaluation of the programs?

Appendix 6: Consent letter from Massey University Human Ethics Committee



Date: 17 January 2017

Dear Hernandi Octaviano

Re: Ethics Notification - 4000017126 - Identifying progress and barriers of National Action Plan for the phase out of mercury in artisanal and small scale gold mining in Indonesia

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our system which is reported in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please go to <http://rims.massey.ac.nz> and register the changes in order that they be assessed as safe to proceed.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research."

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director - Ethics, telephone 06 3569099 ext 86015, email humanethics@massey.ac.nz.

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Research Ethics Office, Research and Enterprise

Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 350 5573; 06 350 5575 F 06 355 7973
E humanethics@massey.ac.nz W <http://humanethics.massey.ac.nz>

Human Ethics Low Risk notification

Dr Brian Finch
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)