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Sustainable development for post closure — a case study of PT Newmont Minahasa Raya

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Abstract

Improving economic and community welfare has become one of the community development programs conducted by PT Newmont Minahasa Raya (PTNMR) from the beginning of mining in 1996. Infrastructure development in each village has substantially improved the condition of villages surrounding the mine to that of an economic district. The groundwork of PTNMR's community development programs was to improve infrastructure in each village so that transportation infrastructure (roads, bridges that connect economic activities) could be facilitated. After mine closure, community development programs were aimed to achieve sustainable development of each community. The programs have three main pillars: sustainable environment, economy and social. The first was based on developing the reclamation forest, development of artificial coral reef using reef balls and mangrove forest rehabilitation. The second, achieving economic sustainability included developing a tourism area and creating new industry, while the social component included strengthening community foundations. In 2011, a Condition of Social Economic of the Community Surrounding the Mine of PTNMR provided the facts that the local economy was developing and improving after closure. The average income of a family in Buyat village in 1994 before the mine started was IDR 1,475,500 =USD 155.80 (currency rate: 1 USD = 9470.55 IDR). After mine closure period in 2011, the average income had improved to IDR 21,557,856 (USD 2269.13). The average expense of each family at the village before mining was IDR 2,050,175 (USD 216.48) and after closure, the average expense per family has reached IDR 15,364,788 (USD 1,622.38). The ownership of permanent housing has improved in East Ratatotok to more than 69% from 2.2% when the mine began. The condition of the houses has also improved from only 22% of cement-floor houses in 1994 to more than 95% cement, tile and wood floor houses in 2011. The sizes of the houses also increased from just 20 m^2 in 1994 to an average 61.15 m^2 in 2011. The total number of villages in Ratatotok and Buyat area was only three villages (1986) when the mine started. The area has developed to 18 villages after closure in 2011.

1 Introduction

Today's global economy provides opportunities for increased international trade and thus for the creation of economic wealth. Equally, it raises new challenges in how best to develop trading relationships that deliver in support of the UN's Millennium goals of reducing poverty and ensuring greater environmental security. This is the context in which 'corporate social responsibility' (CSR) in its diverse form has emerged as a key framework within which business operations are being re-examined and further developed. The European Commission has identified CSR as where companies *"integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis"* (Swift and Zadek, 2002).

The state of CSR in Indonesia is still at an early stage, though development has indicated encouraging signs. Indonesian companies, particularly those operating in the global market have become increasingly aware that they are required to balance the economic, social and environmental components of their business, while building shareholder value. In July 2007, the House of Representatives of Indonesia passed the corporation bill into law, making CSR mandatory for companies operating in any business field related to

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natural resources, with sanctions to be imposed on non-compliant firms. Thus Indonesia has officially become the first nation on earth to legislate CSR. The scope of CSR practices in Indonesia has mainly focused on education, environment, enterprise and economic empowerment, and human resource issues (Sedyono, 2007).

PTNMR is a gold mining company operated in Indonesia since 1996. The company is a joint venture company of Newmont Mining Corporation located in Denver, USA and PT Tanjung Serapung, Indonesia. Newmont Mining Corporation mentioned the importance of sustainability in the company mission: *"To build a sustainable mining business that delivers top quartile shareholder returns while leading in safety, environmental stewardship and social responsibility"* (Newmont Mining Corporation, 2011).

The objective of this paper is to describe the sustainability programs of PTNMR during the operating phase of the project to mine closure.

1.1 PT Newmont Minahasa Raya overview

PTNMR operated a gold mine that commenced the production of gold in April 1996. The mine site is located in the 'Mesel' gold mine area in southeast Minahasa regency, approximately 80 km south of Manado, in North Sulawesi (Figure 1). Mineral extraction activities at the mine site ceased in October 2001 and mineral processing was finished in September 2004. The reason for mine closure was that the mineable economic gold deposit was depleted. Closure activities were largely finished in 2006, and closure monitoring was completed in 2010. PTNMR was one of the first large-scale mine in Indonesia to close. The reclamation area was already handed over to the Forestry Ministry of Indonesia in January 2011. Nevertheless, the company is still obliged to fulfil several other requirements before the Government of Indonesia will approve the termination of its Contract of Work (CoW).

The definition of CoW is a contract between government and a mining company which becomes legal consideration to the company to conduct mining business in Indonesia. The government being the principal and the mining company becomes the contractor. CoW arranged the right and obligation of the contractor, also incentives given by the government (Hertanto, 2008).

The history and the development of PTNMR are as follows:

- 1986: Contract of Work signed.
- 1994: Construction/commissioning.
- 1995: Environmental Assessment Document approved.
- 1996: Production begins.
- 2001: Mining completed.
- 2002: Mine closure plan document approved.
- 2004: Gold production completed, operations ceased.
- 2005: Decommissioning (plant dismantling and demobilisation).
- 2004–2009: Mine closure monitoring and reclamation maintenance.
- 2006: Goodwill Agreement signed between PTNMR and the Government of Indonesia.
- 2007–2016: Goodwill Agreement implementations: environmental monitoring and community development.
- 2011: Mine closure approval and handover of reclamation area to the Forestry Ministry.
- 2016: Contract of Work termination.

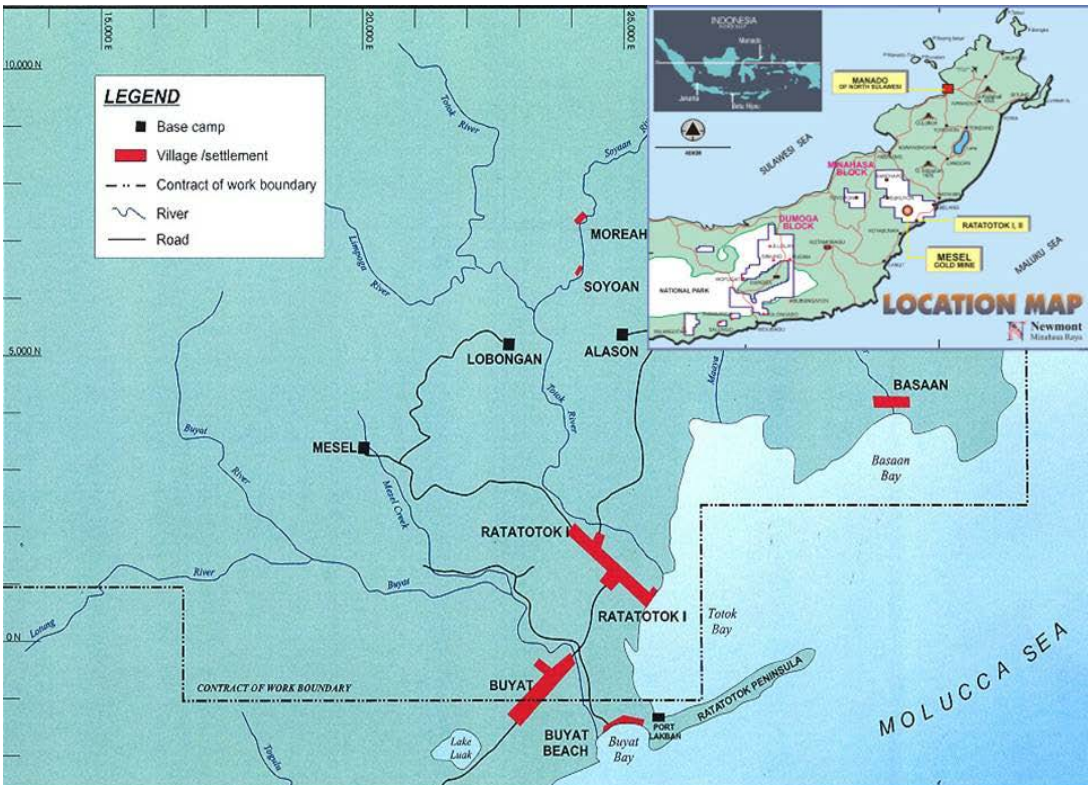

Figure 1 Location of PTNMR's 'Mesel' gold mine site – southeast Minahasa Regency

1.2 Conditions before mining

PTNMR conducted a study regarding baseline conditions before operations commenced. These baseline conditions are described to facilitate a comparison to conditions during operation and after mine closure (PTNMR, 1994).

Three communities within the project area are discussed, located on the main south coastal route connecting southeast Minahasa and East Bolaang Mongondow, consist of:

- Basaan Village (Belang subdistrict, Minahasa Regency).
- Ratatotok I and II Villages (Belang subdistrict, Minahasa Regency).
- Buyat Village (Kotabunan subdistrict, Bolaang Monondow Regency).

The population traditionally derived their livelihood from dry land agriculture, tree crops, fisheries and small-scale mining. Approximately 70% of Buyat villagers and 59% of Ratatototok villagers were either farmers or farm labourers. Other occupations are fishermen, traders and others. The economy was based on fisheries and agriculture. Farming was dominated by small scale plantations of coconuts and cloves. Most of the basic requirements (e.g. kerosene, rice, salt and sugar) were supplied from other region. Horticultural commodities such as vegetables and spices were supplied from Langoan while manufactured products including clothes and building material were imported from Manado. Marine fish that were produced locally were sold primarily at village markets. About 75% of the freshwater fisheries products were transported daily for regional distribution. There was an economically interdependent relationship between Basaan, Ratatotok I/II and Buyat and locations to the north (Langoan and Manado).

Prior to PTNMR operation, there were two junior high schools and one senior high school in the Ratatotok II village. However, Basaan, Ratatotok I/II and Buyat residents who completed senior high school totalled less than 1%. This is significantly below the government statistics for graduation levels in all Minahasa regencies (12%) (Lorax Environmental, 2002).

The main road (approximately 125 km) that connected the area to Manado (capital city of North Sulawesi) and other nearby towns was in poor condition. Local residents typically used marine transportation if they wanted to sell their agriculture and fishery products to the markets in other areas. For public transportation vehicles, there were only two Toyota 'kijang' (station wagon) cars (each can carry 12 passengers) available in Ratatotok prior to mining.

Public health of the villagers was reasonably good, albeit for the presence of many infectious diseases such as malaria, diarrhoea and influenza. Health facilities were provided by the government: one local clinic each in Basaan, Ratatotok and Buyat. There were also two integrated health service posts for mother and children in Buyat. Only 15% of the households in Basaan had a functional toilet while in Buyat it was only 5%. The drainage in the settlements was uncontrolled and many people discarded their waste in the river or on the beach. Villagers with serious ailments had to travel to other district or Manado for medical care as the villages did not have their own doctor.

1.3 Community development programs

In its early years in the area, PTNMR strived to build the infrastructure to change the poor condition of the immediate neighbouring villages of Ratatotok and Buyat. The main roads were built and maintained to connect the area with other areas and also to each other, thus facilitating the local economy through easier access and less travel time.

Village infrastructures and facilities were improved. Bad sanitation and poor health had to be eradicated, and education improved to help prepare a skilled labour force for the mine and other employment opportunities. The primary community development programs included:

1. Building roads and bridges:
    a. Main road.
    b. Village road.
    c. Village bridges.
2. Building schools:
    a. Elementary, junior and high school.
    b. Library.
3. Building health facilities:
    a. Community health centre.
    b. Village health centre.
    c. Public toilets.
4. Building water systems:
    a. Small scale irrigation for agriculture.
    b. Water tank (supplying water for the villages).
    c. Water supply (potable water).
5. Village level facilities:
    a. Government offices.
    b. Village meeting hall.
    c. Market complex.
    d. Terminal for buses.

e. Fish market point.

The company used local manpower to build all the infrastructure projects. These facilities were built to attract population influx to the region, to develop the existing facilities and to help the villages thrive.

While building the infrastructure, PTNMR also conducted various community development programs including: curative health care (e.g. free medication, monthly grant for doctors and paramedic), educational programs (e.g. agriculture machinery, preventive health programs and seaweed production); environmental enhancement programs (e.g. artificial reef program), fishermen's skill improvement; and micro-credit and training for small business. Other significant training included skills training to prepare the residents to become mine employees.

1.4 Community concerns of regression after closure

PTNMR's contribution to the local community has been enhanced and focused by the Community Consultative Committee (CCC). This committee was established to develop an interactive and transparent community development program. The CCC is comprised of a group of community leaders who bridge the gap in communication between the local community and PTNMR's community development department. The 47 members of the CCC originate from both the immediate villages within the mine circle as well as locations that are more distant from the mine site. The CCC meets regularly to discuss issues in the community related to the mine operation and informs PTNMR of the community's aspirations and priorities as well as holding discussions on alternative community development activities.

During mine closure, the CCC conveyed their fears and concerns that the area would regress after Newmont left. They were afraid that PTNMR closure would remove the primary resources of local contractors and local employee's income. It was their concern that the cessation of infrastructure, education and health programs would have significant detrimental impact on community welfare. In short, their concern was that the region would transform into a 'ghost town' after mine closure. The same concerns were voiced by the government, researchers, Non-Government Organisations (NGOs) and the broader public.

PTNMR stated that it was committed to identifying and mitigating potential economic and social impacts on the local communities arising from the closure of its operations. A critical component of PTNMR's overall closure plan was the Integrated Sustainable Development Program, which had been conceived and designed through an extensive stakeholder consultative process and which was implemented by PTNMR at closure.

A socio-economic survey was implemented in early 2011 to identify the conditions of the community after closure. The research may alleviate community concerns about whether the area will become a 'ghost-town' after closure.

2 Methodology

Several research projects were conducted in order to measure economic and social impact of community development programs. In 1994, prior to operation, PTNMR conducted the Environmental Impact Assessment to identify community conditions and economy factors. During mine operations, third parties such as the University of Sam Ratulangi (Unsrat) and ACNielsen conducted surveys to analyse community profiles and economic conditions surrounding the mine.

In 2011, Faculty of Economy carried out a survey regarding Condition of Social Economic of the Community Surrounding the Mine of PTNMR in 15 villages at Ratatotok and three villages at Buyat. The survey was using multistage random sampling technique. All the population was stratified on the basis of population in each village in order to obtain a proportional number of samples in each village. The second stratum is the division on the basis of the residence in the village. Targets of the surveyed population were people aged over 18 years. Total population of the 18 villages were: 16,496 people. Total number of respondents was:

1,637 people. The number of samples taken was calculated based on the Slovin formula with error tolerance of 10%:

$$n = N/(1 + (Ne^2)) \quad (1)$$

n = Number of samples.

N = Total population.

e = error tolerance.

In the qualitative research phase, a focus group meeting with 26 respondents was held. Respondents were selected based on judgmental sampling, in which respondents were chosen because they could provide the necessary information based on their role in the community. Most would choose the village heads of Buyat and Ratatotok as well as religious and youth leaders.

In the quantitative research phase, collected field data were analysed using the application program SPSS (Statistical Package for Social Sciences) so that its output was descriptive in the form of frequency tables and cross tabulation. The results of this study were illustrated in the visual presentation of data in the profile tables, diagrams and figures. As for qualitative analysis, data were analysed through the exploration of open questions as well as secondary sources of relevant documents, so as to sharpen the data (Faculty of Economy Research Team, 2011).

3 Sustainable development for post closure

3.1 Sustainable development programs

Mine closure should not be an 'end of mine life process' but rather should be integral to the 'whole of mine life' if it is to be successful. Planning for closure should commence at the feasibility phase of an operation. In this way, future constraints on, and costs of, mine closure can be minimised, post-mining land use options can be maximised and innovative strategies have the greatest chance of being realised (ANZMEC, 2000).

The Minahasa Mine closure plan was submitted to the Government of Indonesia in March 2002 and approved in December that same year. However, the preparation for mine closure commenced much earlier. In March 2001, PTNMR implemented a stakeholder consultative process to assess the potential socio-economic impacts on surrounding communities following mine closure (Lorax Environmental, 2002). The four key stakeholder groups, as identified by PTNMR, include: employees, local communities, representatives of various levels of government, and NGOs. The local communities have been involved in identifying the socio-economic impacts of closure and helping to develop programs that may help mitigate impacts.

The objectives of PTNMR's sustainable development are:

- To create reclamation forest that will be sustained after the mine closes.
- To create new industry for the community that will be sustained after closure.
- To create an independent and self-reliant community after closure.

PTNMR's three main pillars and programs of sustainable development include:

1. Environmental sustainability:
    a. Artificial coral reef (reef balls).
    b. Mangrove rehabilitation.
    c. Reclamation forest.
2. Economic sustainability:

a. Create a tourism area.

b. Establish a new industry:

1) Cooperatives/community group.

2) Ice block/cold storage.

3. Social sustainability:

a. Establish community foundation.

1) Minahasa Raya foundation.

2) North Sulawesi sustainable development foundation.

3) Ratatotok – Buyat sustainable development foundation.

3.2 Environmental sustainability

3.2.1 Reef balls

As part of PTNMR's commitment to the environment and the local community, PTNMR funded the construction and monitoring of the largest reef balls artificial reef program undertaken by a private company, with over 3,000 reef balls deployed in Buyat Bay and Totok Bay area. The results will hopefully continue to sustain livelihoods of local fishermen for many years. A reef ball is dome-shaped artificial reef placed on the seabed to attract organisms, and facilitate spawning in a new habitat that resembles the natural habitat of fish. The diameter of reef balls is 0.6–0.9 m and they weigh around 280–650 kg. Due to the weight, reef balls are considered stable and would not be swept away by average sea currents (Lennon et al., 2009).

The objectives of the reef balls program were to:

- Enhance fish stock.
- Mitigate loss of reef due to blast fishing, cyanide fishing or other unsustainable practices.
- Increase skills within the local community, provide additional source of income.

Annual surveys were conducted in 2001–2009 to assess the results of reef balls placement. The study identified 13 families, 30 genera, 83 species and 4,171 individuals inhabiting the reefs. Some fish species have become permanent residents and grown well in certain reef balls such as *Acanthurus xanthopterus, Lutjanus fulvus* and *Heniochus acuminatus* (Kojansow et al., 2009).

The result of the survey proved that reef balls have become the new habitat underwater for fish and other marine biota. The increasing number of fish and other marine biota will be benefiting for fishermen and underwater tourism.

3.2.2 Mangrove rehabilitation

Community based mangrove rehabilitation projects started in 2001 with ASPISIA (Association of Scientific Divers) as a local partner. Approximately 50,000 mangroves had been planted on five hectares of land in Ratatotok and Buyat. More than 10,000 mangrove seedlings of local species have been produced in the community nursery.

The objectives of the project were:

- To make local communities the main components and drivers of mangrove rehabilitation and conservation efforts by improving their knowledge and awareness of mangrove ecology.
- To rehabilitate the mangrove forest and its ecological function.
- To create new diving objects underwater.

A survey conducted in 2004 found a significant increase in community awareness of the importance of mangroves. A significant proportion of East Ratatotok villagers (63.3%) said that there would be economic advantage for them if the mangrove area is managed well, and only 26.7% claimed there would not. Among the economic advantages recognised by the community was the protection provided by the mangrove forest to prevent houses from erosion and to help provide them with fish, crabs and clams to be consumed or sold as sources of income. As well, mangroves are an important source of firewood. The Community Based Mangrove Rehabilitation and Management Project in East Ratatotok have greatly increased community awareness of mangrove management. From a survey conducted by Aspisia in 2004, involving 30 respondents, 76.7% said that they now were more aware of the need to conserve mangrove, and only 23.3% said that their awareness had not changed.

3.2.3 Reclamation forest

3.2.3.1 Reclamation score

The 443.40 hectares of reclaimed mine area has already been handed over to the Government of Indonesia in January 2011. The former mine area has become a secondary forest with high economic values. PTNMR has been the first mining company to apply Government Regulation No.60/2009 regarding forest rehabilitation of ex-mine area. According to the regulation criteria's, PTNMR's score is 93 out of 100, with 100% vegetation plants coverage accomplished (Minister of Forestry Republic of Indonesia, 2010).

The score were based on several accomplished criteria: land management (20 points), erosion and sedimentation management (30 points) and revegetation (50 points). Land management were included land surface management, refilling the pit hole, size of the area, ground stability and top soil sowing. Erosion control was included land conservation building, cover crop planting, erosion and sedimentation. Revegetation was included the size of reclamation area, percentage of plant growth, number of plants, composition of vegetation and plant health (Minister of Forestry Republic of Indonesia, 2009).

3.2.3.2 Economic value of the forest

The main species planted in reclamation area, i.e. mahogany, teak, nyatoh, and sengon, have grown relatively well, and will become a valuable investment for the future and will be inherited by the community and the government. The size for trees to gain premium price starts at a diameter greater than 30 cm. Therefore, sengon could be harvested earlier than other species followed by mahogany, teak, and the slowest one is nyatoh. However, the price of sengon is not as high as other species which is only around US$ 70/m^3 of log, or approximately US$ 20 per tree with a diameter of 30 cm. The other three species could, with proper maintenance, be harvested 20 years after planting with an expected price of US$ 400/m^3 or approximately US$ 125/m^3 per tree. Therefore, extrapolating from data in Table 1, where the number of sengon is 3,754 trees, and the other three highly commercial tree species are 163,294 trees, reforestation will generate income of US$ 20,411,750. The stand could be harvested in rotation to ensure its sustainability (Mansur et al., 2010).

Table 1 Proportions, numbers and the growth of tree species planted in mine rehabilitation area

No.	Tree Species	Proportion (%)	Total Number (trees)	Diameter* (cm)	Height* (m)
1.	Mahogany	52	97,601	25.2	14.0
2.	Teak	19	35,662	15.9	15.9
3.	Nyatoh	16	30,031	12.6	12.5
4.	Sengon	2	3,754	31.9	19.4
5.	Mix species	11	20,646	NA	NA
	Total	**100**	**187,694**		

(NA = Not Available)

Note: *Diameter and height data are measured from the average size of trees age 9 years old only

From the data presented it can be concluded that it is possible to convert gold mining into sustainable high economic timber production (green gold). However, selection of the trees species is important, not only ecologically important tree species, but also those of economically valuable.

PTNMR is currently working closely with the local government to protect the forest and to improve its status category to that of National Garden. The reclamation forest serves a long-term economic benefit and also has significant role in reducing carbon emissions from the environment.

3.3 Economic sustainability

3.3.1 Developing tourism area

Buyat Bay and its surrounding areas have been developed into an integrated tourism area. Facilities built include sports fields, public toilet and lifeguard post. Most of the tourists that come to the area are domestic tourists. PTNMR handed over the area to South East Minahasa government in 2006. The tourism area is presently managed by Ratatotok district government. Visitors have to buy tickets for IDR 2,500/person and IDR 5,000/vehicle. The revenue from ticket sales were later included as Southeast Minahasa regional revenue.

PTNMR is working together with a diving resort to introduce Buyat Bay and surroundings to the broader diving community. On average, more than a hundred divers from inside and outside the country come every year. Villagers rents boats and sell food to tourists. The bay has become one of North Sulawesi's important new diving locations.

The effort to promote the bay underwater tourism was started in 2002. The company was working together with the Tourism office of South Minahasa to publish the Buyat bay Diving Guidebook. Currently the bay has been widely covered by national and international media. Diving coverage in Buyat Bay has appeared in many magazines, TV shows and newspapers such as Dive Discovery, EZ Magazine, National Geographic Indonesia and The Jakarta Post.

> *"Buyat Bay offers something quite individual amongst North Sulawesi's existing dive attractions. Buyat's distinctive DNA consists of clear waters and reefs that explode with coral growth. The hard coral here is phenomenal. The reefs form steep slopes rather than drop offs so are almost continuous carpets of coral. Some colonies are huge. One stand (maybe Porites, actually we could not identify it in any of the books) appeared to be a single individual and was as large as a house meaning it was probably more than 1,000 years old."* Mustard (2009)

3.3.2 Creating a new industry

PTNMR built a cold storage building and ice block facility at the former port location. Formerly, the fishermen would have to go to Belang (23 km from Ratatotok) to buy high quality ice blocks. With the new ice block factory in Ratatotok, they could reduce production cost and improving product quality.

Small industries were encouraged to grow by providing a micro-credit financing plan, working together with a local bank unit. Housewives were supported to improve the household financial condition by in home industry units such as cookie production, traditional beverages and fishery food production.

Working together with the government and NGOs, the community development programs encouraged the establishment of cooperatives. Cooperatives were founded to finance and empower small industry groups at Buyat and Ratatotok, including:

- Animal husbandry group.
- Carpentry group (furniture).
- Farmer group (compost, palm sugar).
- Fishermen (seaweed, floating fishnet).
- Agriculture group (corn planting).

The company is working together with NGOs and the cooperatives to provide support in the form of initial funding (revolving fund), training and assistance to each group. The groups were supported to elevate their product to add value for competitive price and market.

3.4 Social sustainability

Three community foundations were established to mitigate the social and economic issues associated with the closure of the mine. The main objectives of these foundations were to develop social and educational programs for Ratatotok and Buyat area after mine closure.

The three foundations are:

- Minahasa Raya Foundation: Founded in 2000 by the Government of Minahasa and PTNMR to implement education and environmental programs. The main activity was aimed at improving education quality in Minahasa. To date, the foundation has granted donations to hundreds of students in North Sulawesi.
- North Sulawesi Sustainability Foundation: Founded in 2006 by the Government of Indonesia and PTNMR, its main focus has been infrastructure, education, cooperatives, capacity building, agriculture, fishery and health. The foundation has built Ratatotok – Buyat Hospital, the most advanced and biggest hospital in Southeast Minahasa. The Government of Indonesia and PTNMR also agreed to establish an Independent Scientific Panel (ISP) to monitor Buyat Bay water quality for 10 years (2006–2016). The Panel is under the supervision of the Ministry of Research and Technology. The results of the monitoring program will be presented each year to the public, for transparency. The foundation has also built village roads, bridges, school facilities, a computer laboratory, fishing boats, carpentry, workshops, and housing for low income residents. As well, the foundation has established community cooperatives in every village in Ratatotok and Buyat.
- The Ratatotok Buyat Sustainability Foundation: Founded in 2008 by PTNMR and representatives of the local communities of Buyat and Ratatotok. The foundation distributes scholarships for students, assists small enterprise, distributes micro-credit and has established a business company and a radio. The foundation received ‘Smart House’ facility for early age education improvement, donated by the First Lady of Indonesia, Mrs Ani Bambang Yudhoyono. Smart House is part of Smart Indonesia program, established by the First Lady and Association of Indonesian Minister’s Wife. Smart House is a program to donate a building completed with computers room,

TV, library car/motorcycle and books to a remote village or district. The tutor would be recruited to teach children and adults using equipment and facilities in the house.

4 Measuring the sustainability factors – condition of social economic of the community: 2011

4.1 Area development after closure

Prior to PTNMR operations in 1994, Ratatotok consisted of three villages while Buyat only one village. After the closure period (2011) the area had developed considerably. Ratatotok has grown to become a district which consists of 15 villages, including Basaan in 2003. Ratatotok is presently part of Southeast Minahasa regency. Buyat area had developed to three villages and is presently part of East Bolaang Mongondow regency. Public facilities have improved. Previously the residents had to travel to other region for a doctor. Now Ratatotok has Type-C General Hospital built in 2010 by PTNMR foundation. The national hospital was managed by the Ministry of Health of Indonesia. The road and public transport has improved to better condition, connecting the area with other regions.

PTNMR has built infrastructure such a village meeting hall, community health-centre building, jetty, fishermen port, school buildings, public toilets, and roads. These facilities were a preliminary requirement for Ratatotok to obtain provincial government approval to become a district.

The population centres most affected by PTNMR operations included: nine villages in Ratatotok District in Southeast Minahasa regency and three Buyat villages in Kotabunan District, East Bolaang Mongondow regency. Total population in these areas in 1990 was recorded as 6,964 people (Lorax Environmental, 2002). In 2011 the number increased to 11,103 people (Faculty of Economy Research Team, 2011).

4.2 Survey results

In 2011, result from the Survey of Condition of Social Economic of the Community Surrounding the Mine of PTNMR provided the facts that the local economy was developing and improving after closure. The survey was conducted in January–February 2011 at Ratatotok (15 villages) and Buyat (three villages). Total number of families in the region was 4,519. Total population was: 16,496 people. Total number of respondents was: 1,637 people (Figure 2).

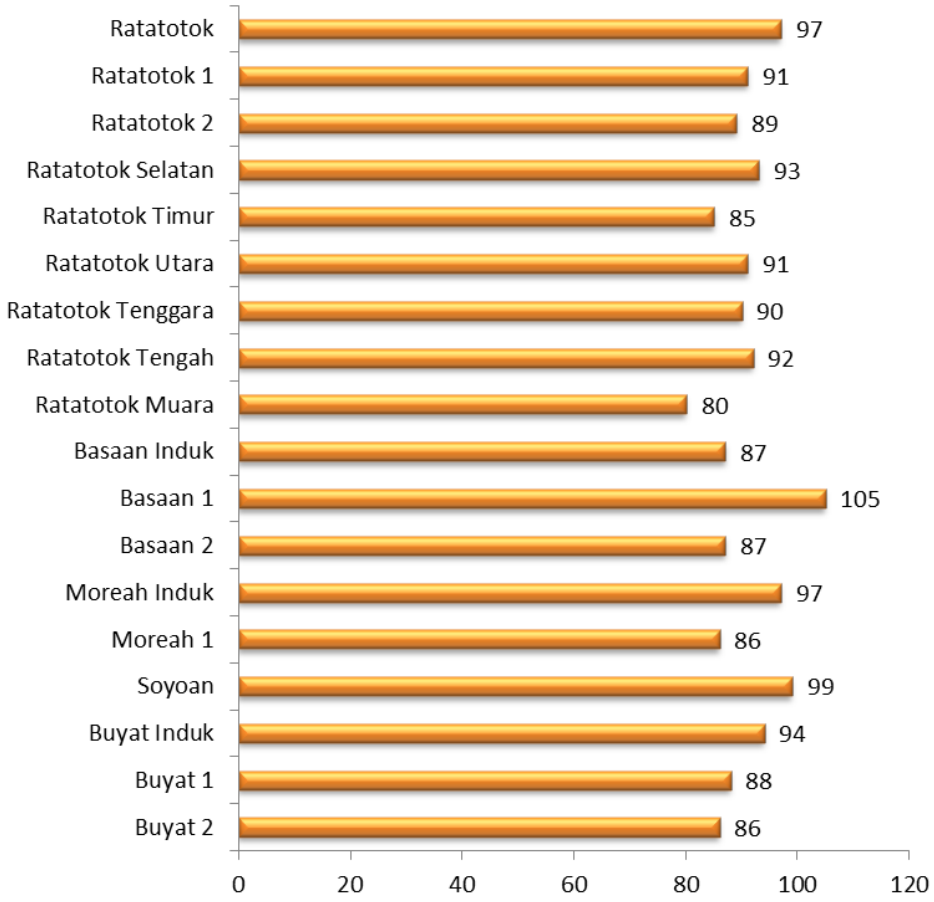

Figure 2 Total numbers of respondents from each village in Ratatotok and Buyat

The minimum age of the respondents in this study were 18 years, taking into account that at that age the respondents would have been able to give the right answer, clearly an accurately to assist the analysis. The number of respondents by age can be identified in Figure 3. Most of the respondent is at the age of 35–44 years old (Figure 3).

Figure 3 Total respondent number per village classified by age

The survey measured various factors including income, expense, size of houses, condition of houses, population growth rate and goods ownership. Even though the survey in Ratatotok and Buyat area were undertaken at 18 villages, however the data taken for comparison with other survey results would be limited to only 12 villages nearest to the mine. The 12 villages are:

- Ratatotok area: Ratatotok, Ratatotok 1, Ratatotok 2, Ratatotok Selatan, Ratatotok Timur, Ratatotok Utara, Ratatotok Tenggara, Ratatotok Tengah, Ratatotok Muara.
- Buyat area: Buyat Induk, Buyat 1, Buyat 2.

The Environmental Impact Assessment (PTNMR, 1994) and Minahasa Mine Closure Plan (Lorax Environmental, 2002) were focused on these villages as that of direct mine influence. Table 2 provides comparison of several factors prior to PTNMR presence and after closure.

Table 2 Comparison of demographic and socio-economic profile in Ratatotok and Buyat prior to PTNMR presence and after closure

	Environmental Impact Assessment (PTNMR, 1994)	**ACNielsen (2004)**	**Faculty of Economy Research Team, Unsrat (2011)**
Total number of population	4,466 (Ratatotok) 2,606 (Buyat)	NA	7,523 (Ratatotok) 3,850 (Buyat)
Number of villages	2 (Ratatotok) 1 (Buyat)	4 (Ratatotok) 1 (Buyat)	9 (Ratatotok) 3 (Buyat)
Working occupation	Farmer, fishermen, trader, other	Farmer, skilled labourer, traditional miner, trader, fishermen, staff, construction worker	Government officer, midwives, teacher, driver, own business, farmer, fishermen, traditional miner, other
Income per family per year	IDR 1,475,520 (Bolmong) (USD 155.80)* IDR 1,772,640 (USD 187.17) (Minahasa)	IDR 8,544,000 (Buyat) (USD 902.17) IDR 9,420,000 (USD 994.66) (East Ratatotok)	IDR 21,557,856 (USD 2269.13) (average income for 1 family in Buyat and Ratatotok)
Expense per family per year	IDR 2,050,175 (USD 215.80)	IDR 7,200,000 (Buyat) (USD 757.85) IDR 7,440,000 (USD 783.12) (East Ratatotok)	IDR 15,364,788 (USD 1,617.26) (average expense for 1 family in Buyat and Ratatotok)
Total number of family members (average)	4.8	4.4	3.63 (Ratatotok)
Size of the house	20 m^2 (average) (most common found in Ratatotok)	53 m^2 (East Ratatotok) 57 m^2 (Buyat)	61.15 m^2 (average) 83.78 m^2 (East Ratatotok) 65.66m^2 (Buyat 1)
Permanent house	2.2% (the rest are semi-permanent, wood and bamboo house)	35% (East Ratatotok) 57% (Buyat)	69% (East Ratatotok) 61% (Buyat 1)

House floor	22% cement	60% cement (Ratatotok and Buyat)	96.67% cement, tile and wood (Ratatotok and Buyat)
Sanitation (water closet)	5% (Buyat) while most houses in Ratatotok II have no toilets	46% (Buyat)	58.3% (average Buyat)
Ownership of durable: motorcycles	NA	10%	27.5%
Education level	1% of population finished high school	14% high school, 1% bachelor, 1% university	20.9% high school, 3.3% S1 degree (North Ratatotok); 3.19% S1 degree (Buyat)

Note: *Currency rate: 1 USD = 9470.55 IDR

The comparison of surveys conducted in 1994, 2004 and 2011 showed significant changes in community socio-economic profiles. The survey also compared the availability of public facilities prior to PTNMR presence in the area and after closure (Table 3).

Table 3 Comparison of public facilities availability in Ratatotok and Buyat prior to PTNMR presence and after closure

	Environmental Impact Assessment (PTNMR, 1994)	**ACNielsen (2004)**	**Faculty of Economy Research Team, Unsrat (2011)**
Public transport	2 Toyota 'Kijang' and boats (1–2 trips per day)	Bus, car, motorcycle, horse carriage, boat, taxi, company car	Bus, car, motorcycle, horse carriage, boat, taxi, others
Road condition	Unfavourable (poor condition), unpaved, most of the road without asphalt	73% asphalt road (Ratatotok); 40% asphalt and rock	80% asphalt, 20% soil and rock (Ratatotok I); 60% asphalt, 40% soil and rock (Buyat Induk)
Water supply	Spring, river, wells, potable water	River/lake/spring, tube wells, wells, potable water, cistern truck, public/shared tap, water pump	Spring, potable water, bottled water, wells, water pump
Health facilities	1 local government clinic, 2 small community health centres and 2 integrated posts for mother-child care (usually only for general medical)	2 local government clinics, 1 clinic, 5 integrated posts for mother-child care, 3 medical aides	1 Type-C Hospital, 10 local government clinics (*puskesmas*), 18 mother-child care integrated posts (*posyandu*), 3 medical aides (*poskesdes*)
Medical doctor	Not available (residents have to travel to Belang (23 km) and Manado (125 km) for serious medication	Doctor available at community health centre (2 doctors)	Doctors, specialists and paramedic available at Ratatotok–Buyat General Hospital and community health centre

Education	2 junior high schools and 1 high school	4 kindergartens, 4 elementary schools, 3 junior high schools, 1 high school	8 kindergartens, 11 elementary schools, 5 junior high schools, 3 high schools

5 Conclusions

PTNMR had established reclamation forest, develop tourism area and cooperatives to mitigate the social and economic issues associated with mine closure and to ensure the sustainability after closure.

The establishment of reclamation forest had converted gold mining into sustainable high economic timber production (green gold) which ecologically important and economically valuable while the reef balls program and promoting Buyat bay underwater tourism had created a new tourism object in the region and also the cooperatives would financing and facilitating small industry groups of community.

The results of surveys conducted in 1994, 2004 and 2011 showed important changes in community socio-economic profiles. The result of post closure survey found that the social and economic conditions improved after closure.

Sustainability and success of sustainable community development programs will be largely determined by the company's commitment, government support and the acceptance and cooperation from the community.

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