CHAPTER 4

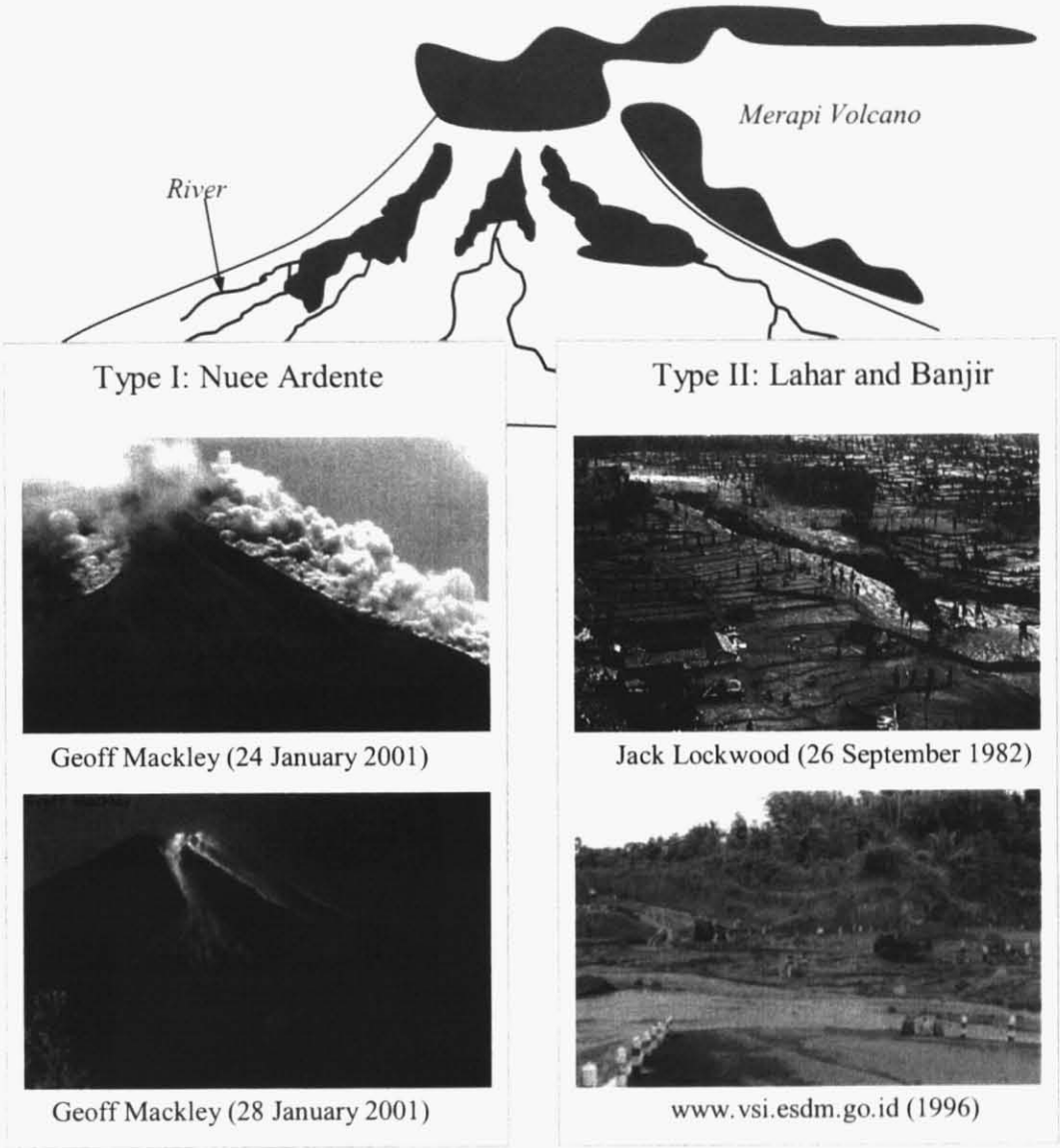
CASE STUDY I: SABO DAMS AT MT. MERAPI (SBDM)

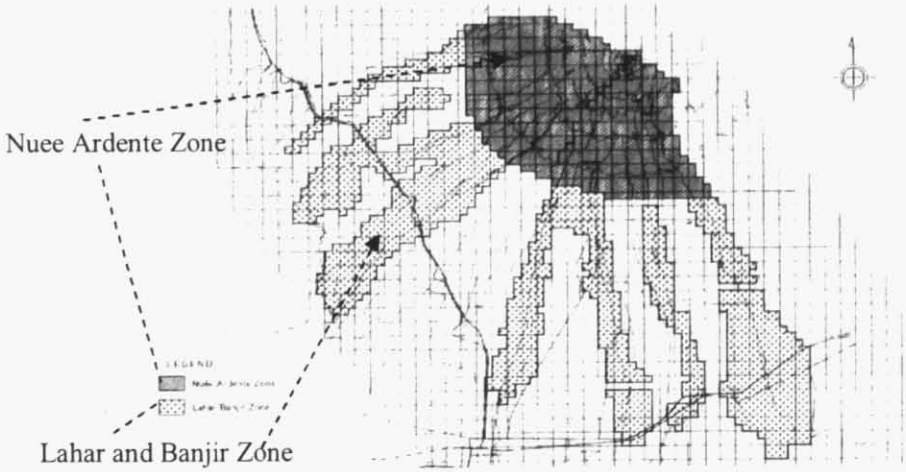
4.1 INTRODUCTION

What are the typical perceptions when hearing news about the invasion of forest areas? People may expect that the problem occurs because of the market value of trees. Yet beyond all the possibilities that can be imagined, the invasion of the forests of Mt. Merapi in Indonesia is occurring due to the market value of sand. Sand-quarrying activities in this area are causing environmental problems such as the destruction of forest areas and the degradation of rivers. Why is there an abundance of sand in the area? What facilitates the sand-quarrying activities? Are the problems related to infrastructure developments in the area? This chapter tells the story.

Mt. Merapi is one of the most famous active volcanoes in the world. It is located 30 kilometers north of the city of Yogyakarta, in the Central Java province in Indonesia. It has been producing hazards in the area.

Mt. Merapi is responsible for several types of disasters, of which two deserve close attention. The first type of disaster is direct volcanic eruptions (Nuee Ardente) (see figure 4-1). Eruptions have been occurring every few years; in the latter part of last century they occurred in 1930, 1954, 1961, 1969, 1971, 1973, 1974, 1975, 1976, 1986,





Merapi Volcanic Hazard Map (JICA, 1980)

Figure 4-1: Volcanic Disasters on Mt. Merapi

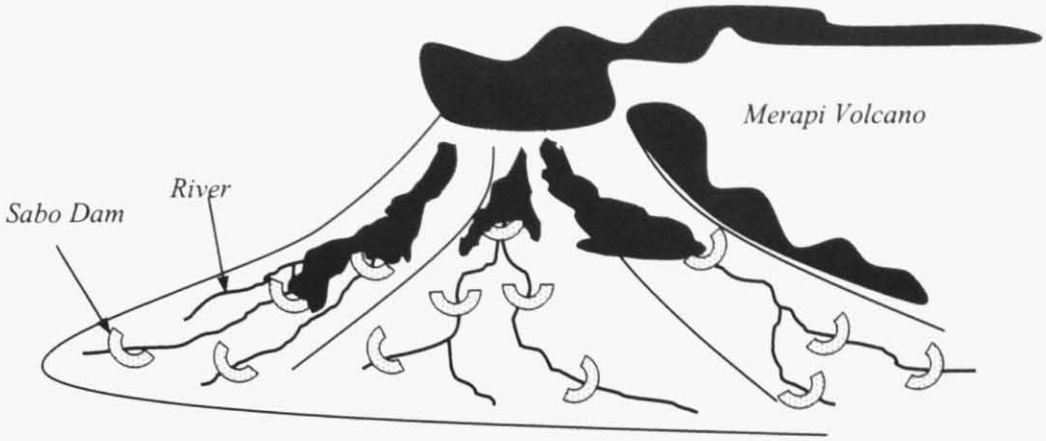
1994, 2001, and 2002 [DVGHM (1996), JBIC (2003), SGVP (2005)]. Since 1548, Mt. Merapi has had around 68 major eruptions [Susan, 2005].

Recently, in May 2006, a shift to alert status meant that villagers stayed in evacuation shelters at night [Susanto and Suherdjoko, 2006]. The local population expect to experience several eruptions during their lifetime. An eruption is likely to cause severe damage to lives and properties; for example, the 1976 eruption affected 385 households and destroyed 5 bridges in the area [JBIC, 2003].

The second type of disaster, which is actually more important, is volcanic debris flows (lahar) and flooding with much sediment (*banjir*) (see figure 4-1). This type of disaster is caused by unstable debris that accumulates on the upper slopes of the mountain. For instance, due to heavy rainfalls in 1982, a debris flow of old lahar deposits traveled around 20 kilometers down the mountainside and killed 80 people [Volcano World, 2000]. This type of disaster usually occurs during the rainy season, and causes damage to lives and properties more frequently than eruptions do. Figure 4-1 also shows the hazard zones of Mt. Merapi.

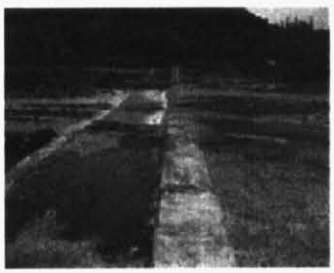
4.2 VOLCANIC DISASTER COUNTERMEASURE PROJECT

The Sabo facilities at Mt. Merapi consist of soil erosion and debris control structures; these include check dams, consolidation dams, training dikes, and so forth (see figure 4-2). A check dam is "a dam structure built on rivers with steep gradient streams, and is designed to control sediment production caused by hillside collapse or the erosion of the river channel, to prevent unstable flows of sediment that has accumulated on the



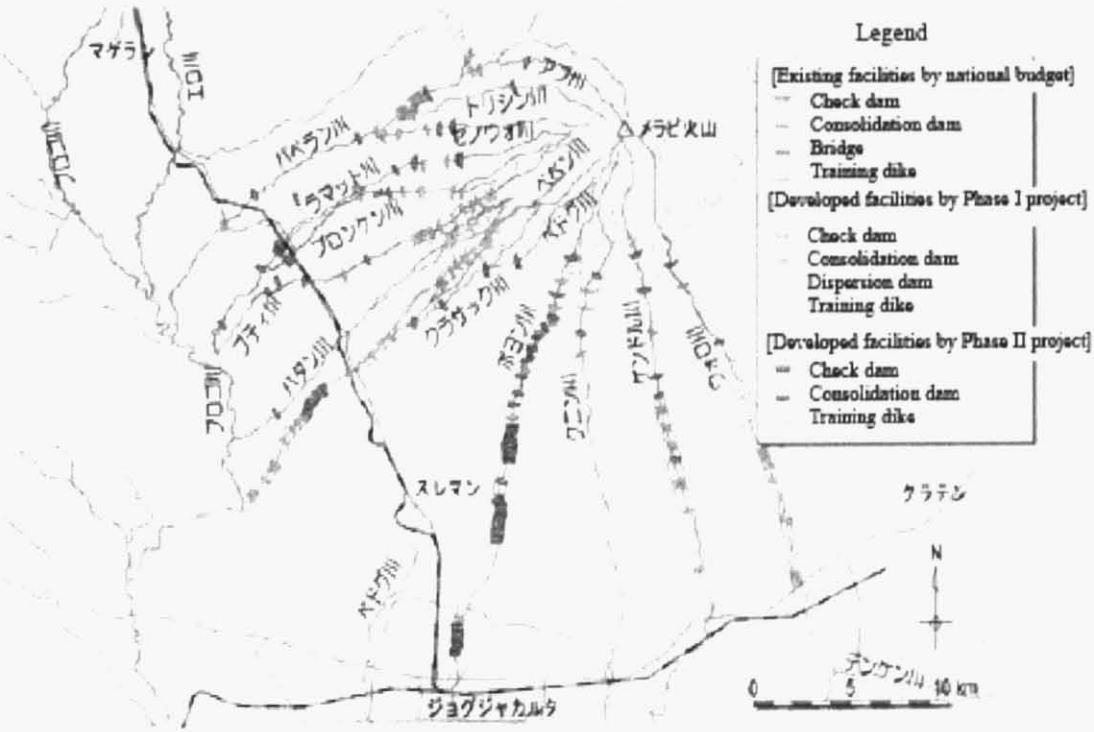
Sabo Facilities (Photo from JBIC, 2003)

Check Dam



Consolidation Dam

Training Dike



Locations of Sabo Facilities at Mt. Merapi (JBIC, 2003)

Figure 4-2: Sabo Facilities at Mt. Merapi

riverbed, and to avert debris flow." A consolidation dam is "primarily designed to prevent riverbed erosion and to stabilize the gradient and form of the riverbed along the course of the river; such dams are built across rivers." A training dike is "an embankment structure that regulates the direction of mudflows, rendering them harmless" [JICA (1980), JBIC (2003)].

The Sabo facilities were constructed in the areas adjacent to Mt. Merapi in order to prevent or mitigate the damage caused by the above-mentioned disasters. Historically, the Sabo facilities were constructed in three stages; the first stage was enabled by a national budget, the second by Japanese funding (phase I) in 1985-1992, and the third also by Japanese funding (phase II) in 1995-2001 (see figure 4-2). The facilities acquired in phase II were constructed due to a change in the general direction of eruptions towards the southern and western flanks of Mt. Merapi. In this phase, the Sabo facilities constructed included 14 check dams, 29 consolidation dams, and 2 training dikes [JICA (1980), JBIC (2003)].

According to the JBIC's ex post evaluation report (2003), the targeted sediment control rate of the Sabo facilities is 70.6%, and the achieved rate is 71.6%. Other achievements and benefits of the project are described below.

Considering their potential natural impact, it was expected that the constructed structures would help to stabilize the area and the river channels and to preserve the river basins around the Mt. Merapi. [JICA, 1980]

Considering the impact on locals' sense of security, there have been no fatalities or serious damage to property or agricultural land since 1994, even though debris flows have occurred every year. According to the beneficiary survey conducted with 100 villagers, prior to the project implementation 47% of respondents were "worried about debris flows and would like to move to another area if possible" (see figure 4-3). After project completion, this feeling has disappeared. Furthermore, the percentage of respondents who have no fear at all has increased from 3% before the project to 65% after the project [JBIC, 2003].

Considering the economic impact, the benefits have included the increased use of agricultural land in areas near the check dams, the increased employment and earning opportunities in gravel collection and sales in the agricultural off-season, and the improved transportation access provided by roads that have been constructed in association with the Sabo facilities for maintenance purposes. [JBIC, 2003]

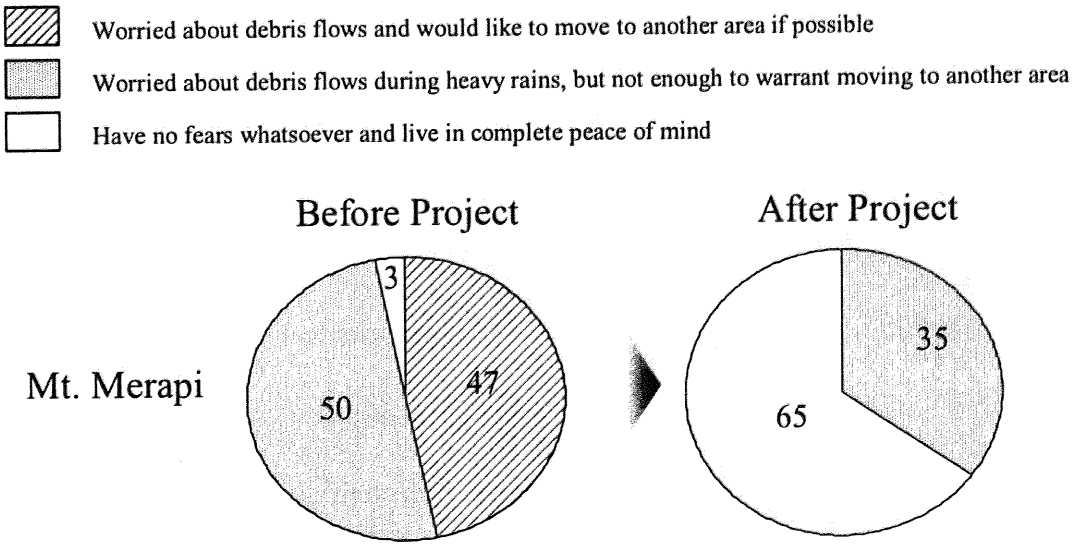


Figure 4-3: Assessment of Security Perceptions in the Region - Before & After Project (Source: JBIC, 2003)

4.3 SAND QUARRYING AND ITS NEGATIVE IMPACTS

The sediment in volcanic debris flows consists of sand and gravel. These materials have a good market value because they are suitable for construction purposes [The Jakarta Post (2000), JBIC (2003)]. According to data obtained in 2003, the cost of transporting sand from the mountain to the city of Semarang (the capital city of Central Java province) is 15,000 rupiah per cubic meter, while its sales price is 100,000 rupiah per cubic meter [JBIC, 2003]. The high value of these materials is so attractive that sand quarrying has been flourishing.

The sediments have been accumulated in three main areas: in parts of the forest, along the upper reaches of the rivers, and at the Sabo dams [The Jakarta Post, 2000]. Sand-quarrying activities in these three different areas have been causing different impacts. These impacts were not predicted at the time of project planning.

Sand and gravel have been deposited in certain areas of the forest west and southeast of Mt. Merapi [The Jakarta Post, 2000] (see figure 4-4). Sand quarrying results in invasions into forest areas, and it causes the destruction of trees [The Jakarta Post (2000), JBIC (2003), Hartono (2004a), Hartono (2004b)].

There are also some deposits of sand and gravel along the upper reaches of the rivers on the western and southeastern slopes of Mt. Merapi [The Jakarta Post, 2000] (see figure 4-4). Sand quarrying, therefore, occurs in the beds of rivers, and it is claimed that the activities cause the degradation of rivers and water shortages in some villages, and

Sand Quarrying in Forest

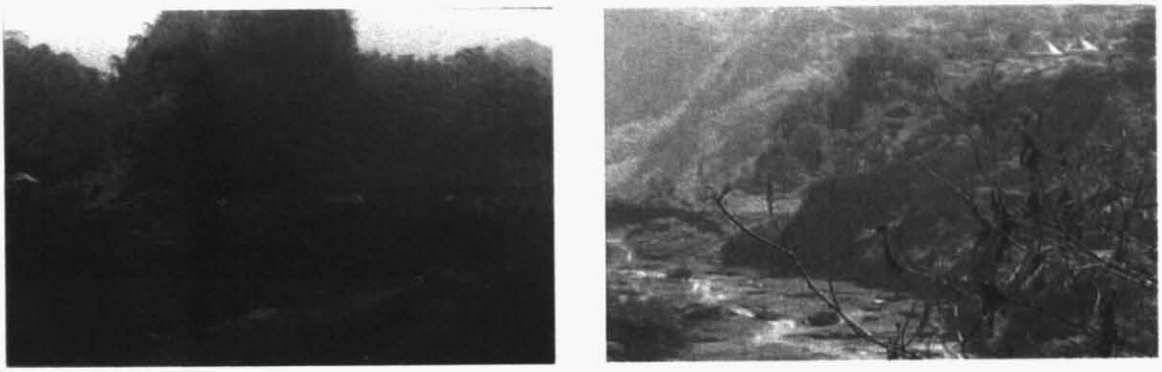


Photo Source: Hartono (2004)

Sand Quarrying along Upper Reaches of Rivers

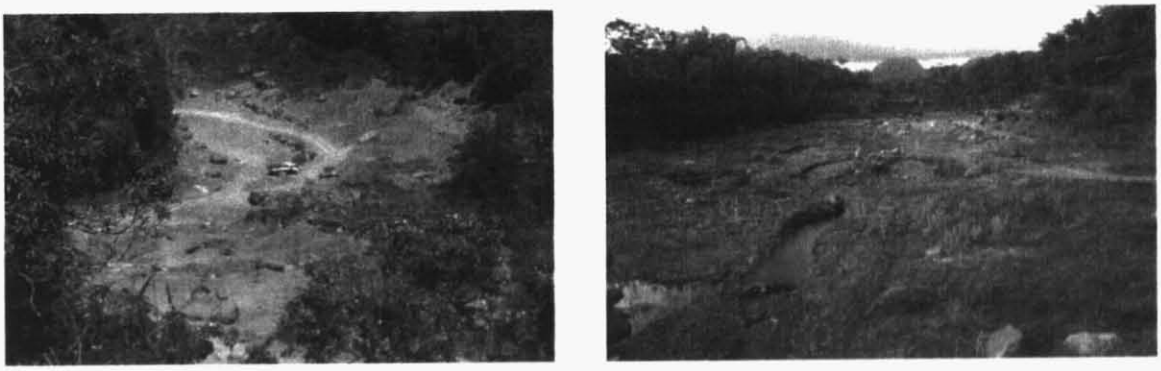


Photo Source: Hartono (2004)

Sand-Quarrying at Dam Site

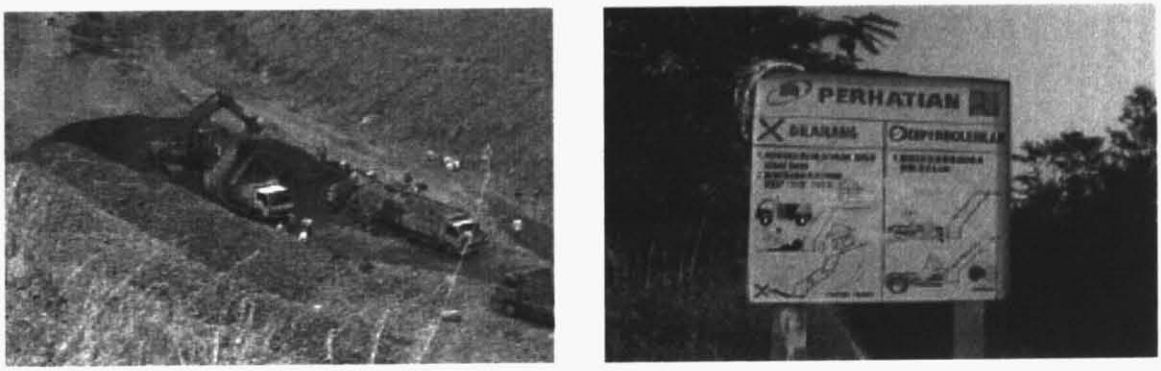


Photo Source: JBIC (2003)

Figure 4-4: Sand-Quarrying Activities

possibly also lead to sudden floods and long droughts [Wahyuni (2002), JBIC (2003), Hartono (2004c), Hartono (2004d)].

Sand quarrying at the Sabo dam sites is necessary to enhance the capacity of the dams for holding future volcanic debris flows [JBIC, 2003] (see figure 4-4). A license system was established to control the activities of private sand-mining companies [JBIC, 2003]. Accordingly, two impacts have occurred; firstly the concern about damage to structures due to the movement of heavy equipment, and secondly the conflict leading to mob violence between traditional local sand miners and private sand-mining companies [The Jakarta Post (2000), Wahyuni Sri (2002), JBIC (2003)].

4.4 CONVENTIONAL ANALYSIS OF CAUSES OF NEGATIVE IMPACTS

In this work, the discussion of sand-quarrying activities is focused on three impacts that have occurred in the vicinity of Mt. Merapi. They are the destruction of trees in the forests, the degradation of rivers, and the conflict between the traditional local sand miners and private sand-mining companies. A conventional analysis of the causes of these impacts can be approached in several ways.

First, the sense of security provided by the Sabo facilities has encouraged people to move towards the mountain area and to make use of the land and other resources on the upper slopes of the mountain, including the sand deposited in certain areas.

Second, poverty and unemployment have forced local people to get involved in sand –quarrying, either as individual miners or laborers working for private sand-mining companies, because it is a potential source of income.

Third, the high market value of sand has stimulated a vigorous local sand-quarrying industry. This is because sand has a high market value when traded in the city, and the quarrying and shipping costs are relatively low. Under these circumstances, poverty and unemployment cannot be considered as the primary driving forces. Sand quarrying is attractive because it can provide additional income during the agricultural off-season, or it may even be an option for occupational change.

Fourth, a lack of education leads locals to prefer sand quarrying over other kinds of jobs. This is because sand quarrying does not require specialized skills, and it is more difficult to get other jobs. Furthermore, a lack of knowledge also means that the locals are unaware of the environmental impacts that will occur in the near future and in the next generations.

Fifth, participation by the private sector is more favorable to the local administration than that of the local sand miners. Private companies with their own heavy equipment can perform the tasks of sand –quarrying efficiently. They therefore appear more attractive and reliable to the local administration, when they consider issuing permits for sand quarrying. Also, a small group of private sand-mining companies is convenient for the local administration to control in the prevention of damage to the Sabo facilities.

4.5 AUTONOMY OF TECHNOLOGICAL IMPERATIVES

The previous section discussed a conventional analysis of the causes of the impacts associated with sand-quarrying activities. However, such an analysis ignores the

power of technology itself. This section argues that, to identify the root cause, closer attention must be paid to the infrastructure itself. A fundamental question that should be asked is what facilitates people's decisions to commodify and exploit sand, and to participate in mob violence?

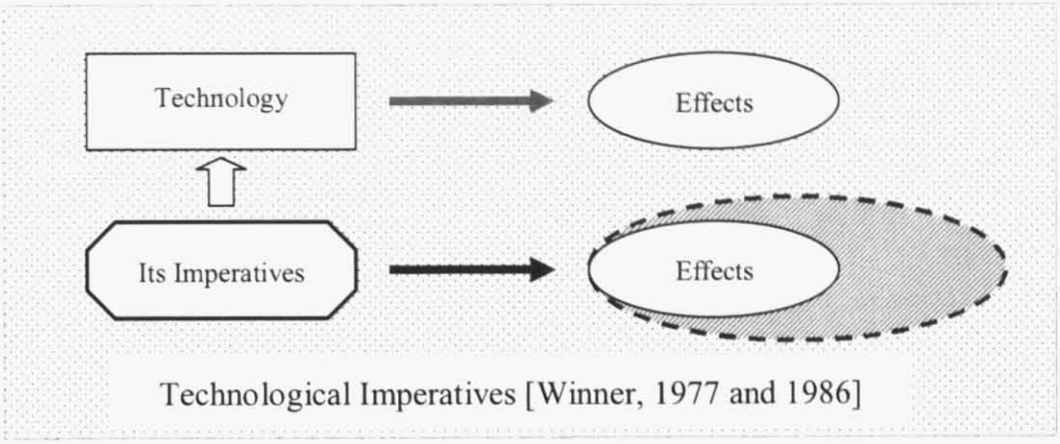
According to the concept of autonomous technology, technologies are not neutral. In other words, they cannot be controlled by humans. They generate unpredicted consequences in addition to their original or designed purposes. It seems that Jacques Ellul is perhaps the most well-known promoter of this concept, and it has been taken up by many scholars. The concept has two main components; first, a technology will generate a number of impacts by itself, and second, a technology cannot be controlled by humans. Winner (1977) proposed a methodology for observing how technology generates impacts by itself. He urged that attention be paid to the conditions or requirements necessary for keeping a technology operating well. Also, he interpreted 'cannot be controlled by humans' as meaning 'it is immaterial who holds the power'. Accordingly, he claimed that the broadest concept of autonomous technology occurs under the circumstance in which there are certain requirements for keeping a technology operating well and these requirements are satisfied regardless of who has political power over the development of the technology.

The Sabo facilities, similarly to other kinds of infrastructures, require a maintenance system. This study argues that, from a technological point of view, the maintenance requirements of the Sabo facilities are the root causes of the impacts

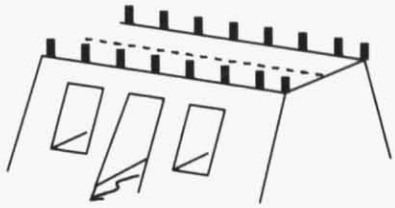
observed at Mt. Merapi. The maintenance requirements of the Sabo facilities can be categorized into two types; these are structural and non-structural requirements.

For the structural maintenance, engineers intentionally constructed a road system – involving both access roads and roads attached to the Sabo dams – to serve several purposes; these included the granting of access to sites for the construction of structures, to nearby sources of construction materials, and to structures during the project life for ongoing maintenance purposes. For project planners, the road system was expected to provide daily transportation between villages in the area and a means of evacuation of villagers in future eruptions.

However, in addition, the road system has been used by a number of people for purposes other than those unintended, and unfortunately these have been negative ones. The road system provides easy access to resource areas, especially on the upper slopes of Mt. Merapi. This makes it possible for heavy equipment to access the resource areas (see figures 4-5 and 4-6). Accordingly, the time and cost for transporting the resources obtained are shorter and cheaper, respectively. The road system has different functions for different parties. It provides for the necessity of maintenance work for engineers and the local administration. It provides evacuation routes for the local administration and villagers. It serves as a transportation network for villagers and tourists. Unfortunately, the road system also provides access to the sand deposited in the forest areas and the upper reaches of rivers for both local sand miners and private companies.

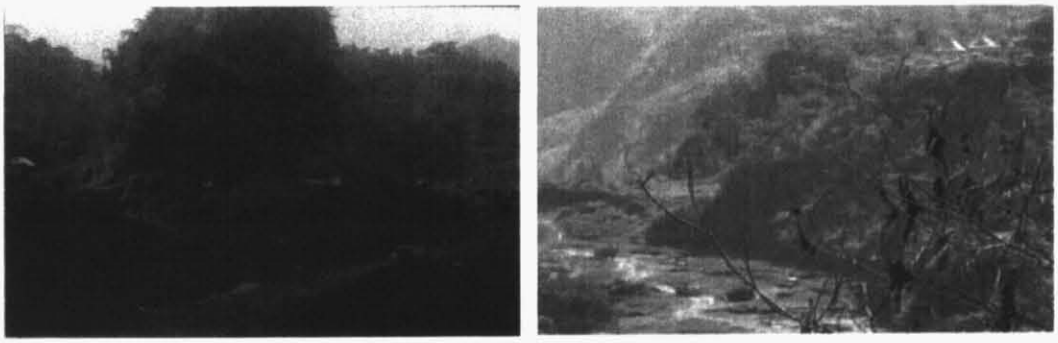


Technological Imperatives [Winner, 1977 and 1986]



Road associated with Sabo dams

Sand Quarrying in Forests

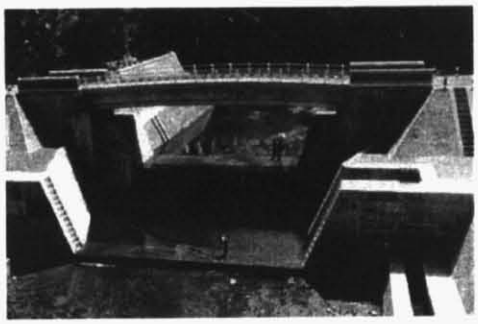


Sand Quarrying in Upper Reaches of Rivers

Photo Source: Hartono (2004)

Figure 4-5: Structural Type of Technological Imperatives

Dam on Apu River, Merapi (JBIC, 2003)



Dam on Lamat River, Merapi

http://ptbck.com (1993)

Dam on Lamat River, Merapi

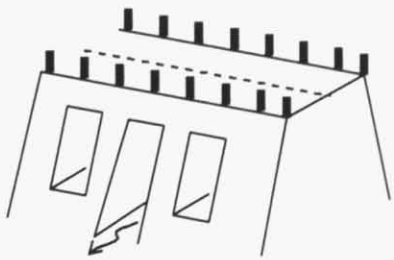
http://ptbck.com (1995)

Dam on Boyong River, Merapi

http://volcano.und.nodak.edu (2000)

Dam on Boyong River, Merapi

(JBIC, 2003)

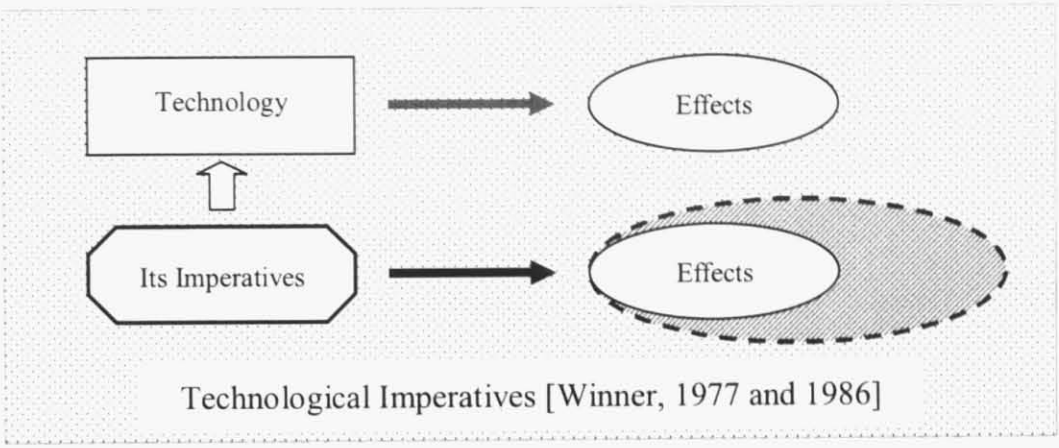


Road associated with Sabo dams

Figure 4-6: Sabo Dams with Built-in Road

A conventional claim about the destruction of resources caused by an infrastructure project is that the main structure and its construction activity cause serious damage to natural resources; for example, a large number of trees is cut down to clear a construction site. However, a lesson learnt from the particular case of the Sabo facilities is that natural resources can possibly be more severely damaged by the ongoing use of a maintenance system for an infrastructure project – roads in this case – than they were by the initial construction of the main Sabo dam structure itself.

Regarding the non-structural maintenance, sand accumulates at the Sabo dams from time to time, and it deteriorates the capacity of the dams to cope with future disasters. Removal of the accumulated sand is necessary to maintain the effectiveness of the dams. For the removal of the sand, a license system overseen by a regional administration body has been set up in order to control the participation of private companies [JBIC, 2003]. The license system (Regional Regulation No.6/1994) requires an official permit for sand quarrying at dam sites and other areas along the upper reaches of the rivers [The Jakarta Post, 2000]. Under the license system, the regional administration body favors private companies over the local sand miners [The Jakarta Post, 2000]. In this situation, villagers who have been quarrying sand in the riverbeds for generations are suffer a loss of income [The Jakarta Post, 2000]. Accordingly, these villagers are dissatisfied with their lack of access to the resources due to the license system (see figure 4-7).



Technological Imperatives [Winner, 1977 and 1986]

Official Permit for Sand Mining

Sand Quarrying at Dam Site

Photo Source: JBIC (2003)

Figure 4-7: Non-structural Type of Technological Imperatives

4.6 SOLUTIONS

Two solutions were implemented in order to resolve the impacts described above. First, in mid-1994 an association of the Paguyuban Gotong Royong (GORO) was established to address the disadvantaged position of the local sand miners. The association successfully negotiated an agreement over this labor employment issue with the private mining companies. However, the agreement was only effective for a short while. It was found that some members of the executive board of the GORO Association were personally involved in activities that created a conflict-of-interest; these included being granted sites for their own sand quarrying, obtaining security jobs at sand-quarrying sites, and taking the middleman role between the sand-mining companies and sale-and-rent heavy-equipment companies. For these reasons, the association with 3,000 members was not effective due to the principal-agent problems that arose. Thus, in December 1999 in Magelang district, a violent mob involving hundreds of traditional local sand miners burned and destroyed some heavy equipment and other property belonging to a private sand-mining company. The reported loss was approximately 13 billion rupiah [The Jakarta Post, 2000].

As the second solution, a national park under the name of Mount Merapi National Park (TNGM) was established. Its main objective is to conserve the environment [DTE (2002), Hartono (2004f)]. This attempt was initiated in 2001, with the intention of enacting the establishment being scheduled for October 2002 [The Jakarta Post, 2002]. However, the declaration ceremony in 2002 was canceled due to mass protests between April and October 2002 [DTE (2002), Hartono (2004e)]. The park was finally established

in May 2004 (the Minister of Forestry Decree 134/Menhut-II/2004), though with the consequence of protests and lawsuits brought by local communities with the support of NGOs [Borrini and Kothari (2006), Hartono (2004e), Naommy (2004), WALHI (2004)]. The protests arose due to a lack of public participation and transparency in the establishment of the park [DTE, 2002], indigenous groups' concerns about eviction and loss of income [DTE (2002), Muryanto (2004), Aryanto (2002)], suspicions of manipulation of the feasibility study [DTE (2002), Naommy (2004)], and doubts about the success of the national park due to stories of the lack of success of previous parks [Hartono, 2004f]. Details of these two solutions are discussed below.

Rice growing is a major occupation and an important part of the economy on the slopes of Mt. Merapi and in its surrounding areas [JICA (1980), Price (2001)]. Before the construction of the Sabo facilities project, farmers and villagers were at risk of eruptions and debris flows. The situation was fully acknowledged by the regional administration. The central government of the Republic of Indonesia developed a plan to undertake the Sabo facilities project with technical assistance from the Japan International Cooperation Agency (JICA) and financial support from the Japan Bank for International Cooperation (JBIC). It seemed that all stakeholders were in agreement with the project at that time. Accordingly, during 1985-1992 the Sabo Facilities Development Project (Phase I) was being constructed [JBIC, 2003].

However, local villagers had been quarrying sand in the riverbeds at the foot of the mountain for generations. Yet after the completion of the Sabo dams, much of the river-borne sand was trapped behind the dams. Dam sites with such deposited sand were

found to be good places for sand quarrying. In addition, villagers moved toward the mountain for various activities. Such activities also included sand quarrying in the forest areas and upper reaches of the rivers. This situation resulted in the destruction of trees and degradation of rivers [The Jakarta Post, 2000].

Not long after that, in 1994 the Central Java provincial administration issued Regional Regulation No. 6/1994, which stipulated that a regional mining permit must be obtained for sand quarrying. The regional administration receives income tax for issuing these permits. The license system run under this regulation requires a regional mining permit for any sand-quarrying activity not only at the dam sites but also throughout hundreds of hectares of terrain surrounding the upper reaches of the rivers. These areas used to be quarrying spots for the local sand miners. However, the regional administration favors the private sand-mining companies over the local sand miners. These private companies are from Jakarta, Yogyakarta, Magelang and Semarang. Accordingly, the control of areas suitable for quarrying has been transferred into the hands of the private sand-mining companies who hold permits. Under these conditions, the local sand miners were forced to choose whether to join the private companies as general workers or to find new jobs. The average earnings of villagers decrease from 15,000 rupiah per day in local sand quarrying to 10,000 rupiah per day working for private companies. Additionally the villagers have to work in a rotation system due to the large number of workers and the limited number of heavy machines. Accordingly, they are dissatisfied with the license system [The Jakarta Post, 2000].

Later in 1994 the local sand miners set up an association called Paguyuban Gotong Royong (GORO) to increase their power to negotiate with the private companies. Subsequently, in mid-1994 a demonstration by around 1,000 members of the association was organized at the office of the Regent's Assistant for Salam Region, Magelang. As a result of the demonstration, an agreement was reached. One item in this agreement is that local villagers must be employed for surface flattening work for every sand-transport truck [The Jakarta Post, 2000]. It seemed the conflict was solved.

In December 1995, construction of the Sabo Facilities Development Project (Phase II) was begun. Its stated objective was to enable a change in direction of eruption flows onto the southern and western flanks of Mt. Merapi. The executing agency was the Mt. Merapi Disaster Prevention Office. The Sabo facilities constructed in this phase included 14 check dams, 29 consolidation dams, and 2 training dikes. The project was completed in December 2001 [JBIC, 2003].

The agreement reached in 1994 between the GORO Association and the private companies only remained effective for a short while. It was claimed that the private companies attempted to undermine the GORO Association. Accordingly, in December 1999 at Magelang district, a violent mob of hundreds of the traditional manual sand-miners destroyed and burned heavy equipment and other properties of a private sand-mining company. The reported loss was approximately 13 billions rupiah. [The Jakarta Post, 2000]

In 2001, the plan for establishing the Mt. Merapi National Park (TNGM) was initiated in order to solve environmental impacts, including those impacts due to large-

scale sand-quarrying activities and other exploitative activities such as unsustainable tourism and unsuitable buildings [Hartono (2004f), Muryanto (2004b)]. According to a study by the UGM School of Forestry, at that time only 1,283 hectares of the total area was still in good condition with rich biodiversity [Muryanto, 2004b].

First, the Governor of Yogyakarta proposed a plan for establishing the Mt. Merapi National Park by sending an official letter to the Ministry of Forestry [Hartono, 2004e]. After that, they agreed to establish the national park; the agreement was witnessed by government officials from Yogyakarta and Central Java on 26 November 2001 [Muryanto, 2004b]. The Governor of Yogyakarta described three additional justifications of the national park: it would become a status symbol for the region, generate income from tourism, and provide access to reforestation funding [DTE, 2002].

However, during the process of establishing the national park, local villagers raised opposition for several reasons. First, the establishment process did not involve the local community in the determination of conservation zones [The Jakarta Post, 2002]. Second, the villagers are concerned about prohibitions affecting their usage of natural resources which they depend on for daily living; these include grass for cattle, volcanic sand for buildings, and firewood [Aryanto (2002), DTE (2002), Muryanto (2004a)]. Third, the villagers were very anxious about a mass eviction from their homeland [Aryanto (2002), Muryanto (2004b)]. Fourth, their signatures, obtained during a meeting between the Local Forestry Department of Yogyakarta and the local communities, were manipulated and used without their consent as part of an agreement showing that the local communities supported the national park [Hartono, 2004e]. The Indonesian Forum for the

Environment (WALHI), an NGO, proposed a new model of management involving a consortium of local stakeholders in order to avoid conflicts between the government and indigenous communities, since this is an impact which has occurred in many national parks in Indonesia [DTE, 2002].

Between April and October 2002, many movements and protests were organized by the local communities and NGOs to oppose the national park [Hartono, 2004e]. For example, there was a demonstration during an official visit to Kaliurang by four ministers from Jakarta and Yoyga's governor [DTE, 2002]. At Kaliurang, 300 ha of forest on the slopes of Mt. Merapi were destroyed by fires, which were possibly set by villagers opposing the park [DTE, 2002]. In October a mass demonstration was organized at Boyolali to greet President Megawati who was attending the scheduled launch ceremony of the Mt. Merapi National Park [Hartono, 2004e]. Accordingly, the launch was cancelled.

In July 2003, the JBIC and JICA performed an ex post evaluation survey of the Project Phase II. The report mentioned the operation of a brisk private-sector business in sand mining in the area. While the tax income of the license system was positive in terms of the budget burden, the report mentioned concerns about damage to Sabo structures and environmental impacts caused by illegal sand –mining [JBIC, 2003].

However, despite the many demonstrations and protests staged by local communities and NGOs, on 4 May 2004 the Ministry of Forestry (by Decree No. 134/Menhut-II/2004) declared Mt. Merapi as a national park, including some 6,410 hectares of protected forest in the regencies of Magelang, Boyolali and Klaten in Central

Java Province, and Sleman in Yogyakarta [Hartono (2004e), Muryanto (2004b), Naommy (2004), WALHI (2004)].

Following the decree, conflicts developed into confrontations between the Forestry Department supported by the Yogyakarta Government and local communities supported by NGOs; the protest movement included activities such as community mobilization, a protest letter being sent to the President, demonstrations, a series of debates, meetings among local communities, activists, student groups, and academics, and so forth [Hartono (2004e), WALHI (2004)]. In July 2004, there was a rally involving thousands of people from the four regencies of Sleman, Klaten, Magelang, and Boyolali in Deles, Klaten [Muryanto, 2004b]. In the same month, the Minister of Forestry was sued by WALHI on behalf of NGOs and local communities from four municipalities (Sleman, Klaten, Magelang, and Boyolali); the lawsuits were brought to the State of Administration Court in Jakarta [Borrini and Kothari (2006), Hartono (2004e), Naommy (2004)]. The lawsuits demanded that the court nullify the decree [Naommy, 2004].

The reasons given for demanding that the decree be nullified are as follows. First, the establishment process lacked transparency and violated the principles of democracy and human rights [Hartono (2004f), Naommy (2004)]. Second, it ignored the authority of the regional governments and legislative councils who have jurisdiction in the area [Hartono, 2004f]. Third, the Ministry of Forestry shortened the procedures for changing the status of a forest area from nine steps to three, by the issuance of Decree No. 48/2004 [Naommy, 2004]. Fourth, the decree of the national park was announced earlier than scheduled – one week before the completion of the final draft of the feasibility study

carried out by the Forestry Department of Gadjah Mada University [Hartono (2004e), Naommy (2004)].

Furthermore, doubt has been cast on the success of the national park in conserving the environment for several reasons given by Hartono (2004e, 2004f). First, there have been no comprehensive studies on the management practices of the 42 previously established national parks. Second, environmental conditions have worsened in many of the previously established national parks, such as the Gunung Leuser, Gunung Halimun, Kutai, Bukit Tiga Puluh, Tanjung Puting, Gunung Palung, Ujung Kulon, Lore Lindu, Rawa Aopa, Komodo, Lorentz, and Wasur national parks. Third, as has happened in previously established parks ones, corruption is expected to occur between the National Park Management Body (BPTN) and local business entities; in other parks corruption has resulted in massive illegal logging, massive theft of biological resources, and new mining sites inside the national parks. Fourth, it was a surprise to see that Freeport, one of the largest gold companies in the world, was a main sponsor for the scheduled launch ceremony in 2002.

In June 2004, a group of villagers with the support of NGOs drove out heavy sand-mining machines from the Boyong River because the sand quarrying in the river had caused water shortages in six villages [Hartono, 2004d]. This event indicates that sand-quarrying activity had continued until at least one month after the establishment of the national park. Furthermore, according to a member of WALHI, some sand-mining areas of large private companies are located within the use zone of the national park.

Recently two lawsuits (No.106/G.TUN/2004/PTUN.JKT and 107/G.TUN/2004/PTUN.JKT), filed by a consortium of NGOs organized by WALHI Yogyakarta and presented to the National Court in Jakarta, have failed to satisfy local communities [Borrini and Kothari, 2006]. The conflict between the local communities and the National Resources Conservation Agency (BKSDA) remains on-going because the BKSDA carried out the mapping of the protected zone without community participation. The NGOs are attempting to convince the Great Council and the President of the Republic of Indonesia to engage the local communities in the establishment of the national park by using an international policy framework obtained by the World Commission on Protected Areas (WCPA) and the World Conservation Union (IUCN) [Borrini and Kothari, 2006].

4.7 CHAIN OF SOLUTIONS

The three impacts mentioned above (refer to Section 4.3) have developed into a chain. This chain (see figure 4-8) consists of two early branches that appear to converge into one. The first branch involves the consequences of the impacts on resource accessibility and conflict. Their solution involves the establishment of the GORO Association. The second branch involves the consequences of the impacts on the invasion of forest areas and the degradation of rivers. Their solution involves the establishment of the national park. The interesting point to be noted regarding this case is that the implemented solutions have generated new impacts.

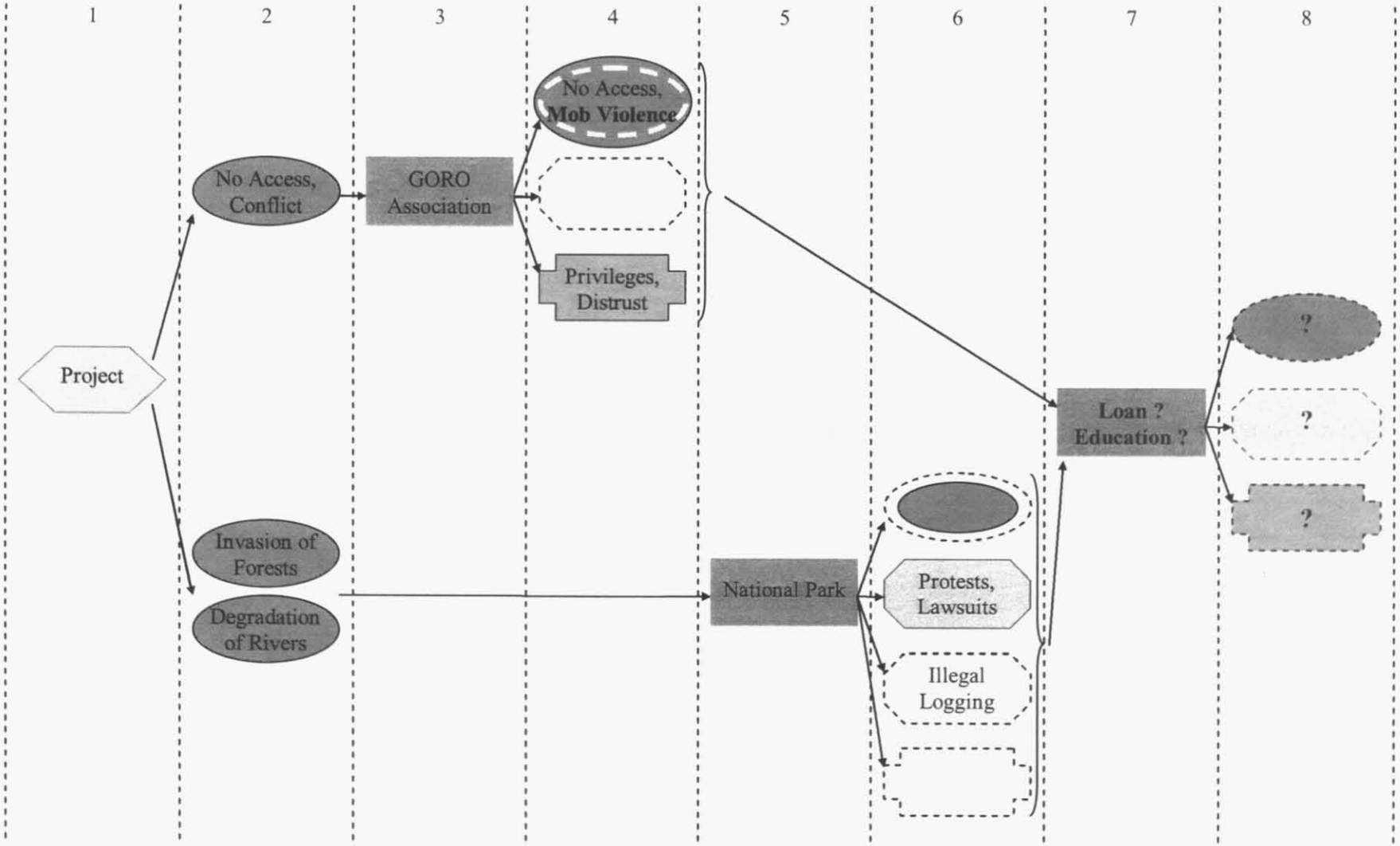


Figure 4-8: Chain of Solutions in the SBDM Case

In the first branch of chain, not only was the establishment of the GORO Association unable to resolve the impact on resource accessibility, it also enlarged the conflict into mob violence. In addition, the unexpected privileging of certain members and distrust occurred within the association.

Another noteworthy point is that a new impact can occur whether a solution succeeds or not. It can be speculated that even if the GORO Association had not encountered principal-agent problems, it might have resulted in another undesired situation: the association might have brought about a coalition between local villagers and private companies, who could have cooperated to quarry sand not only at dam sites but also illegally and pervasively in various forest areas and along the upper reaches of the rivers. As a result, environmental destruction would be accelerated even faster. Fortunately, it seems that this worrisome situation did not occur, due to the occurrence of the principal-agent problems. A lesson to be learnt from this scenario is that some solutions will generate new impacts regardless of their success.

In the second branch of chain, it is uncertain whether the national park will stop the destruction of forests that is being caused by sand-quarrying activities, because the sand-mining areas of the large corporations are located within the use zone of the national park. Thus, while the basic success of the establishment of the national park is unclear, a further impact has arisen in the form of protests and lawsuits.

Furthermore, the national park may well bring about the additional impacts on massive illegal logging, the massive theft of biological resources, and the granting of legal permits for mining inside the park, as these impacts have all occurred in previously established national parks in Indonesia.

Clearly, the two implemented solutions have not succeeded. Therefore, in the near future, the situation may lead to the requirement of further solutions for both the remaining impacts created by the Sabo dams and new impacts created by the previous solutions.

The government may decide to implement further solutions – such as agricultural and commercial loans, and an education program – to solve the environmental and social impacts or to turn the local communities' interest away from the national park and sand quarrying conflict. However, it should be noted that these solutions will have associated costs, and they may not be as effective as expected.

Agricultural and commercial loans are incentive programs often employed by governments to convince people to change their occupations in order to improve their income and living standards. However, this type of solution is often based on a number of erroneous assumptions. For example, the rate of return on agricultural and commercial activities may actually be lower than that generated by sand quarrying and its sales. This is because the natural resource itself is free, the transportation cost is low, and the market price of sand is high. Furthermore, there have been reports in many developing countries that people are often unable to pay back their loans, and this situation makes them poorer instead of richer; this can be due to many factors beyond their control such as floods and droughts, middleman problems, the high costs of fertilizers and pesticides, poor quality control of products, market price fluctuations, a lack of product innovation, a lack of commercial and marketing skills, and so on.

Education is an alternative means of resolving impacts. With higher education and skills, people are enabled to gain more comfortable jobs instead of the blue-collar jobs available in sand quarrying. However, people may not actively participate in the

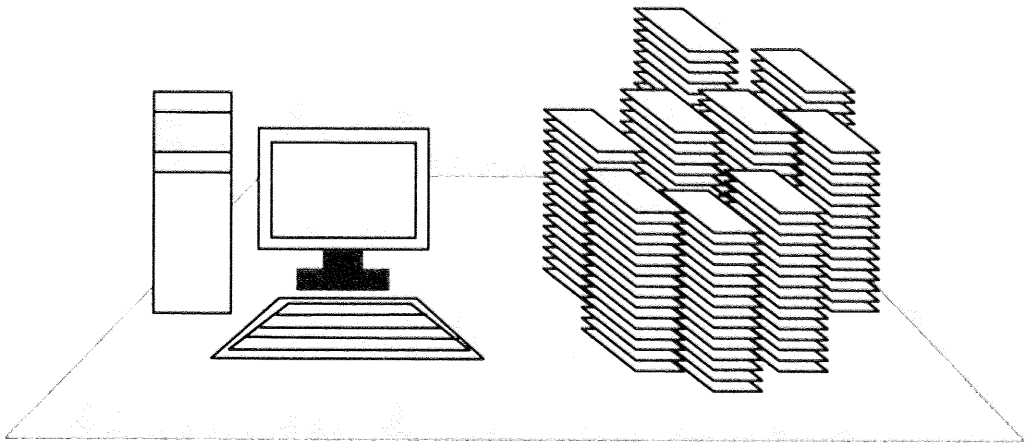
educational program for several reasons. As examples, they may feel too old to learn, they may have no time to join classes due to the need to maintain a day-to-day income, and they may consider that the benefits of the education program will not have an immediate impact on their daily earning. Moreover, a higher education does not always mean a higher level of environmental concern.

Furthermore, these solutions typically require further support projects such as an irrigation project, an industrial park, schools, training centers, and so on. It can be speculated that, in addition to the direct funding burden, these solutions may not only be unable to solve the earlier impacts, but may also generate serious new ones, such as a water battle in an irrigation project, air pollution and solid wastes in an industrial park, and corruption in the procurement processes of schools and training centers.

4.8 REVENGE EFFECTS AND THE AUTONOMY OF A SOLUTION

As described above, several new impacts have arisen due to the implementation of solutions. In an opposite effect to solving the conflict, the establishment of the GORO Association resulted in mob violence which had a more severe effect than the conflict it was expected to resolve. In addition, the association expanded the scope of the conflict into distrust among the members of the association due to principal-agent problems that various privileges were offered to its executive headers.

Furthermore, if the GORO Association had not encountered principal-agent problems, it could also have resulted in a coalition between the local sand miners and private companies for quarrying sand not only at dam sites but also illegally and pervasively in forest areas and along the upper reaches of the rivers.



"If computers really eliminate paperwork, why is the office recycling bin always overflowing? Why are the lines before your bank's ATMs often longer than the ones at the tellers' windows? [Tenner, 1996, back cover]"

"At home, too, cheaper security systems are flooding police with false alarms, half of them caused by user errors. In Philadelphia, only 3,000 of 157,000 calls from automatic security systems over three years were real; by diverting the full-time equivalent of fifty-eight police officers for useless calls, the systems may have promoted crime elsewhere. [Tenner, 1996, pp. 8-9]"

Figure 4-9: Revenge Effects

The impacts that the GORO Association caused provide more evidence to support the concept of revenge effect proposed by Tenner (1996) (see figure 4-9). The increased severity and expanded scope associated with revenge effects are illustrated by the mob violence and the distrust among members, respectively. Also, the GORO Association is a good example of autonomous technology as proposed by Ellul (1962). The association can generate impacts regardless of its success, whether the impact is a violent mob and membership distrust or a mining coalition resulting in environmental destruction.

4.9 CHANGES AND SHIFTS IN VALUE INDUCED BY A SOLUTION

The establishment of the national park resulted in conflicts and lawsuits between the local communities and the Ministry of Forestry. Also, it is likely to create the further impacts on massive illegal logging, massive theft of biological resources, and the granting of legal permits for mining inside the national park.

For example, a private company made a request to the provincial administration for the issuance of a permit for coal mining in the Kerinci Seblat National Park [The Jakarta Post, 2001]. As of August 2004, 13 companies had been given permission to carry out mining operations in the protected areas of national parks across Indonesia [Setiogi, 2004]. Additionally, an Australian-based company has been mining for gold in the Batang Gadis National Park since 1998, without a license from the Ministry of Forestry [Setiogi, 2004]. Recently, illegal logging operations by either the locals or commercial entities have become common inside national parks across Indonesia, including the Way Kambas National Park, the Mount Betung National Park, the Gunung Leuser National Park, and the Kerinci Seblat National Park [Gunawan (2005), Saroso (2005a), Saroso (2005b), Bachyul (2006)].

The establishment of the national park induces such impacts due to the powers of technology. As noted by Jonas (1979), technology suggests or generates new needs and desires by offering new challenges and feasibilities. The national park generates new desires by making it feasible not only to examine the volcanic ecosystem but also to utilize its natural resources economically and productively. Mining and logging companies are quick to recognize the latter possibility so that resource exploitation activities can be expected to occur in the park, either legally or illegally. Technology also has some associated values. As Pacey (1983) has noted, these associated values can vary among use values, exchange values and prestige values. These sets of values co-exist as long as they do not conflict with each other. The establishment of the national park stimulated a change in the values accorded to its resources from use values for the local communities to exchange values for the mining and logging companies. Accordingly, conflicts have occurred, and the exploitation of natural resources is expected to become apparent soon.

4.10 EFFECTS UNDERLYING A SOLUTION CHAIN

What is more important is that some effects that occur underlie the whole chain of solutions. The set of questions proposed in Chapter 3, section 3.6, is applied here to identify such effects. It is found that the first and second questions are particularly helpful in this case.

4.10.1 CERTAINTY IN UNCERTAINTY

The first question asks, 'Which resource input is the same for most of the solutions in a solution chain?' Financial investment is an artificial resource required for solutions in this case. To resolve the environmental impacts, the Indonesian government has spent considerable time and funding on the establishment of the national park.

However, its success is still uncertain. Thus, loan and education programs may be necessary. As described in the previous section, there are many factors which can render loan and education programs unsuccessful. Notably, the successes of the national park and its necessary solutions are uncertain; what certain is that the Indonesian government must continue to spend money.

4.10.2 DISGUISING OF MT. MERAPI'S THREATS

Regarding the second question, 'Do the new impacts created by a series of solutions have a similar foundation to the initial impacts they aimed to resolve?' In '*On Authority*', Engels criticized the view of anti-authoritarians, arguing that the presence of authority is commonly observed in both democratic and socialist countries. He noted:

> *"Supposing a social revolution dethroned the capitalists, who now exercise their authority over the production and circulation of wealth. Supposing, to adopt entirely the point of view of the anti-authoritarians, that the land and the instruments of labor had become the collective property of the workers who use them. Will authority have disappeared or will it only have changed its form? [Engels (no date) in Scharff and Dusek, 2003, pp. 78]"*

Engels insisted that authority is everywhere. He defended his argument through a number of examples, such as a railway system and a sea-going ship. Let consider the impact on conflict associated with the Sabo facilities (see figure 4-10). Without the Sabo dams, eruptions and debris flows from the active volcano are the obvious dangers. However, with the construction of the Sabo dams, under the new license system which controls resources, the local villagers are in danger of a reduced level of income. Therefore, the danger actually still exists but has simply changed its form – from volcanic

disaster to private sand-mining companies. Evaluating the Sabo facilities at Mt. Merapi from this viewpoint, it is difficult to agree with the proposition that the project has eliminated the threat to villagers' lives. Furthermore, considering the possibility of future agricultural and commercial loans, the danger to their lives will be transformed again, but this time from private companies to financial debts.

4.11 IMPACTS AND SOLUTIONS AS OPPORTUNITIES

Impacts and solutions in the chain are actually considered as opportunities for some stakeholders. The analysis and explanation of the arrows representing the links between impacts and solutions provides insight into such opportunities.

There are eight stages of arrows; the arrows from stage 0 to 1, 1 to 2, 2 to 3 in row1, 3 to 4 in row1, 4 to 5 in row2, 5 to 6 in row2, 6 to 7, and 7 to 8 (see figure 4-8). Key stakeholders relating to the Sabo development include the Central Government of the Republic of Indonesia (CG), the Ministry of Settlement and Regional Infrastructure (MI), the Ministry of Forestry (MF), the Ministry of Agriculture (MA), the Japan Bank for International Cooperation (JBIC), the Japan International Cooperation Agency (JICA), Regional Governmental Administrations (RA), private sand-mining companies (PSC), the local sand miners (LSN), farmers and other villagers (FV), non-governmental organizations (NGOs), international mining companies (MC), middlemen (MM), landlords (LL), and fertilizer and pesticide companies (FPC). Relevant events and stakeholders' actions as described in the previous sections are summarized in table 4-1. Their interests and actions are used as a basis for analyzing their coalition relationships, as shown in figure 4-10.

Table 4-1: Stakeholders' Interests and Actions

ACTORS	EXPRESSED INTERESTS	ACTIONS
	SBDM:0-1	
CG-MI	Safety from eruptions and debris flows	Deal with JBIC and JICA
JBIC	Loan offering, success of project	Offer a loan
JICA	Technical assistance, success of project	Perform feasibility and technical studies
RA	Safety from eruptions and debris flows	Support the project
FV	Safety from eruptions and debris flows	No opposition
LSN	Access to sand	Quarry sand at the foot of Mt. Merapi
	SBDM:1-2	
CG-MI	Safety from eruptions and debris flows	-
JBIC	Loan offering, success of project	-
JICA	Technical assistance, success of project	-
RA	Safety from eruptions and debris flows, funding for maintenance costs	Establish license system
FV	Safety from eruptions and debris flows, cultivation	Making use of safe land
PSC	Access to sand	Apply for mining permit
LSN	Access to sand	Quarry sand in forest and rivers, Dissatisfaction with license system
	SBDM:2-3:Row1	
CG-MI	Safety from eruptions and debris flows	Deal with JBIC and JICA
JBIC	Loan offering, success of project	Offer a loan
JICA	Technical assistance, success of project	Perform feasibility and technical studies
RA	Safety from eruptions and debris flows, funding for maintenance costs	Act as middle person for PSC and LSN
FV	Safety from eruptions and debris flows, cultivation	Making use of safe land
PSC	Access to sand	Compromise with GORO
LSN	Access to sand	Establish GORO
	SBDM:3-4:Row1	
CG-MI	Safety from eruptions and debris flows	-
JBIC	Loan offering, success of project	-
JICA	Technical assistance, success of project	-
RA	Safety from eruptions and debris flows, funding for maintenance costs	Maintain license system
FV	Safety from eruptions and debris flows, cultivation	-
PSC	Access to sand	Attempt to deteriorate GORO, Violate regulations
LSN	Access to sand	Some leaders form a coalition with PSC, Create a violent mob
	SBDM:4-5:Row2	
CG-MF	Safety from eruptions and debris flows, environmental concerns	Agree with national park plan
JBIC	Loan offering, success of project	-
JICA	Technical assistance, success of project	-
RA	Safety from eruptions and debris flows, funding for maintenance costs, status symbol, tourism, reforestation funding	Propose national park plan
FV	Safety from eruptions and debris flows, cultivation, participation in decision-making, rights to natural resources for daily existence, eviction	Demonstrations and protests
PSC	Access to sand	-
LSN	Access to sand	-
MC	Resources in areas of the national park	Providing sponsorship for launch ceremony
NGOs	Environmental concerns, advocating for community participation	Organize public meetings, Support villagers' protests

Table 4-1: Stakeholders' Interests and Actions (continued)

ACTORS	EXPRESSED INTERESTS	ACTIONS
	SBDM:5-6:Row2	
CG-MF	Safety from eruptions and debris flows, environmental concerns	Establish national park, Handle protests and lawsuits
JBIC	Loan offering, success of project	Perform ex post evaluation
JICA	Technical assistance, success of project	Perform ex post evaluation
RA	Safety from eruptions and debris flows, funding for maintenance costs, status symbol, tourism, reforestation funding	Support MF's activities
FV	Safety from eruptions and debris flows, cultivation, participation in decision-making, rights to natural resources for daily existence, eviction, water in rivers	Continue protests, Drive out PSC from its activity in river
PSC	Access to sand	-
LSN	Access to sand	-
MC	Resources in areas of the national park	-
NGOs	Environmental concerns, advocating for community participation	Support FV, Distribute information about impacts, File lawsuits
	SBDM:6-7	
CG-MF	Safety from eruptions and debris flows, environmental concerns	-
CG-MA	Safety from eruptions and debris flows, stop protests, solve conflict	Implement agricultural loan program
JBIC	Loan offering, success of project	Offer loan package
JICA	Technical assistance, success of project	Offer technical assistance
RA	Safety from eruptions and debris flows, funding for maintenance costs	Support MA's activities
FV	Safety from eruptions and debris flows, cultivation, participation in decision-making, rights to natural resources for daily existence, eviction, water in rivers, access to loan	Take a loan
PSC	Access to sand	-
LSN	Access to loan	Take a loan
MC	Resources in areas of the national park	-
NGOs	Environmental concerns, advocating for community participation, poverty reduction	Continue advocacy for community participation, Help LSN in agricultural activities
ACTORS	INTERESTS	ACTIONS
	SBDM:7-8	
CG-MF	Safety from eruptions and debris flows, environmental concerns	-
CG-MA	Safety from eruptions and debris flows, stop protests, solve conflict	Consider LSN's and FV's requests
JBIC	Loan offering, success of project	-
JICA	Technical assistance, success of project	-
RA	Safety from eruptions and debris flows, funding for maintenance costs	-
FV	Safety from eruptions and debris flows, cultivation, participation in decision-making, rights to natural resources for daily existence, eviction, water in rivers, access to loan	Ask for postponement of debt payment
PSC	Access to sand	-
LSN	Access to loan	Ask for postponement of debt payment
MC	Resources in areas of the national park	-
NGOs	Environmental concerns, advocating for community participation, poverty reduction	Continue advocacy for community participation, Support villagers in requests for postponement of debt repayment
MM	Sales and transactions	Offer low-price forward contracts
LL	Rental fees	Increase land rental fees
FPC	Sales and market shares	Promote use of fertilizers and pesticides

Note: The underlined texts indicate either new stakeholders or new interests.

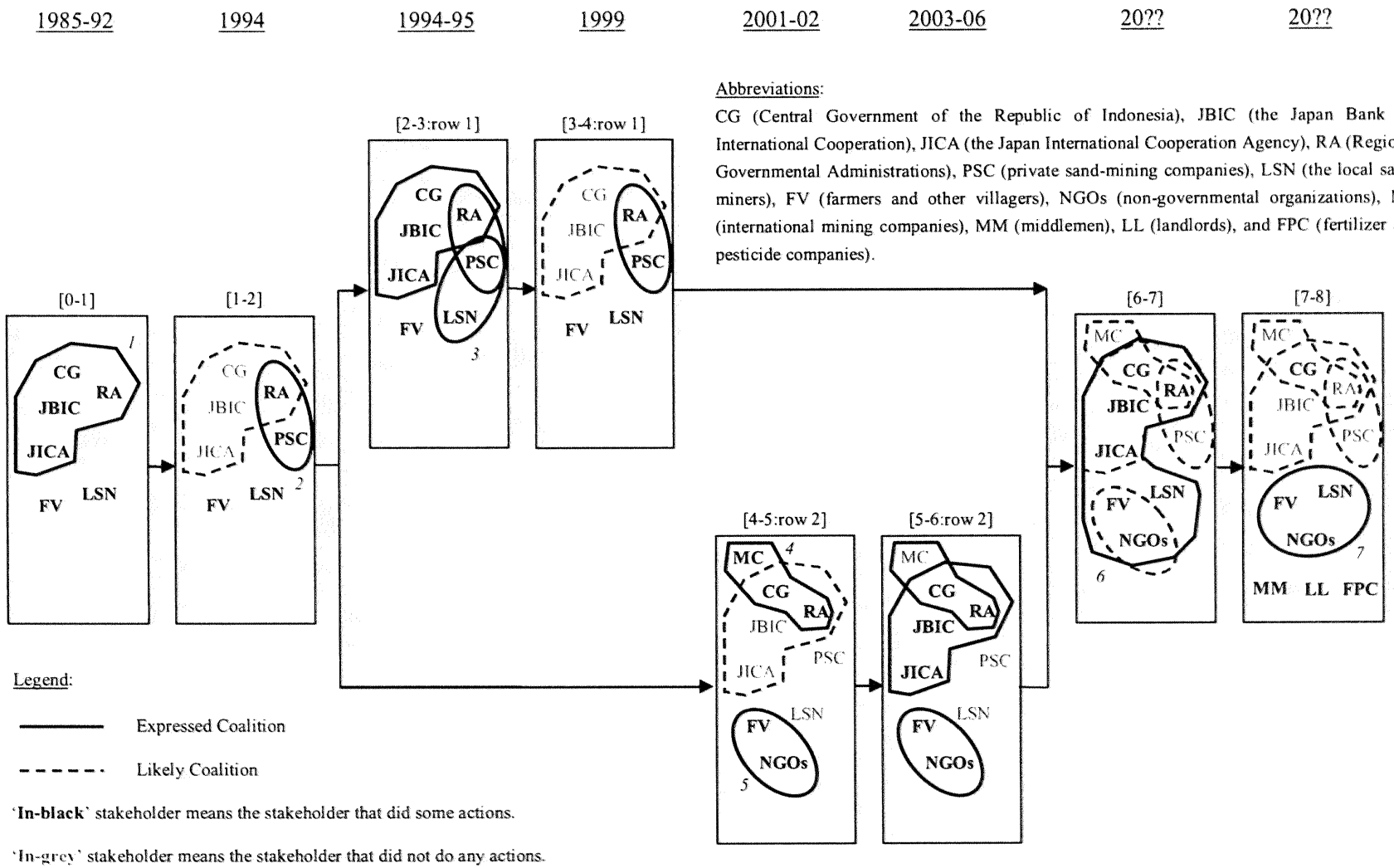


Figure 4-10: Coalition Relationships among Stakeholders

At stage [0-1], at the beginning of the Sabo project, it appeared that all of the key stakeholders agreed with the necessity of the project. The Republic of Indonesia agreed on a loan and assistance program with JBIC and JICA. There was no report of significant opposition from local villagers. However, it seemed that development projects in Indonesia at that time were pursued on the basis of top-down decisions, rather than bottom-up ones.

At stage [1-2], after the completion of the project, the sand-quarrying activities of locals were flourishing at dam sites, in forest areas, and along the upper reaches of the rivers. Once the Central Java provincial administration issued regional regulations governing the use of mining permits, the license system brought in a new actor – the private sand-mining companies. The license system was able to reduce the burden of the maintenance budget for the responsible agency. At the same time it discriminated against the local sand miners by limiting their access to sand, because the regional administration favored the private sand-mining companies. Lack of access to sand became a source of conflict between the local sand miners and the private companies cooperating with the regional administration. In other words, the license system provided a rent or privilege for private companies at the expense of the locals.

At stage [2-3: row1], the local sand miners set up the GORO Association and succeeded in negotiating with the private companies. The private companies agreed to hire the locals in their sand-mining operations. At around the same time, the Republic of Indonesia, with the cooperation of JBIC and JICA, constructed the Sabo Project Phase II.

At stage [3-4: row1], the cooperative relationship between the local sand miners and the private companies had ceased due to the occurrence of principle-agent problems within the GORO Association. The private companies offered privileges to the executive

leaders of the GORO Association. This behavior on the part of the private companies was considered as an effort to deteriorate the GORO Association. Although it was possible that the executive leaders did not intend to take conflict-of-interest actions at the time of establishing the association, a number of them used their positions as an opportunity to obtain special rights and incomes.

At stage [4-5: row2], the Mt. Merapi National Park Plan was proposed by the Governor of Yogyakarta. The Ministry of Forestry agreed with the plan. The launch ceremony was scheduled to be held in October 2002 with the sponsorship of Freeport, one of the largest gold companies in the world. At this stage, NGOs appeared for the first time as key actors. According to a newspaper interview, the Governor of Yogyakarta described three other justifications for the national park; these were that the park would become a status symbol, would generate income from tourism, and would provide access to reforestation funding. These justifications were actually opportunities for the regional administration. According to a member of WALHI, the existing regulations, if strictly enforced, could have been used instead of the national park plan to solve the environmental impacts occurring at Mt. Merapi.

At stage [5-6:row2], the national park was finally established. Since then, local communities with the support of NGOs have continuously been organizing demonstrations and protests. They have also filed two lawsuits against the Minister of Forestry. Furthermore, the villagers consider that water shortages occurring in six villages have been due to sand-quarrying activities. Thus, a group of villagers with the support of NGOs drove heavy sand-mining machines out from the Boyong River. At this time, JBIC and JICA performed an ex post evaluation survey of the Project Phase II.

At stage [6-7], if the Republic of Indonesia were to initiate an agriculture loan program, such a program may be aimed at resolving the environmental and social impacts, or to turn the interest of local communities away from the conflicts over the national park and sand quarrying. The Republic of Indonesia may approach JBIC and JICA for international financial and technical cooperation, or vice versa. This would present an opportunity for JBIC in offering a loan for future interest, and for JICA in exercising their technical knowledge and obtaining local information. The local sand-miners, farmers, and other villagers may be attracted by such a loan program, since they may have become tired of conflicts which are likely to remain unfinished. Also, NGOs are generally not against such programs, and they might also use this opportunity to convince local sand miners to engage in various agricultural activities. At this stage, most stakeholders would cooperate with each other. They would include the Republic of Indonesia, JBIC, JICA, the regional administration, farmers and villagers, the local sand miners, and NGOs.

It should be noted that those groups who receive a loan are also taking on the risk of a loan default. This kind of risk does not exist in earlier lifestyles in which villagers depend on natural resources such as volcanic sand, grass for cattle, and firewood. In addition, the loan program may encourage the involvement of new actors who are rent seekers. With a typical agricultural loan, rent seekers include middlemen, landlords, seeding companies, cattle-feed product companies, and fertilizer and pesticide companies.

Therefore, with the risks of agricultural activities and the possible involvement of new rent seekers, at stage [7-8] the local sand miners, farmers, and other villagers may end up with loan defaults. If this occurred their cooperation with the government would cease. They might also unite together, with the support of NGOs, to negotiate with the government agency responsible for a postponement of their debt payments or a discounted interest rate. Accordingly, the government might postpone the debt payment

due-date, which would increase the burden of the national debt, or insist on payment with consequent conflicts with the locals. Notably, the Sabo project would thus not only bring debt to the Republic of Indonesia from the initial loan for the project itself, but also from successive solutions such as the above-described agricultural loan program. Opportunities arising from possible impacts and solutions are summarized in table 4-2.

Table 4-2: Impacts and Solutions as Opportunities

#	Source of opportunity: What impact?	Source of opportunity: What solution?	Whose opportunity?	What action?	What opportunity?	Who/What might suffer?	Concept of technology
1	No access to sand, Conflicts	-	-	-	-	-	-
	-	GORO	GORO's Leader	Unfavorable principle-agent behavior	Privileges	Members of GORO	Power over technology
2	Invasion of forest, Degradation of river	-	Regional government	Propose national park plan	Funding	Local communities	Imperatives, Instrumentalism
	-	National park	Mining Company	Seek mining permit	Ore	Environmental conditions	Challenge & Feasibility, Alien Values
			National Park Management Body	Allow corruption	Bribes	Environmental conditions	
3	Conflict over sand, Conflict over national park	-	-	-	-	-	-
	-	Agricultural loan	MM	Manipulate prices	Profit from price gap	LSN, FV	Imperatives
			LL	Increase land-rental fee	Land-rental fee	LSN, FV	
			FPC	Promote usage and sale	Sales, Market share	LSN, FV	
			PSC	(Do nothing)	Sand	Environmental conditions	Background Relations