The Study on Comprehensive Disaster Prevention around Mayon Volcano

Volume II - MAIN REPORT

(Part I: Master Plan)

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

In response to the official request of the Government of the Republic of the Philippines (GOP), the Government of Japan (GOJ) has decided to conduct a Study on Comprehensive Disaster Prevention around Mayon Volcano in the Republic of the Philippines (the Study) and exchanged the Note Verbale with GOP concerning the implementation of the Study.

The Japan International Cooperation Agency (JICA), official agency responsible for the implementation of the technical cooperation programs of GOJ, commenced the Study from September 1998, in accordance with the relevant laws and regulations in force in Japan. On the part of GOP, the Department of Public Works and Highways (DPWH) acts as a counterpart agency for the JICA Study Team and also as a coordinating body in relation with other relevant governmental and non-governmental organizations concerned for the smooth implementation of the Study.

1.2 Objectives of the Study

The objectives of the Study are:

1) To formulate a master plan on comprehensive disaster prevention measures, both structural and non-structural, around Mayon Volcano in the Republic of the Philippines.
2) To conduct a feasibility study for prioritized projects selected by the master plan.
3) To perform technology transfer to the counterpart personnel to be dispatched by GOP in the course of the Study.

1.3 Scope of the Study

In accordance with the "Implementing Arrangement" agreed upon between both parties (GOP and JICA) and terms of reference (TOR) given by JICA, the Study centers on the "comprehensive disaster prevention", especially focusing prevention/mitigation, forecasting and warning, awareness raising, and evacuation and resettlement.

The disasters to be brought by hazards of "volcanic eruption", "flood & debris flow" and "typhoon" are focused in the Study in compliance with the terms of reference given by JICA.

1.4 Study Area

The Master Plan Study on Comprehensive Disaster Prevention around Mayon Volcano covers the surrounding areas around Mayon Volcano as shown in the Location Map. In this area, there exist seven river systems and 17 rivers including their tributaries, which are exposed to potential hazards and need disaster management analysis.

Administratively, the Study Area concerns one city (Legazpi) and nine municipalities consisting of Bacacay, Camalig, Daraga, Guinobatan, Ligao, Malilipot, Malinao, Sto. Domingo, and Tabaco. In consideration of the term of "surrounding areas around Mayon Volcano", the Study Area or disastrous zone could be confined at a radius of 17 km from the volcano's crater.

The Feasibility Study focused on the two administrative divisions: Legazpi City and Daraga Municipality, where the priority project sites selected in the Master Plan are mostly located.

1.5 Study Organization

The Study was carried out by a Study Team appointed by JICA in close collaboration with DPWH and other government agencies concerned with provision of the counterpart personnel attached to the Study Team. Sixteen JICA experts have participated in the Study.

To conduct the Study effectively, GOP organized a Steering Committee and Technical Working Group consisting of representatives from relevant DPWH divisions and other departments.

On the other hand, JICA formed the Advisory Committee for the Study to provide advice to the JICA Study Team. The member lists of the Study Team with their respective counterparts, Steering Committee, Technical Working Group, JICA Advisory Committee are given in Tables 1.1, 1.2 and 1.3 respectively, together with the representatives of JICA Philippines Office.

1.6 Study Performance

The entire work schedule of the Study is shown in Table 1.4. The Study started at the end of September 1998 with preparation of the Inception Report and is scheduled to be completed in July 2000 with submission of the Final Report. The Study is divided into two phases: (a) Phase I for basic study and formulation of a Master Plan and (b) Phase II for Feasibility Study on the priority projects & programs selected in the Master Plan.

(1) Activities during Phase I

At the beginning of the Phase I first fieldwork, discussion meetings were held on October 2, 7, and 8, 1998. The Study Team explained and discussed the contents of the Inception Report describing the plan of operation of the Study with representatives of the GOP authorities concerned. With approval of this plan of operation at the Steering Committee meeting, the JICA Study Team commenced the fieldwork and collected the relevant data and information from various agencies. In parallel, the Study Team inspected the disaster-prone areas to grasp the present situation of disaster prevention in the respective areas around Mayon Volcano, and clarified the present constraints and problems. All the results of assessment and preliminary basic development plan were compiled into the Progress Report (1).

With reference to the comments and suggestions of GOP in the meetings on the Progress Report (1) on March 10 and 12, 1999 and the results of further study in Japan, a Master Plan on Comprehensive Disaster Prevention was compiled in the Interim Report.

The formulation work of the Master Plan was originally to be carried out in Japan from May to July, 1999. However, upon request of the Philippine side, a part of this Study was converted into fieldwork in the Philippines - from May to July - to carry out its formulation work jointly with the Philippine counterpart personnel. In the Steering Committee meeting held on June 18, 1999 (at the end of field work in Phase I), the Study Team explained the process of formulating the Master Plan and exchanged views on the interim results of the Study. Subsequently, the homework in Japan followed and the Interim Report was compiled in June 1999.

(2) Activities during Phase II

The Phase II fieldwork started in the Philippines on August 19, 1999. The Study Team submitted the Interim Report to DPWH (GOP) and held discussions on the report, especially focusing on the priority projects and programs selected in the Master Plan. The contents of the Interim Report were agreed on in principle by the Steering Committee. After the meeting, the JICA Study Team resumed the field study and collected additional data and information from the agencies concerned and exchanged views on the priority projects and programs subjected to the Feasibility Study. The interim outputs of the Phase II field study were compiled as Progress Report (2) and discussed in the Steering Committee held on December 15, 1999. Successively, the Study Team conducted the Phase II homework in Japan until the middle of March to prepare the Draft Final Report.

From May 21 to June 15, 2000 (Phase II 4th field work), the Study Team visited the Philippines for the purpose of making presentation and discussion about the contents of the Draft Final Report, and holding the 2nd Technology Transfer Seminar and Workshops for the 2nd Pilot Project. The Final Report was prepared in the 3rd home work in Japan, based on the review results on comments from GOP.

1.7 Logical Framework of the Study

Construction of the Log Frame is not just for monitoring and evaluation purpose but for planning purpose. Appreciating this point that the Log Frame is good as a "planning device" which also helps to place monitoring and evaluation within a wider policy/program/project framework, the construction of a logical framework was attempted for Comprehensive Disaster Prevention Plan in compliance with the request of the NEDA Region-V. Its construction works were carried out in close cooperation with a representative staff of the NEDA Region-V and their results are summarized below.

(1) Goal of the Comprehensive Disaster Prevention Plan

The Logical Framework Matrix of the Comprehensive Disaster Prevention Plan is summarized in Table 1.5. The goal of the Comprehensive Disaster Prevention Plan is :

> to "protect the life and property of the people living around Mayon Volcano and establish the sustainable comprehensive disaster prevention system".

This goal describes the ultimate objective of formulating and undertaking the Plan. To achieve this goal, the following essential conditions are assumed: the Philippine governments (NGAs & LGUs) and the people recognize and support the long-term objectives and benefits of the comprehensive disaster prevention. This assumption statement is an integral part of the Plan's success.

(2) Purpose of the Plan

The purpose of the Plan is :

> to "strengthening the disaster prevention capacity" of the communities and their people by means of reducing vulnerability and mitigating hazard.

The assumptions for achieving purpose are as follows:

- The Philippine government (National Government and Local Government Units, LGUs) maintains political support and commitment for implementation of the Plan,
- Sustained community and public support is generated and maintained for the structural and non-structural measures proposed in the Plan, and
- The Comprehensive Disaster Prevention Plan will be implemented, together with accelerated area development programs.

(3) Outputs of the Plan

The "outputs" are expressed as outcome, which the Project expects to realize by the target year of the Study. The outputs of the Plan include the following :

- Reduction of the damages by mud and debris flows by constructing the sabo facilities and enhanced land use in the protected area,
- Reduction of the flood damage in Legazpi City by implementing the urban drainage project,
- No loss of life, no casualties and mitigated damages through upgrading the forecasting, warning, and evacuation system,
- No loss of life and property through relocation of people to the proposed,
- Resettlement site with livelihood support, and
- Reduction of the vulnerability and/or upgraded disaster coping capacity of the government agencies and communities through institutional improvement and enhance land use.

The assumptions for achieving "outputs" are important conditions or decisions outside the control of the project management, necessary for achievement of the immediate objective. These are used to highlight real or potential project weaknesses.

The assumptions for achieving these outputs are as follows:

- The magnitude of Mayon Volcano eruption is the same as those of 1984 and 1993 eruptions,
- 20-year probable rainfall for mud & debris flow and flood, while 10-year probable rainfall for the urban drainage,
- The Philippine government consisting of the National Government and LGUs allocates the necessary fund for implementation of the projects,
- Adequate local funds are allocated for their O&M and supporting services by NGAs and LGUs, and

- Suitable human resources development for staffs of the agencies concerned and target beneficiaries.

1.8 Transfer of Technology

On October 30, 1998, the Technology Transfer Plan for the Study on Comprehensive Disaster Prevention around Mayon Volcano was signed by the both parties: DPWH and the JICA Study Team, and officially took effect. This Plan of Operation for Technology Transfer was prepared with a view to ensure more efficient transfer of technology to the counterpart personnel from the GOP in the course of the Study period, especially during field works of Phases I and II.

The 1st and 2nd field works have been carried out in close cooperation and joint-work with the counterpart personnel consisting of engineers and officers at Central and Local Government levels. The transfer of technology has been done mainly by the "Learn-by Doing" and this is facilitated with the weekly meeting on the progress of the week.

As mentioned in the Technology Transfer Plan, the methods to be adopted in this Study are categorized as follows.

1) On the Job Training for counterpart personnel on study and planning methods
2) Technical Transfer Seminars (two times)
3) Transfer of technology through five workshops by PCM method

The major technology transfer programs granted during the Phase I and Phase II (as of date) are the following.

1) 1st PCM Workshop (October 15-16, 1998)
2) Seminar on the Remote Sensing & GIS Technology and its Application to the Study on Comprehensive Disaster Prevention around Mayon Volcano (February 11, 1999)
3) Seminar on Disaster Prevention around Mayon Volcano (March 3-5, 1999)
4) Seminars on Trench Excavation Works at the Sites of Cagsawa and Sto. Domingo (March 10-12, 1999)
5) 1st Technology Transfer Seminar (August 25, 1999)
6) 2nd PCM Workshop (October 26-27, 1999)
7) 3rd Workshop (November 24, 1999)
8) Implementation of the Pilot Project (November 27, 1999)
9) 4th Workshop (December 2nd, 1999)
10) 2nd Technology Transfer Seminar (May 30, 2000)
11) Workshops for the Second Pilot Project (June 5, 9 and 13, 2000)

With a view to assessing the results of technology transfer, the JICA Study Team distributed to every Philippine participant to fill up an “evaluation sheet” at most of the major seminars and workshops organized by the Study Team. According to the results of their evaluations on these seminars and workshops, 97% to 100% of the respective participants appreciated them by giving the higher ratings consisting of “excellent”, “very good” and “good” (refer to the Technology Transfer Achievement Report for more detailed information).

Judging from the above favorable assessments, it may be reasonable to conclude that the technology transfer plan made for this Study was successively carried out and the seminars and workshops organized by the Team could satisfy expectations of almost all the participants.

CHAPTER 2 ISSUES FOR COMPREHENSIVE DISASTER PREVENTION PLANNING

2.1 Issues Identified in the Past Events

The location of the area around Mayon Volcano (the Study Area) renders it prone to both geologic and meteorological hazards, i.e. volcanic eruption, typhoons, mud and debris flow, floods, etc. Such situation of the area leaves the population at risk and the poss

.ibility of these hazards resulting in disasters is very high as evidenced by their past occurrences (see Table 2.1).

The Study Area is located in the midst of the Philippine archipelago. Typhoons and flooding historically occur almost every year, while the volcano has a pattern of eruption every 8 to 10 years. In fact, this possibility of hazards increases as the population, economic, social and political activities concentrate in highly hazardous areas.

(1) Case Studies on the Latest Major Disasters

Due to lack of basic data, the effects of a natural disaster on the economy of a community are difficult to quantify, and surprisingly, little attention has been given to economic reconstruction efforts. It is also hard to put exact figures on economic regression or decrease in living standards. However, estimates of PDCC on the cost of damage due to mud & debris flows and flooding were at PHP938.6 millions wrought by six tropical cyclones that had rocked the province from year 1993 to 1997.

Albay Province has an average frequency of typhoon occurrence of one time per year. The frequency itself is the country's mean as shown in the following table, but the hazards associated with tropical depression like mud & debris flows, flash floods and strong winds have aggravated the disaster impacts on the area.

Frequency of Tropical Typhoon Passage over Philippine Provinces, 1948-1994 (47 years period)

Province	Tropical Depression	Tropical Storm	Typhoon	Total
1. Albay	10	9	23	42
2. Camarines Norte	5	11	9	25
3. Camarines Sur	9	14	26	49
4. Catanduanes	3	11	15	29
5. Masbate	5	13	28	46
6. Sorsogon	4	10	18	32
Country's Mean	6.8	12.7	23.6	43.1

Notes: Classification of Tropical Cyclones
- Tropical depression: maximum winds blowing near the center do not exceed 63 kph.
- Tropical storm: maximum winds blowing near the center have speed from 63 to 118 kph.
- Typhoon: maximum winds blowing near the center have speed over 118 kph.

Source: Disaster Preparedness Training Program for Local Government Units in the Philippines, Local Government Academy Training Center & University of the Philippines (Los Banos/Laguna), November 1996.

Analyzing the past disaster cases like hazardous impacts and measures taken would serve to elucidate the root causes of disasters, vulnerability and disaster prevention capacity which are the key issues to be dealt in the comprehensive disaster prevention.

1) Mayon Eruption in 1993

In 1993, Mayon Volcano erupted and caused damages as summarized below.

(Casualties & Mobilization)

Death	77
Injured	5
Missing	0
No. of affected barangays	75
No. of affected families	12,139
No. of evacuated families	12,139
No. of evacuated people	63,055
No. of evacuation centers	52

(Damages on Agriculture)

Crop loss	11,916 ha	(PHP 71,073,000)
Livestock	1,688 ha	(PHP 2,198,000)
Fishery	7,285 ha	(PHP 19,000)
Forest	350 ha	(PHP 4,380,000)
Total Damages		PHP 77,670,000

Note: For more detailed information, refer to Table 2.1

The problems pointed out in this eruption can be summarized as follows:

- The eruption of 1993 occurred suddenly without any detectable precursors. Therefore, PHIVOLCS instruments could not forecast nor issue any warning.
- 70 persons died out of the 104 persons victimized by the pyroclastic flows of the eruption. Most of them are those who were practicing farming on the slopes of the Mayon Volcano. There was no shelter in the danger zone.
- Since the eruption occurred suddenly, it took so much time to evacuate all people at risk, and the following troubles happened in the course of evacuation and relief of the affected people:

  (Evacuation)

  - Lack of communications facilities
  - Confused information
  - Delayed evacuation due to problem of transportation

  (Relief)

  - Lack of rescue equipment and funds
  - Dishonest volunteers
  - Political intervention (Relief activities through affiliation of political party)
- After eruption, the resettlement sites were prepared to accommodate the Mayon victims, but most of them were without livelihood or, if provided, livelihood assistance was shortly consumed.
- Some water reservoirs supplying the major water requirements of Legazpi City and Daraga Municipality (Albay) were seriously exposed to contamination after eruption, especially due to damage by mud flow.

2) Typhoon Loleng in 1998

The impact of Typhoon Loleng in Albay Province registered the following casualties and damages:

(Casualties & Mobilization)

Death	3
Injured	11
Missing	0
No. of affected barangays	561
No. of evacuated families	49,595
No. of evacuated people	218,374
No. of evacuation centers	202

(Damages on Agriculture)

Crop loss	10,820 ha	(PHP 195,686,000)
Livestock	33,963 heads	(PHP 4,264,000)
Fishery	97,500 ha	(PHP 915,000)
Forest	442,000 ha	(PHP 4,552,000)

(Damages on Public Facility and Homes)

Public facility		(PHP 201,000,000)
Total destroyed homes	13,547	(PHP 677,350,000)
Partially destroyed homes	60,411	(PHP 906,165,000)
Total Damages		PHP 1,989,932,000

Note: For more detailed information, refer to Table 2.1

The problems identified in this typhoon can be summarized as follows:

- The damages caused by this typhoon were mostly due to strong wind.
- Most injuries were caused by falling debris.
- The reported one dead person was due to flooding after the typhoon. The two others were likewise caused by post typhoon effects.
- Relief assistance to the victims was given relatively fast by DSWD Regional Field Office No.5 Disaster Action and Response Team (DART), LGUs and NGOs.
- Shortage of evacuation facilities compelled some to take shelter under big trees which are unsafe.
- Lack of chlorination facilities to ensure safe drinking water after the typoon due to flood contamination in open wells.
- Trouble in communication system (VHF radio and telephone) that lasted for several months due to damaged outdoor antenna and wire lines. As of date, a total of 17 municipalities have no functional radios due to high cost of replacement estimated at PHP1.8 millions. These devices comprise 20 base units, 15 mobile units, and 20 potable sets.

- Lack of national intervention to assist the need of the victims after the typhoon. The local government capabilities were insufficient to supply the immediate demands to rehabilitate socioeconomic damages.
- The public facilities like roads & bridges, power supply and communication systems were damaged and out of service more than 10 days. The prolonged recovery affected greatly the socioeconomic activities and caused the recession.

Just after Typhoon Loleng hit (on October 23 & 24, 1998), the JICA Study Team conducted the site reconnaissance survey around Mayon Volcano, and prepared an observation report with regard to damages and vulnerabilities of the area for the purpose of reporting to DPWH with the respective proposed countermeasures. Although the survey area was limited and survey itself was conducted in an ocular basis, this report contained real situations of the damages brought by this typhoon. According to this report, many public infrastructures were damaged by scouring and erosion as observed in Table 2.2.

As seen in the above, severe damages in the Study Area around Mayon Volcano have been mainly attributed to tropical cyclones and volcanic eruptions. Apparently, the social and economic stability was disrupted. The devastating volcanic eruptions, mudflows, and flash floods have repeatedly caused damages to the physical structures of the area, such as public facilities like buildings, roads and bridges and other social infrastructures, in addition to huge economic disturbances.

In this connection, the frequency and magnitude of disaster occurrence in Albay Province including the Study Area can be corroborated by the annual average of national calamity funds disbursed from 1996 to 1998 (see Table 2.3). In terms of the total amount disbursed as national calamity funds in this period, Bicol Region (Region V) is ranked at “First”, accounting for 24.5% of the total amount. Of the Bicol Region’s total, Camarines Sur Province occupies 41.0%, followed by Albay Province (29.4%), Sorsogon (10.1%), Camarines Norte (9.9%) and Catanduanes (8.5%).

Despite its total amount, Canarines Sur Province has double the land area of Albay Province. Consequently, the degree of calamity (or calamity fund per km^2) in Albay Province (PHP15,539) is more dense than that in Camarines Sur (PHP13,066). From this data, it is evident that Albay Province including the Study Area is situated in the disaster prone region.

(2) Assessment of the Past Disaster Prevention Works and Activities in the Study Area

In addition to this Study being implemented by JICA, the major studies and works carried out so far in relation to the disaster prevention around Mayon Volcano are the following :

1) Master Plan for Mayon Volcano Sabo and Flood Control Project, March 1981, JICA

In the 1981 Master Plan, the Sabo plan was formulated to mitigate and retard the sediment materials, and proposed the construction of Sabo facilities for major rivers around Mayon Volcano. The number of Sabo facilities proposed in the 1981 Master Plan are summarized below with the respective sediment run-off volumes.

Sabo Facilities Proposed in the Master Plan for Mayon Volcano Sabo and Flood Control Project, March 1981, JICA

Rivers	Sabo Dam	Consoli-dation Dam	Spur Dike	Ground Sill	Jetty	Sediment Run-off Volume (m^3)		
						Without Facilities	With Facilities	Sediment Volume Reduction Ratio (%)
Yawa	-	-	-	-	-	-	-	-
Pawa-Burabod	1	7	7	-	-	252,000	69,500	72%
Budiao	-	-	8	-	6	234,600	58,100	75%
Anoling	-	5	-	-	-	415,600	85,800	79%
Quirangay	-	-	6	-	3	260,100	78,200	70%
Tumpa	-	15	-	-	-	43,700	26,900	38%
Manilila	-	9	-	-	-	94,000	36,700	61%
Masarawag	-	9	13	-	3	276,800	65,300	76%
Ogsong	-	2	6	3	9	140,500	28,500	80%
Nasisi	-	2	3	23	-	992,100	270,900	73%
Buang	-	4	2	-	-	211,800	67,800	68%
Quinali (B)	1	-	-	-	-	319,700	119,700	63%
San Vicente	-	-	-	-	-	-	-	-
Arimbay	-	-	-	-	-	-	-	-
Padang	-	-	-	-	-	-	-	-
Basud	-	-	-	-	-	-	-	-
Bulawan	-	-	-	-	-	-	-	-

Source: Master Plan Study Report for Mayon Volcano Sabo and Flood Control Project, 1981, JICA

2) Re-Study of Mayon Volcano Sabo and Flood Control Project, March 1983, JICA

In 1981, the typhoon “Daling” hit the Bicol region including the Study Area, and brought about serious damages with geomorphological changes on the slopes of Mayon Volcano. From this respect, the Master Plan for Mayon Volcano Sabo and Flood Control Project prepared in 1981 was re-assessed and reviewed, primarily

taking account of the serious disaster occurred during typhoon "Daling". After completion of the re-assessment and review of the Master Plan in March 1983, both the Sabo project on the southern slope of Volcano and disaster forecasting and warning system project were proposed.

Based on and/or referring to the Sabo plans in 1981 and 1983, the DPWH Region-V has constructed Sabo facilities around Mayon Volcano. Some of the facilities have collapsed a few years later after their construction due to the associated hazards like mud and debris flows and flush floods caused subsequently to the volcanic eruption in 1993 and typhoons. The causes of damages were also scrutinized in the present JICA Study and optimum countermeasures are incorporated into the formulated Sabo plans to avoid the similar destruction and damages.

3) Disaster Preparedness and Response Pilot Project at the Community Level, 1989-1992 (Italian Government Assistance Project)

The Action Program for the Italian Aid Project in Albay Province was prepared in a three month period commencing in August 1989. The project proper was implemented with the financial and technical assistance of the Italian Government from 1991 to 1992. Two Italian Experts specialized in project planning, monitoring and supervision participated in this project.

On the Philippine side, the Provincial Disaster Coordinating Council (PDCC) took charge of planning and management, supervision of the project. The total budget for this project is reported to amount to US$700,000.

The pilot project was meant to develop field tested methodology for community-based disaster preparedness and response activities, which might eventually be extended nationwide, to support and strengthen the Philippine National Plan for Disaster Preparedness and Response. The ultimate objective of the project was to prevent and reduce the adverse effects of natural disasters on the community by minimizing its vulnerability through the strengthening of its coping capacity, and promoting and sustaining the community development.

The project covered seven municipalities of: Sto. Domingo, Rapu-Rapu, Bacacay, Malilipot, Tabaco, Manito, and the City of Legazpi. For implementation of the Project, 186 barangays were selected. Barangays in these areas are mostly coastal and usually affected hardly by typhoon and storm surges.

The project was comprised of the following three major components :

1) Organizational set-up, human resources development and awareness promotion on disaster prevention : establishment of Disaster Preparedness Committee, provision of training, awareness promotion, etc.,
2) Strengthening of the disaster management facilities and equipment: renovation of the PDCC, installation of radio equipment and so on, and
3) Other activities including the supports to promote the livelihood projects and provision of basic social infrastructure.
   Note : For more detailed information, refer to Table 2.4.

The effectiveness of the "Disaster Preparedness and Response Pilot Project" implemented with the support of the Italian Government could be measured by the following:

1) The project served as the motivating factor for the Province to institutionalize the Provincial Disaster Management Office (PDMO) to continue what was started and as a result of the project recommendation.
2) It inspired PDCC member agencies to continue coordinating arrangements not only for the Project but also especially in times of calamity. For this, Albay-PDCC was recognized by the Asian Disaster Preparedness Center in Bangkok, Thailand as a good exemplar in disaster management for reasons of its achievements described in Table 2.4.
3) The experiences, which were found effective in the Pilot Project have been applied in the PDCC operations.
4) Using experiences with the Italian Project and its application to actual disaster management on typhoon and volcanic eruptions, Albay became popular on disaster management having been invited as resource province to share disaster management experiences in various seminars and training conducted by the Corporate Network for Disaster Response (CNDR) and Action Disaster Preparedness Center (ADPC) in the Philippines, since 1995 to 1998.

According to the results of the interview survey to those involved in this project (presently PDMO staff) and evaluation report entitled "Study on Disaster Prevention and Preparedness in Developing Countries (ECFA)", the problems pointed out could be converged on the following three issues:

- Inappropriate project design which lacks in comprehensive approach based on the needs of the communities and people concerned and in overall coordination,

- Insufficient coordination with local NGOs (except PNRC) from the planning stage through its implementation, and
- Lack of project implementation records for further monitoring and feedback.

Based on the precious experiences and lessons learnt from this project, the following are primary issues to be considered in formulation of the Comprehensive Disaster Prevention Plan.

- To enhance the effectiveness of the community-based disaster prevention project, it needs to introduce an appropriate technology for project design, by taking into account the inter-relation of the respective project components,
- For the sound implementation and sustainability of the project, it is important to make involve the locally active NGOs from the planning stage, and
- To serve as a model project and make the most use of their outputs, it is essential to continue to monitor the project, and make a record on its implementation, which contains the factors of success and failure identified in its post-evaluation.

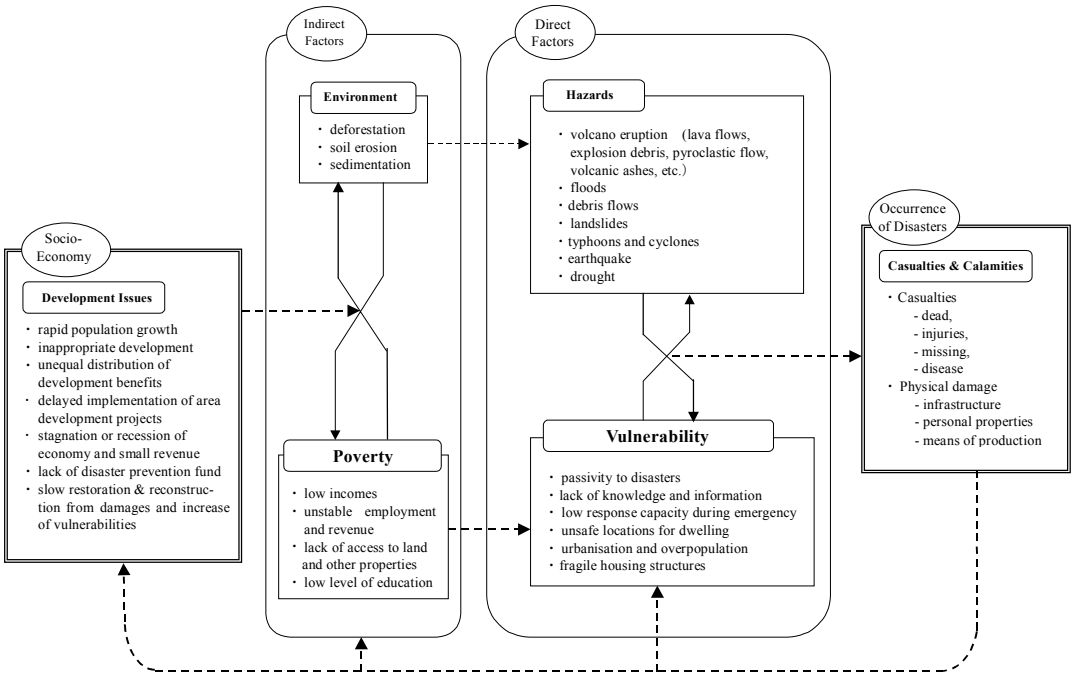
2.2 Analysis of Disaster Related Factors and Disaster Prevention Capacity

(1) Cause and Effect in Disaster Mechanism

The crucial point about understanding why disasters occur is that it is not only natural events that cause them. They are also the products of the social, political, and economic environment as distinct from the natural environment. People living in adverse economic situations are used to inhabit areas that are affected by natural hazards like on slopes of volcanoes, flood plains of rivers, or dangerous disaster-prone zones. Besides, there are many other less obvious political and economic factors that underlie the impact of hazards.

As illustrated in the following figure, many disasters are usually a complex mix of natural hazards and human action.

Cause and Effect Mechanism of Disaster Occurrence



In "natural" disasters, a geophysical or biological event is clearly implicated in some way in causing it. Yet, even where such natural hazards appear to be directly linked to the loss of life and damage to property, the social, economic, and political origins of the disaster remain as the root causes. The "natural" and the "human" are so inextricably bound together in almost all disaster situations, especially when viewed in an enlarged time and space framework.

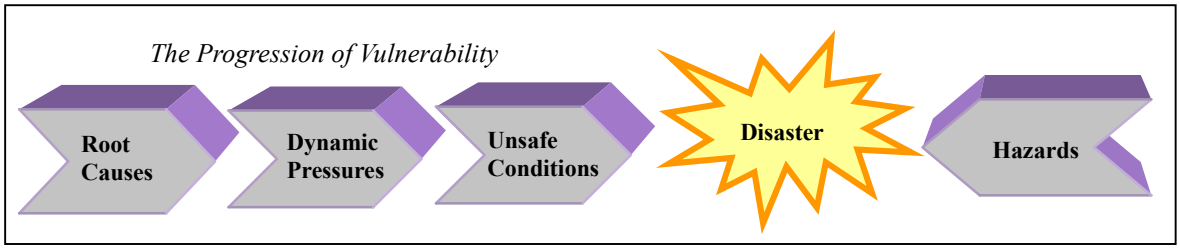
In view of the huge damages brought about by the repeated disasters and persistent poverty in the Study Area, it seems that the "vicious cycle" of poverty - population explosion - environmental degradation exist partially in the Study Area, especially in the disaster prone areas. This implies the existence of regional inequalities and unequal distribution of income.

In spite of the great efforts having been made by the authorities and communities concerned for recovery and rehabilitation from the disasters, the socio-economy of the Study Area has been periodically disrupted after every disaster occurrence. The statistics on the poverty in the area indicate its geo-meteorological and politico-economic characteristics, and these all associated actually induce slow paced economic development.

(2) Relationship of Disaster, Hazards & Vulnerabilities

Disasters can not be prevented, but their disastrous impacts can be mitigated. This can be done by proper understanding of the disaster mechanism consisting of hazards and vulnerabilities and through their assessment and analysis. The progression of vulnerability and disaster mechanism can be depicted as shown below.

Progression of Vulnerability and Mechanism of Disaster



Reference: At Risk - Natural Hazards, People's Vulnerability, and Disasters, Piers Blaikie, Terry Cannon, Ian Davis, and Ben Wisner, Routledge, London and New York.

Hazards signify the phenomena that pose a threat(s) to people, structure or economic assets and which may cause a "disaster". They could be either man-made or naturally occurring in the natural environment. On the other hand, vulnerability means the extent to which a community, structure, service or geographical area is likely to be damaged or disrupted by the impact of a particular hazard.

Disasters result from vulnerable conditions being exposed to a potential hazard. Therefore, the first step in taking any mitigation measures is to assess the hazard. This hazard assessment is to come to grips with: (a) nature, severity and frequency of the hazard, (b) area likely to be affected, and (c) time and duration of impact. Having established the space/time/intensity dimensions of hazard incidence, as well as its general characteristics, the second step is vulnerability analysis. This is the process used to identify vulnerable conditions which are exposed to natural hazards.

Vulnerabilities refer to long-term factors which affect the inability of a community to respond to events, or which make it susceptible to hazards. Vulnerabilities are examined to understand : (a) why a disaster happened, (b) what the impact of the disaster has been, (c) why it affected a particular group of people, and (d) how the risks of future disasters can be assessed. Vulnerability analysis results in an understanding of the level of exposure of persons and property to the various natural hazards identified.

From the analysis of the past record, the disasters in the Study Area (refer to 2.1) should be focused on volcanic eruption, debris flow, flood and typhoons. The following are the principal vulnerability elements and factors contributing to vulnerability, as summarized below.

Principal Vulnerability Elements and Factors in the Study Area

Elements at Risk	Vulnerability Factors
1. Volcanic Eruption	
- Anything close to the volcano : people, crops, livestock, combustible roofs, etc.	- Settlements on the slopes of Volcano - Settlements in the historical paths of lava or mud flow - Structures with roof designs not resistant to ash accumulation - Presence of combustible materials - Lack of evacuation plan or warning systems
2. Debris Flow and Flood - Everything located in debris flow and flood prone areas : people, infrastructure, weak buildings, crops, livestock, etc.	- Location of settlements on flood prone area - Non-resistant buildings and foundations - High risk infrastructural elements - Unprotected food stocks, livestock and standing crops - Lack of awareness of flooding and debris hazard - Reduction of absorptive capacity of land (erosion, concrete)
3. Typhoons (Tropical Cyclones)	
- Lightweight building and roofs, people, fences, trees, signs, fishing boats and coastal industries, etc.	- Settlements located in typhoon path - Settlements in adjacent areas (heavy rains, floods & debris flows) - Lightweight structures, older construction, poor quality masonry - Infrastructural elements, fishing boats and maritime industries - Poor communications or warning systems

Reference: Module on Disaster Management & Preparedness & How to Handle Natural Calamities, NORVIN Training Center Phil., Inc.

The types of vulnerability can be categorized under the following groupings:

1) Physical/Material Vulnerability

- Geographical location of population, buildings and crops susceptible to disasters
- Low physical capacity of buildings and poor infrastructure to cope with the battering of natural forces

2) Financial/Economic Vulnerability

- Direct loss potential (loss to the owners of the business establishments or business investors)
- Indirect loss potential (loss to retailers whose income is dependent on the existence of big business establishments)

3) Social/Organizational Vulnerability

- Existence of special categories of vulnerable groups of people (e.g. elderly, children, women, physically handicapped, etc.)
- Livelihood at risk (susceptible to interruptions from hazards)
- Population density issue (strong correlation between population density and casualties)
- Perception of risk (insufficient awareness or, at times, lack of awareness of vulnerabilities)
- Weak local institutions which take the role of mediator between families and government

4) Attitudinal/Motivational Vulnerability

- Low level of awareness on hazards
- Fatalistic attitude
- Low confidence of the people in their ability makes have "lost heart" and feel defeated by events they can not control

The most visible areas of vulnerabilities are physical/material and financial/economic vulnerabilities. Poor people suffer more from crises than people who are richer – because they have little or no savings, few income or production options, and limited resources.

(3) Disaster Equation and Comprehensive Disaster Prevention Measures

It is essential to make a distinction between "hazard" and "disaster", and to recognize that the effect of the former upon the latter is essentially a measure of the society's "vulnerability". Disaster stems from the fact that certain communities or structures are vulnerable to hazards. Thus:

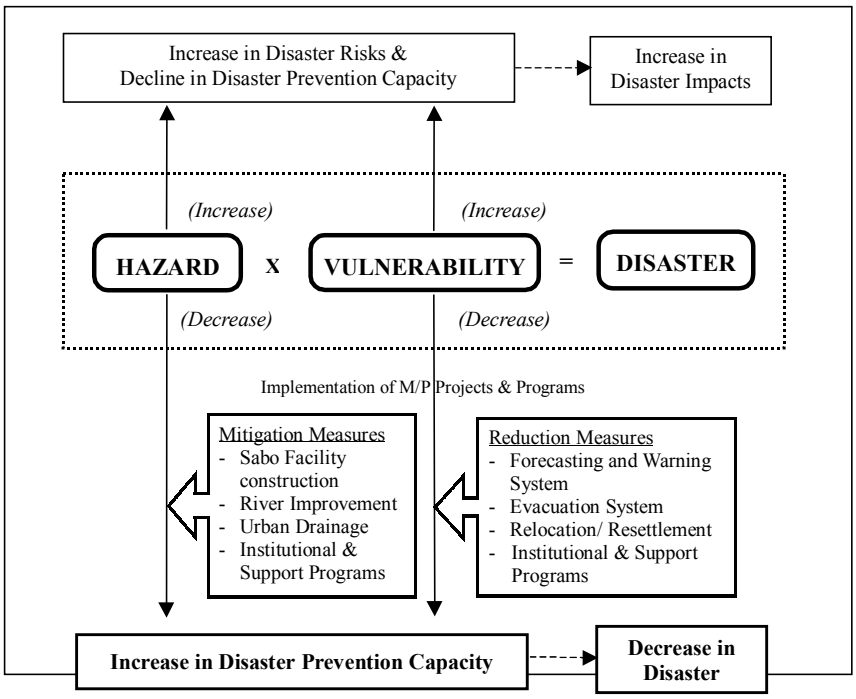
HAZARD x VULNERABILITY = DISASTER

Note: In the publication titled "At Risk", 1994, Routledge, the risk (disaster) is expressed with the following equation: Hazard + Vulnerability = Risk (Disaster). The JICA Study Team reached the conclusion that the multiplication (x) of hazard and vulnerability is logically more appropriate than their addition (+) to the natural disasters focused in this Study.

"Disaster" is not the "hazard" but the result of hazard's interacting with "vulnerability". Hazard may occur in an area without creating disaster if this area is not populated, and there are no critical resources. The whole population maybe affected by a strong typhoon but possibly not all people may suffer serious disaster.

The interrelation between this disaster equation and the projects & programs proposed in JICA Study on Comprehensive Disaster Prevention around Mayon Volcano is illustrated below.

Interrelation between Disaster Equation and Comprehensive Disaster Prevention Measures Proposed in the Study



As shown in this figure, vulnerability is inversely proportional to disaster prevention capacity. The 16 projects and programs proposed in the Master Plan Study can be classified into two categories in terms of hazard - vulnerability relationship as follows:

a. Mitigation of hazards
   - Sabo facility construction (countermeasures against mud and debris flows)
   - River improvement (flood control)
   - Urban drainage upgrading (flood control)

b. Reduction of vulnerabilities
   - Upgrading of forecasting and warning system
   - Strengthening of evacuation system
   - Relocation/Resettlement of vulnerable people

c. Institutional and supporting services strengthening
   - The supporting programs constitute an integral part of the anchor projects, especially their respective sound operation and sustainability. Then, they should be implemented as a package with the above all projects and programs.

As vulnerability of a community is linked to the capacity of the community to deal with hazards and their attendant impact, its disaster prevention capacity could be upgraded through mitigating or reducing the hazards and/or vulnerabilities and strengthening of their institutional and supporting systems.

(4) Disaster Prevention Capacity

1) Vulnerabilities and Disaster Prevention Capacities

To avoid increasing vulnerabilities, it is necessary to identify capacities in order to know what exist within a society, even among disaster victims, on which future development can be built. Acknowledging the capacities of an affected population is essential for designing and implementing disaster responses that have development impacts.

Vulnerability of a community is linked to the capacity of the community to deal with hazards and their attendant impact. Vulnerability is inversely proportional to capacities, i.e., low vulnerability, high capacity or high vulnerability, low capacity.

The levels of disaster prevention capacity could be measured accordingly, as high, average, and low. High level coping capacity reveals a fast recovery of the distressed area after a disaster, which is manifested by mobilization of the people's own resources (within the barangay) without any government and non-government intervention. On the other hand, the distressed area with an average

level of coping might recover partly the damages, utilizing their own resources, and the rest being shouldered by the government and other agencies.

2) Disaster Prevention Capacity Assessment of the Communities around Mayon Volcano

People's or community disaster prevention capacities can also be grouped under the same groupings as vulnerabilities. Therefore, capacities can be classified as physical/material, financial, social/organizational, and attitudinal/motivational.

To sum up, the disaster prevention capacities of the communities around Mayon Volcano are relatively high in terms of social/organizational and attitudinal/motivational terms, in comparison with those in other areas of the country. This seems to be due to the repeated disasters like typhoons, mud & debris flows, floods and eruptions of volcano. As to the physical/material and financial/economic capacities, they are limited to be minimal mostly for immediate rehabilitation and just for response after impact. When people are willing to cooperate and share resources, they have the capacities to cope with disaster thereby lowering vulnerabilities.

3) Strengthening the Disaster Prevention Capacity

There are two important ways of strengthening the disaster prevention capacity, through preparedness and mitigation. Preparedness aspect comprises the following: capability & vulnerability assessment, emergency planning, institutional strengthening, forecasting & warning system, information system, education and training, drills and exercises, and so on.

Mitigation aspect includes structural and non-structural. Structural mitigation consists of engineering and construction, and physical planning, while non-structural mitigation deals with economic, management and institutional, societal, conflict resolution and spatial planning.

Mitigation also entails the protection of the economy from disasters aside from protection of the population and critical resources. Damage to infrastructures and to the means of production depresses the economy. The agricultural sector of the economy is most vulnerable to volcanic eruption. Developing an alternative livelihood will strengthen the coping capacity of the agricultural sector that can be affected by disaster.

There is also a need to strengthen the utility and industrial support systems in the Mayon areas like loans, technical assistance, institution development support. The

lifeline system such as water, electric power, transport links and communication should be more effective, as well as, resistant to volcanic hazards.

Community participation is another mitigation strategy such as awareness of various disasters, identification of danger zone and preparedness for evacuation, evacuation drills and taking shelter in strong and impact-resistant structures. Safety standards form part of the legislative function of the Sanggunian Panlalawigan ng Albay (Albay Provincial Board) of the Provincial Government of Albay and LGUs. Grant system, preferential loans and/or supply of housing materials could be used as incentives to help the poverty-stricken people improve the hazard resistance of non-engineered houses and structures.

In conclusion, the tripartite tie-up initiatives among the community - LGU - private sector/NGO are indispensable to generate the Disaster Prevention Capacity (DPC) in a community at risk. The only way to reduce the vulnerability or foster DPC will be realized through implementing the poverty alleviation projects, and these could lead to a successful severance of the vicious cycle of poverty and environmental degradation. To promote poverty alleviation, emphasis should be placed on community empowerment.

The projects for community empowerment will be composed of various sub-projects from large-scale, medium-scale, through micro-scale. Since their implementation requires strong leadership as well as coordination capacity and professional skills, the intensive training programs will be provided prior to and at the initial stage of the project implementation.

(5) Effects of Disasters in Socioeconomic Activities

1) Disasters and Development

The respective issues related to the both “disaster and development” have the following identical and inseparable themes.

- Disasters set back development and disrupt development initiatives, while they can provide significant opportunities to initiate development.
- Development can increase an area’s vulnerability to disasters, but on the other hand it can reduce the vulnerability to disasters.

Note : This new conceptualization has been growing in the development community over the last few years and is a major philosophical underpinning of the United Nations Disaster Management Training Program. However, it is also true that a disaster frequently wipes out years of development programming and sets the slow course of implement in third countries further behind, wasting precious resources.

Although the effects of disasters on socioeconomic activities are being given attention in the development plans of the Government, the disaster coping measures are mostly taken in the context of emergency response due to the financial constraints. When disasters occur, relief usually comes from relief organizations and/or donor countries.

The beneficial and destructive aspects of volcanoes are not unrelated. A large part of the benefit is the creation of a very fertile soil, and this in turn attracts large number of farmers. Severe damages in Albay have been mainly attributed to tropical cyclones and volcanic eruptions. Apparently, the social and economic stability was disrupted. The devastating volcanic eruption, mudflows and flashfloods caused additional damage to the physical structures of Albay, such as buildings, infrastructures, roads and bridges.

Economic losses have been determined by computing insufficient data on the total cost of rehabilitation and percentage recovery. The PDMO has not been able to generate reports collecting all necessary data from the municipalities concerned in the province.

2) Pump-priming Projects for Area Development

The Strengths, Weaknesses, Opportunities, Threats (SWOT) of the Study Area are analyzed in Table 2.5. The City of Legazpi and Daraga Municipalities (LGUs concerned) plan to develop the respective areas, making the most use of their strengths and opportunities.

Through promotion of regional or area economic development, it is expected to produce an “economic surplus” which may enable the local governments and communities to keep aside a certain fund for disaster management. This area economic development is also indispensable to realize the per capita GRDP of the Study Area set in the socioeconomic framework of the Master Plan.

The point of contact between “disaster prevention” and “area development” would be the “livelihood projects” to be implemented in the resettlement sites. These livelihood projects and programs proposed coupled with the resettlement site development are expected to form local development growth centers. The area development projects and programs formulated in the Provincial and City/Municipal Development Plans are indispensable to sustain and promote these livelihood projects, and will play a leading role. The lists and profiles of the ODA and area economic development projects in Albay Province are attached in the Volume II Supporting Report (1), XII: Socio-economy.

The following are the major pump-priming projects, which are expected to be implemented in the near future:

- Legazpi City Special Economic Zone (Phase I : 33ha),
- Bicol Regional Agro-industrial Center (BRAIC),
- International Airport Construction Project at Bariis (Legazpi City),
- Improvement of Legazpi Port,
- Improvement of Tabaco Port,
- Rehabilitation of the Philippine National Railways,
- Improvement & Construction of Roads in Urban Centers and Tourism Areas, and
- Construction of Pantao Port

(6) Population around Mayon Volcano and Their Income Level

1) Population around Mayon Volcano

The population of Legazpi City in 1995 was 141,865, indicating a growth rate of 3.22% during the period from 1990 to 1995, and it is supposed to be about 161,000 in 1999. While, the population of Daraga Municipality in 1995 was 91,971 indicating a growth rate of 1.89% during the same period, and it is estimated at over 99,000 in 1999.

According to the survey results conducted by the PDMO-Rapid Assessment of Population at Risk in June 1999, it is reported that there is no more residents within the 6km-radius zone from the crater or Permanent Danger Zone (PDZ) of both Legazpi City and Daraga Municipality. However, this does not mean that there are no men who enter the zone. To sustain subsistence, some farmers continue farming there during the daytime.

The populations dwelling in danger zones (within the 6 to 8km and 8 to 10km) of the two municipalities are estimated as follows:

Barangays and Population in Danger Zones

Danger Zones	Estimated 1999 Population		Annual Growth Rate (%)	Est. Population at Risk	
	No. of HHs	HH Population		No. of HHs	HH Population
1. Legazpi City					
- 6 to 8 km zone (7 barangays)	2,673	14,624	(2.99)	2,179	11,686
- 8 to 10 km zone (7barangays)	3,994	21,441	(2.98)	3,992	21,131
2. Daraga Municipality					
- 6 to 8 km zone (5 barangays)	1,464	7,687	(1.53)	332	1,664
- 8 to 10 km zone (8 barangays)	4,401	23,216	(1.47)	288	1,361

Sources: Data from the Social Welfare and Development Offices of Legazpi City and Daraga Municipality, 1999.

In this table, it should be noted that the population growth rates in the 6 to 8 km danger zones are slightly higher compared to those in 8 to 10 km zones. This might be due to the inflow of population from the 6 km permanent danger zone (PDZ). Although the population growth rates in the 8 to 10 km zones are lower than those of the City and Municipal averages (3.22% and 1.89% recorded during the 1990-1995 period, respectively), they still show constant increasing rates due to the population pressure from the urban areas.

In order to minimize the loss of lives and properties, especially of those dwelling in the 6 to 8 km danger zones, primary concerns of the LGUs are to be placed on the construction of the Sabo facilities, relocation/resettlement of the repeatedly affected people and/or strengthening of forecasting and warning system.

2) Poverty Analysis and Expectations of the People Living around Mayon Volcano

Table 2.6 shows that Region V was ranked 2nd from the bottom among 16 regions in terms of poverty incidence. 50.1% of the total families had an annual per capita income below the poverty threshold of PHP10,497 in 1997. Albay Province is no exception, especially in marginal rural areas around Mayon Volcano. The data on family income & expenditure and poverty are available only at regional level or without breakdowns at provincial level as summarized below:

Average Annual Family Income, Expenditure and Savings, 1994 & 1997, Bicol Region

(Unit : Pesos)

Annual Family Average	1994	1997 P	% Change
1. Income	54,167	77,098	42.3
- Urban	74,411	120,465	61.9
- Rural	45,338	61,241	35.9
2. Expenditure	46,343	66,967	44.5
- Urban	61,745	100,064	62.1
- Rural	39,626	54,866	38.5
3. Savings	7,824	10,131	29.5
- Urban	12,666	20,401	61.1
- Rural	5,712	6,375	11.6
5. Average Annual Per Capita Income	11,227	14,547 *	29.6
6. Average Monthly Family Income **	4,959 *	6,425 *	29.6

Notes: P = Provisional

* Average family members = 5.5 persons

** Estimated by JICA Team

Sources: NSO and NSCB

The results of the People's Intention Survey conducted by the JICA Study Team in September-October 1999 revealed the average income levels of the households of resettlers and candidate resettlers living around Mayon Volcano, as summarized below.

Income Level of the Households Living around Mayon Volcano

Source of Income	Economically Active Household Members			Yearly Estimated Income (PHP)		
	Total in HHs* (A)	Average (B)=(A)/180	% (C)	Total in HHs* (D)	Average (E)=(D)/180	% (F)
A. Resettlers						
1. Agricultural Income	25	0.1388	16.78	86,000	477.77	1.77
2. Employment Salary/ Wage	28	0.1555	18.80	1,978,953	10,994.18	40.62
3. Contract Labor Wage	52	0.2888	34.90	1,896,532	10,536.28	38.93
4. Private Business	23	0.1277	15.43	639,508	3,552.82	13.13
5. Pensions	1	0.0055	0.67	31,212	173.4	0.64
6. Remittances	13	0.0722	8.72	166,300	923.88	3.41
7. Others	7	0.0388	4.70	72,840	404.66	1.50
Subtotal	149	0.8273	100.00	4,871,345	27,062.99	100.00
B. Candidate Resettlers						
1. Agricultural Income	94	0.5222	31.87	137,618	764.54	5.09
2. Employment Salary/ Wage	37	0.2055	12.54	407,380	2,263.22	15.07
3. Contract Labor Wage	127	0.7055	43.05	1,675,058	9,305.87	62.00
4. Private Business	16	0.0888	5.42	289,260	1,607	10.7
5. Pensions	0	0.0000	0.00	0.00	0.00	0.00
6. Remittances	18	0.1000	6.10	127,300	707.22	4.71
7. Others	3	0.0166	1.02	65,480	363.77	2.43
Subtotal	295	1.6386	100.00	2,702,096	15,011.62	100.00
Grand Total	444	2.4667	100.00	7,573,441	42,075	100.00

Notes: total number of samples=180; *Households (HHs) = Total number of persons in the interviewed HHs.

Source: People's Intention Survey for Resettlers and Candidate Resettlers on Resettlement Site Improvement and Livelihood Development, conducted in September-October 1999 by the JICA Study Team.

In this survey, a ramdom sampling of 180 households were interviewed from among the resettlers in Banquerohan (Legazpi City) and candidate resettlers dwelling in Budiao barangay (Daraga Municipality). On the average, 2.47 persons are economically active in a household. The contract labor wage amounted to 34.9% of the total income for resettlers and 43.05% for candidate resettlers, respectively. As for the agricultural income, it is noticeable that it remained at 16.78% for resettlers, while that of candidate resettlers accounted for 31.87%. This small share for resettlers implies the fact that they are placed in bad situations to continue the farming. The sampled households earn an average of PHP42,075 per year or monthly income of PHP3,506. This monthly income is far below accounting for almost a half of the Bicol's average (PHP6,425) estimated in 1997.

To the question: "the present amount you are earning is enough to sustain your family?", 39% of the respondents answered "yes", while 61% gave an answer of "No". For the question: "how much should be earned monthly", the average worked out to be PHP4,792, as shown below.

Perception on Adequacy of Income

Amount earned is enough?	Total	%
1. Yes	70	38.9
2. No	110	61.1
Total	180	100.0
How much should be earned monthly ? *(Average*)* *PHP4,792*		

Note: * Average of the people (110 persons) who answered "no".

Source : People's Intention Survey conducted by the JICA Study Team.

Regarding the perception of economic status of the interviewed households, JICA Survey also revealed an interesting result: 47.8% of the respondents answered that they consider themselves as belonging to "lower middle" income group of about PHP1,654 per month. 21.1% of them realize that they are very poor, while 18.9% feel that they are in the middle level, as indicated in the following table.

Perception of Economic Status of the Interviewed Households

Family Economic Status	Total	%
1. Rich	0	0.00
2. Upper Middle	3	1.67
3. Middle	34	18.89
4. Lower Middle	86	47.78
5. Poor	19	10.56
6. Very Poor	38	21.11
Total	180	100.00

Source: People's Intention Survey conducted by JICA Study Team

Their perceptions are noticeable, especially when compared to the poverty level as defined by the National Economic Development Agency (NEDA). Nonetheless, it is the perception of the respondents that 68.3% of them belong to the middle income groups, and only 31,7% of them are poor.

When asked "How do you compare your current status with that of five years ago?", 43.9% of the respondents answered that they feel nothing has changed and 29.4% responded they are worse off, while the rest (26.7%) said they are better off. The major reasons cited by the respondents for being worse off are the economic crisis, lack of capital, and calamities. On the other hand, the major reasons cited for being better off are less calamities, employment and high yield.

Others are more fatalistic in the sense that they do not feel any change in their current status. This may be attributed to the series of volcanic eruptions that they have experienced over their lifetimes and they can no longer dissociate whether what is happening to them is a matter of choice or still a matter of divine intervention or providence.

To improve the quality of life, the following projects or programs are expected by the respondents in the order of importance:

1)	Job creation	:	handicraft making, food processing, dress making, factory work and home-based industry
2)	Improvement of basic infrastructure	:	roads, wells and water facility
3)	Social services	:	Construction of health & day-care centers, schools, toilets, and provision of nurses/doctors, medicines and free education
4)	Distribution of lands	:	provision of lands for livestock and farming
5)	Upgrading of housing	:	repair and rehabilitation of houses
6)	Others	:	marketing support, establishment of cooperatives, etc.