JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF URBAN DEVELOPMENT,

THE REPUBLIC OF ARMENIA

THE STUDY ON

LANDSLIDE DISASTER MANAGEMENT

IN THE REPUBLIC OF ARMENIA

FINAL REPORT

VOLUME-IV

Main Report

February 2006

KOKUSAI KOGYO CO., LTD.

NIPPON KOEI CO., LTD.

Composition of the Final Report

VOLUME	REPORT	LANGUAGE	MEDIA
Volume I :	SUMMARY	JAPANESE	Heard copy, Compact disk
Volume II :	SUMMARY	ARMENIAN	Heard copy, Compact disk
Volume III :	SUMMARY	ENGLISH	Heard copy, Compact disk
Volume IV :	MAIN REPORT	ENGLISH	Heard copy, Compact disk
Volume V :	SECTORAL REPORT-1 PRESENT CONDITIONS	ENGLISH	Compact disk
Volume VI :	SECTORAL REPORT-2 PILOT PROJECTS	ENGLISH	Compact disk
Volume VII :	SECTORAL REPORT-3 TECHNICAL BULLETIN With Landslide Map, Inventory	ARMENIAN/ENGLISH	Compact disk

Currency Exchange Rates Adopted for the Study

USD 1.00	=	AMD 455
AMD 1.00	=	JPY 0.26

November 2005

PREFACE

In response to a request from the Government of Armenia, the Government of Japan decided to conduct the Study on Landslide Disaster Management in the Republic of Armenia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected a study team headed by Mr. Satoru TSUKAMOTO of Kokusai Kogyo Co., Ltd. The study team was formed from Kokusai Kogyo Co., Ltd. and Nippon Koei. Co., Ltd. and was dispatched between March 2004 and December 2005.

In addition, JICA set up an advisory committee headed by Mr. Masayuki WATANABE. The advisory committee examined the study from technical points of view.

The team held discussions with the officials concerned of the Republic of Armenia and relevant personnel. The team members also conducted landslide inventory surveys of the whole territory and four pilot project sites. Upon returning to Japan, the team prepared this final report.

I hope that this report will contribute to the promotion of this master plan and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere application to the officials concerned of the Government of the Republic of Armenia for the close cooperation extended to the study.

February 2006

Ariyuki MATUMOTO
Deputy Vice President
Japan International Cooperation Agency

Mr. Ariyuki MATUMOTO

Deputy Vice President
Japan International Cooperation Agency (JICA)
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir,

It is with great pleasure that we submit to you the Final Report of the "The study on Landslide Disaster Management in the Republic of Armenia".

Because of the low precipitation in the Republic of Armenia, landslides are ordinarily stable. But in case of inappropriate surface and drainage water control, landslides can become active and cause losses to the inhabitants and endangering life. This kind of landslide capable of being stabilized by appropriate drainage works.

The heads of communities have a duty to secure the lives of inhabitants and protect community developments. But around 80% of communities have no investment budget and are unable to fulfill their obligations to the inhabitants. This report describes the technical and financial public assistance that are necessary to correct this situation. Landslide management that can be undertaken with the current abilities of communities (Community Based Approach) is efficient and practical.

Priority programmes of Armenian mountainous areas are "road, water supply, irrigation". And the overall goals of the programmes are poverty reduction. The study conducted pilot projects for which the overall goal is community development. The project's outputs are community infrastructure development that contribute to landslide mitigation and project resource acquisition (income generation). This report also described the activities of the pilot projects.

We believe that "technical materials containing landslide location map" will contribute to the planning of priority programmes for poverty reduction.

We wish to express our deep appreciation and gratitude to the personal concerned of your Agency, JICA, the Embassy of Japan in Moscow, the Ministry of Urban Development and other related authorities of the Republic of Armenia, Municipalities and Communities, and NGOs for the courtesies and cooperation extended to us during our Study.

Very truly yours,

February 2006

Satoru TUKAMOTO
Team Leader
The Study on Landslide Disaster
Management in the Republic of Armenia

LOCATION MAP OF THE STUDY AREA

THE STUDY ON
LANDSLIDE DISASTER MANAGEMENT
IN THE REPUBLIC OF ARMENIA
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Abbreviations

AMD	Armenian Drams
ARS	Armenian Rescue Service
ARC	Armenian Red Cross
ArmRIEE&PC	Closed Joint Stock Company "Armenian Research Institute of Earthquake Engineering and Protection of Constructions
Bln	Billion
CBA	Community Based Approach
CU	Community Union
CB	Central Bank of the Republic of Armenia
CGC	Centre of Geodesy and Cartography
CIS	Commonwealth of Independent States
CJSC	Closed Joint Stock Company
CMI	Crisis Management Institute under EMA
CPI	Consumer Price Index
DCU	Dilijan Community Union
DEM	Digital Elevation Model
DfID	Department for International Development of Armenia Regional Development Programme under UK
ED	Emergency Department of the Government of the Republic of Armenia
EBRD	European Bank of Reconstruction & Development
EIA	Environmental Impact Assessment
EMA	Emergency Management Administration under the Government of the Republic of Armenia (EMA was changed the name to ARS in December 2005)
ESRI	Environmental Systems Research Institute, Inc.
GoA	Government of Armenia
GDP	Gross Domestic Product
GIS	Geographic Information System
GUI	Graphical User Interface
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit, German International Technical Corporation
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
IAEG	International Association for Engineering Geology and the Environment
ICU	Inter Community Union
IB	International Trading Bank of the Republic of Armenia
IDA	International Development Agency
IDB	Inter-American Development Bank
IFC	International Financial Community of the Republic of Armenia
IFRC	International Federation of Red Cross
IOM	International Organization of Migration under the Government
ISTD	International Scientific-Technical Center of the Republic of Armenia
IT	Information Technologies
IMF	International Monetary Fund
KCU	Kapan Community Union

masl	meters above sea level
MoA	Ministry of Agriculture of the Republic of Armenia
MoFA	Ministry of Foreign Affair of the Republic of Armenia
MoFE	Ministry of Finance and Economics of the Republic of Armenia
MoEP	Ministry of Environment Protection of the Republic of Armenia
MoTA	Ministry for Coordination of Territorial Administration and Infrastructure Operation
MoTC	Ministry of Transport and Communication of the Republic of Armenia
MoUD	Ministry of Urban Development of the Republic of Armenia
MoWSA	Ministry of Work and Social Affairs of the Republic of Armenia
Mln	Million
MTEF	Medium Term Expenditure Framework
NA	National Assembly of the Republic of Armenia
NAS	Armenian National Academy of Science
NASA	National Aeronautics and Space Administration (United States of America)
NATO	North Atlantic Treaty Organization
NGO	Nongovernmental Organization
NSS	National Statistical Service of the Republic of Armenia
NSSP	National Survey for Seismic Protection under the EMA
OECD	Organization for Economic Collaboration and Development
OJS	Open Joint Stock Company
PTA	Public Television of Armenia
PRA	Public Radio of Armenia
PRSP	Poverty Reduction Strategy Paper
PREDP	Poverty Reduction and Economic Development Plan
RA	Republic of Armenia
SAP	NGO “STABILITY AND PROGRESS”
SCJSC	State closed Joint Stock Company
SCREC	State Committee of the Real Estate Cadastre
SDC	Swiss Agency for Development and Cooperation
SNCO	State Non-Commercial Organization
SRTM	Space shuttle Rader Topographic Mission
SSTA	Social Service Territorial Agency
LANDSAT TM	LANDSAT Thematic Mapper
LSG	Local Self Government
USSR	Union of Soviet Socialist Republics
USA	United States of America
US$	United State Dollars
UN	United Nations
UNCHS	The United Nations Center for Human Settlements (habitat)
UNDP	United Nations Development Program
UNHCR	United Nations High Commission for Refugees
USAID	United States Agency for International Development
UTM	Universe Transverse Mercator
VAT	Value Added Tax
WB	World Bank
WHO	World Health Organization

WTO	World Trade Organization
YCA	Yerevan City Administration

Explanation of Terms

ARS/EMA: Armenian Rescue Service/ Emergency Management Administration under the Government of the Republic of Armenia

The EMA became a sub-organization of the Ministry of Territorial Administration in June 2005. EMA was renamed the ARS in December 2005.

CVM: Contingency Value Method

Method of estimating “Willingness to Pay (WTP)” using a questionnaire

Community Union

Armenian Community Law describes that the adjoining community can formulate "Inter-Community Union : ICU" based on mutual agreement

The DfID assists in the ICU formation. GTZ assists in the formation of CU as a temporary organization until the ICU is formed based on law. GTZ supports the communities' projects through CU.

Marz

RA is subdivided into 11 regions（Yerevan Privilege City and 10 Marz） Marzes are regional administrations of the central government. The regional administrations do not have the assembly, and the function of regional law formulation.

MEASUREMENT UNITS

Area

cm^2	=	square-centimeter(s) (1.0 cm x 1.0 cm)
m^2	=	square-meter(s) (1.0 m x 1.0 m)
km^2	=	square-kilometer(s) (1.0 Km x 1.0 km)
ha	=	hectare(s) (10,000 m^2)

Volume

cm^3	=	cubic-centimeter(s) (1.0 cm x 1.0 cm x 1.0 cm)
m^3	=	cubic-meter(s) (1.0 m x 1.0 m x 1.0 m)
L	=	Liter (1,000 cm^3)

Length

mm	=	millimeter(s)
cm	=	centimeters (cm = 10 mm)
m	=	meters (m= 100 cm)
km	=	kilometers (km = 1,000 m)

Weight

g	=	gram(s)
kg	=	kilogram(s) (1,000 g)
t	=	metric ton(s) (1,000 kg)

Currency

USD	=	United State Dollars
JPY	=	Japanese Yen
AMD	=	Armenian Drams

Time

s	=	second(s)
min	=	minute(s) (60 s)
hr	=	Hour(s) (60 hr)

PART-I CONDITION OF LANDSLIDE MANAGEMENT

CHAPTER 1 OUTLINE OF THE STUDY

1.1 Background of the Study

The Republic of Armenia (RA), with an area of 29,740km^2, is surrounded by Azerbaijan, Georgia, Turkey, and Iran. It has a predominantly hilly terrain and is prone to landslide hazards induced by adverse natural conditions including steep topography, fragile geological conditions and intermittent earthquakes such as the Spitak earthquake of 1988. It is said that more than 3,000 landslides of different scales occurred in an area of 700 km2. Some 200 km^2 of this landslide-prone area is inhabited, which represents 12% of the total populated area within the country (estimated to be 1605.5 km2) or 5.4 % of the overall area of Armenia. Landslides have often been left untreated unstable in many locations. As a result, houses and roads that are damaged due to recurring landslide deformation have remained to be un-repaired. Inhabitants living in these areas are therefore obliged to live under adverse conditions both physically and mentally. These are more severe during winter when inhabitants must survive in extreme cold, with temperatures in damaged houses often falling below minus 10 degrees Celsius. According to data from the Emergencies Board of Armenia, damage to the social economic infrastructure of the country due to landslides is estimated to be around 10 million dollars annually.

The Government of Armenia has been tackling with the problems associated with landslide disasters using their own resources and expertise as well as through the assistance of donor country agencies. However, these efforts have yet to realize any significant results, mainly due to budgetary and technical constraints. To improve this situation, the Government of RA decided to develop a plan for landslide disaster management with the assistance of the Japan International Cooperation Agency (JICA).

In response to the official request of the Government of the Republic of Armenia, the Japan International Cooperation Agency dispatched a Preparatory Study Team, headed by Mr. Masayuki Watanabe, from August 15 to September 3, 2003, to discuss and agree on the Scope of Work for the Study on Landslide Disaster Management in the Republic of Armenia.

This study, referred to as ‘The Study on Landslide Disaster Management of the Republic of Armenia’, is to be undertaken based on the scope of work agreed upon on 21 August 2003 between the Ministry of Urban Development and the Preparatory Study Team, Japan International

Cooperation Agency.

1.2 Objectives and Scope of the Works

1.2.1 Objectives

The objectives of the works are:

(1) To formulate a Master Plan (M/P) for landslide management based on landslide location maps and their inventory tables;
(2) To implement Pilot Projects (P/P) for priority implementation, which include a study on practical landslide countermeasure method in RA, and to reflect the experience in the M/P; and
(3) To transfer skills and technologies on landslide management to counterpart staff, Communities and relevant organizations during the course of the study.

1.2.2 Scope of Works

The scope of each phase is presented below.

- Phase I – Baseline Survey

1) Preparation of a GIS-based landslide inventory; and
2) Understanding of the socio-economic conditions, organizations and legal conditions.

The major activities during this period are outlined in Table 1.1. Based on materials obtained in the baseline survey, workshops were held on methods of improving the existing disaster management.

Table 1.1 Major Surveys and Outputs in Phase I

Major Survey /Operation	Output
1) Inception seminar	Introduction of the study; Introduction of Japanese landslides
2) Landslide inventory survey	Landslide inventory on GIS
3) Social survey	Social condition of selected landslide areas
4) Organization /institution /legal survey	Legal conditions on landslide management, ToRs of duties of sectors, Institutional improvement plan
5)Financial review of landslide disaster management	Financial capability for landslide disaster management

- Phase II – Draft Master Plan

The draft master plan of landslide disaster management was prepared during Phase II. Pilot project sites were selected to apply the proposed landslide management.

- Phase III – Pilot Projects

The pilot projects in high priority areas were executed. The Master Plan was reviewed and elaborated.

Table 1.2 Study and Operations in Phase III

Study/Operation	Output
1) Topographical and geotechnical surveys	Information on landslide hazard conditions
2) Analysis of field data	Mechanism of landslides
3) Planning of mitigation method	Proposal for landslide management
4) Planning of organization for disaster management	Organization for landslide management
5) Pilot projects for highest priority areas	Model of planning disaster management and evaluation method for the plan
6) Workshops	Consensus on disaster management system for the project area
7) Seminar	Reporting to key personnel in headquarters

The objectives of the pilot project involved the:

1) Trial implementation of a master plan policy;
2) Collection of information for revising the proposed master plan;
3) Technical transfer seminar for the counterpart experts and communities; and
4) Dissemination of knowledge to inhabitants in the landslide areas.

During the course of the P/P, workshops, a general assembly and a seminar involving counterpart staff and inhabitants of the landslide areas were held to transfer technology on landslide disaster management and to gain a better understanding of local conditions and inhabitant's situations in the landslide areas.

An overall image of the Study is shown in Figure 1.1.

1.2.3 Phasing of the Study

The study was undertaken in three phases over the period March 2004 to February 2006, as shown in Figure 1.2. As shown in this figure, seminars and workshops were held progressively throughout the study to assist in technology transfer.

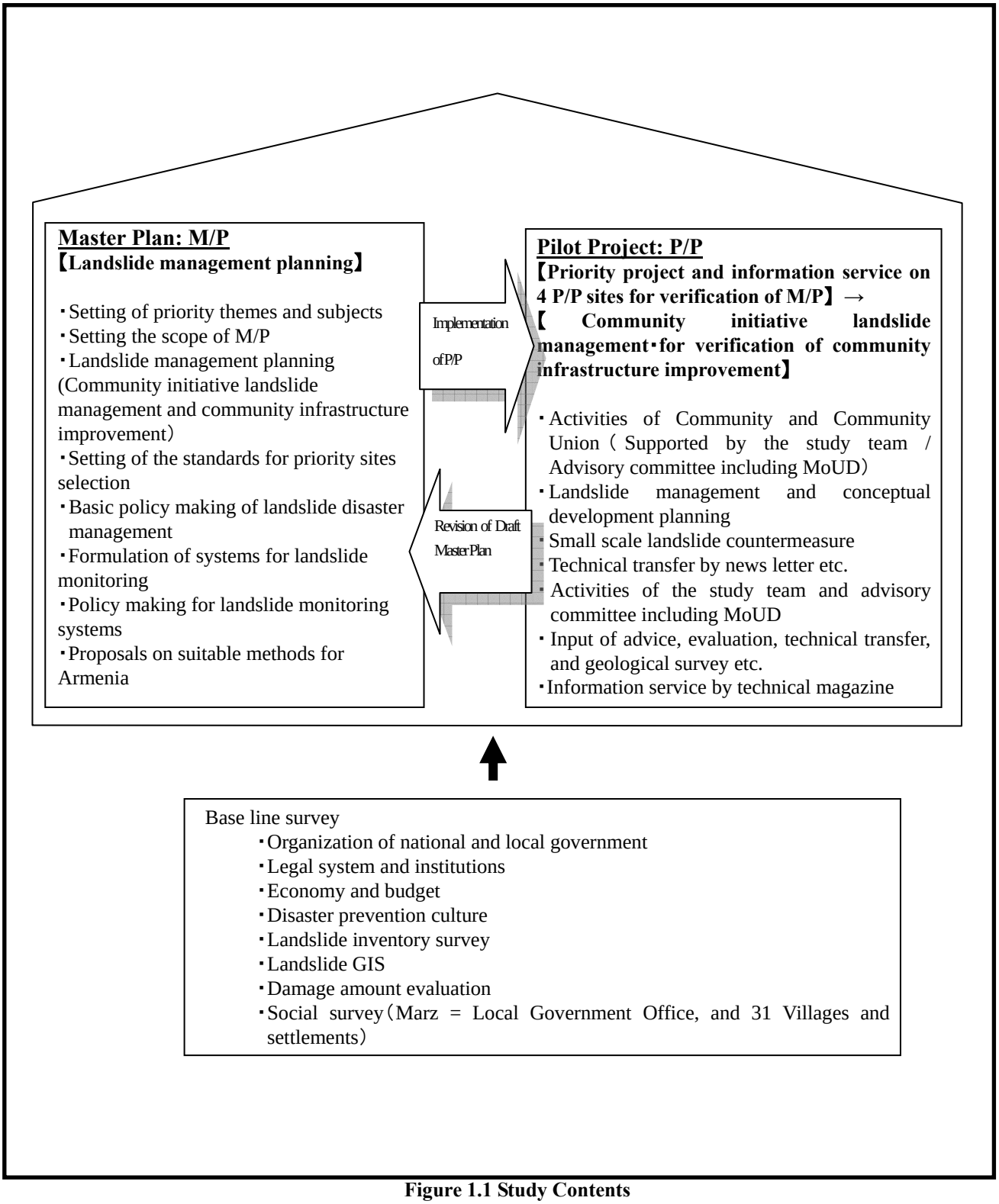


Figure 1.1 Study Contents

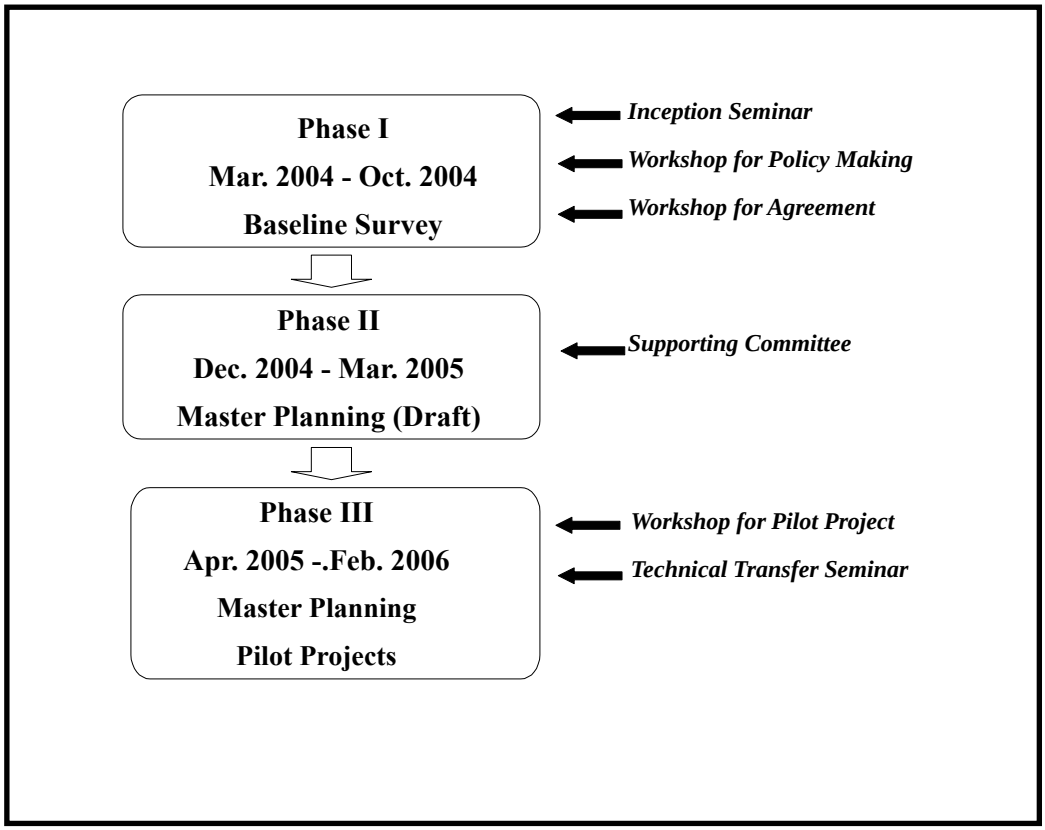


Figure 1.2 Flow of the Study

Table 1.3 Time Table of the Study

Year	2004											2005												2006		
Month	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Works in Armenia and Japan		Phase 1										Phase2				Phase 3										
		Baseline Survey										Master Planning (Draft)														
Fieldworks		First Fieldworks										Second Fieldworks				Third Fieldworks										
Reports			△ Inception Report						△ Progress Report 1					△ Interim Report						△ Progress Report 2			△ Draft Final Report		△ Final Report	

1.3 Organizations Involved in the Study

The study was carried out and managed by the following organizations in accordance with the plan of operation.

Table 1.4 Organizations of the Study

Organization	Leader	Function and Responsibility
1) Ministry of Urban Development	Mr. HARUTYUNYAN Minister of Urban Development	Counterpart of the study team Provide undertakings for the study team ・Approvals for the study
2) Working Group for the whole study (Ministry of Urban Development)	Mr. KOCHARYAN Deputy Minister of Urban Development (from Phase I to Phase II)	Support for the study team through operation Execution of the study in cooperation with the study team
3) Supporting Committee	Mr. KOCHARYAN Deputy Minister of Urban Development (from Phase I to Phase II)	Advice to the study Consent to the study policy and results
4-1) Working commission of Gosh pilot project	Mr. GHAZARYAN	Formulation of concept plan for landslide management and community infrastructure development
4-2) Working commission of Martuni pilot project	Mr. HOVANESSIAN	
4-3) Working commission of Kapan pilot project	Mr. SARGISYAN	
5-1) Advisory committee for Gosh pilot project	Mr. MOVISISYAN Head of Science and Technical Policy Department of the Ministry of Urban Development	Advice and initial environmental evaluation for pilot projects
5-2) Advisory committee for Kapan pilot project		
5-3) Advisory committee for Yerevan cemetery pilot project		
4) Study Team	Mr. TSUKAMOTO	Execution of the study in cooperation with RA counterpart
5) Japan International Cooperation Agency		General management Provide budget for the study
6) Japan Advisory Committee	Mr. WATANABE	Advice to the study on operational policy and results

The study was completed in close cooperation with relevant ministries, local governments, organizations of donors and NGOs. The study team wishes to express its appreciation to all concerned who assisted the team in the course of its study.

The organizational frameworks for the Study are shown in Figures 1.3 and 1.4.

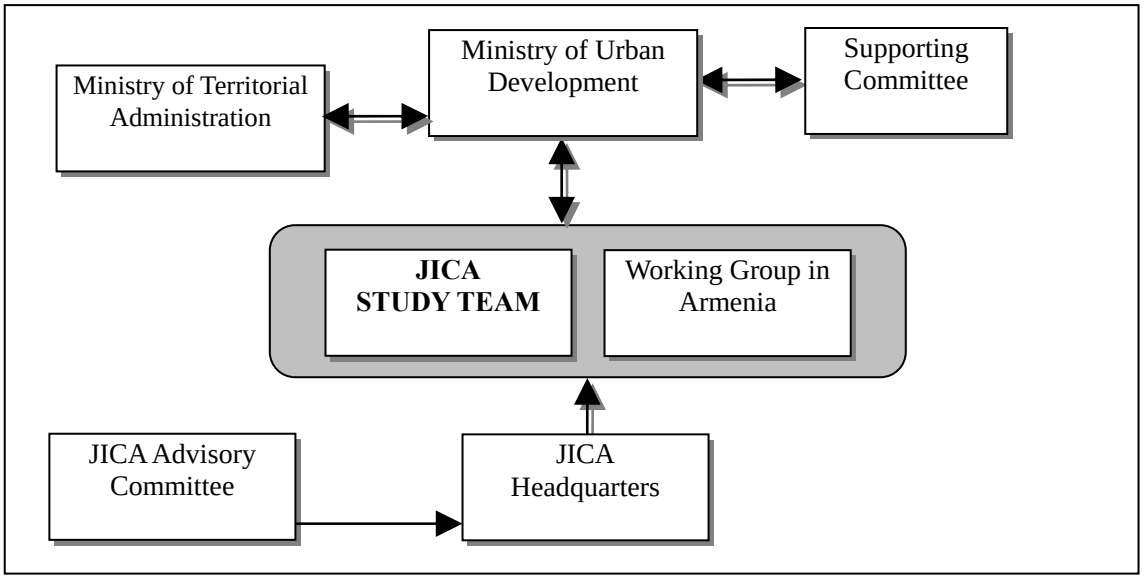


Figure 1.3 Organizations Involved in the Study: Phases I and II

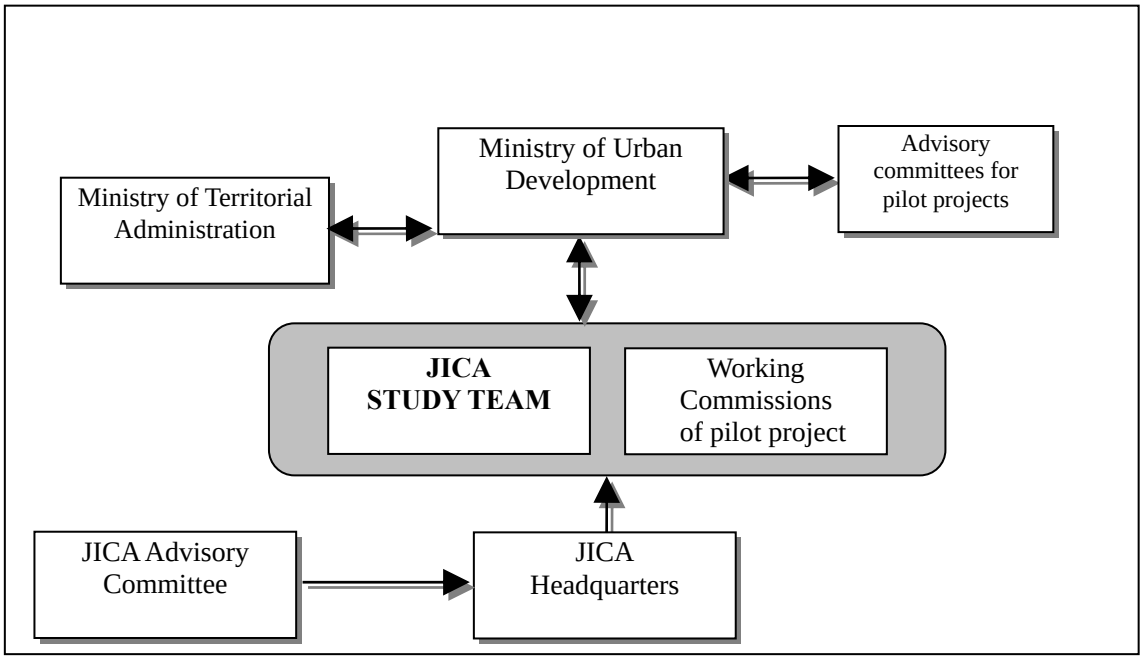


Figure 1.4 Organization Involved in the Study: Phase III

CHAPTER 2 PRESENT CONDITIONS

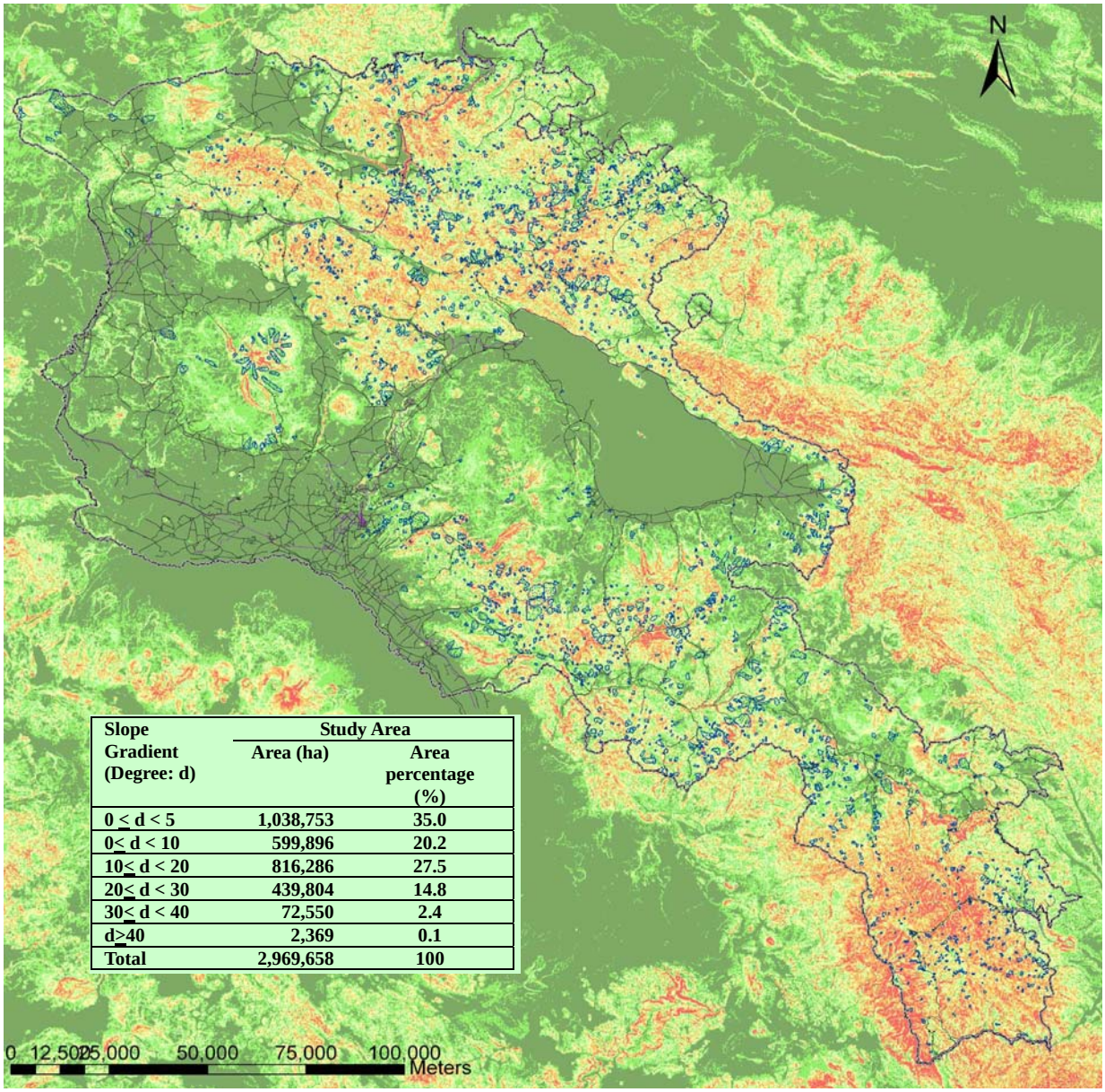
2.1 Natural Conditions

2.1.1 Topography

The Republic of Armenia (RA) is located in the southern part of the Caucasus. As the Lesser Caucasus range extends through northern Armenia, runs southeast between Lake Sevan and Azerbaijan, then to the south, about half of Armenia's area of approximately 29,800 square kilometers has an elevation of at least 2,000 masl (meters above see level), and only 3 percent of the country lies below 650 masl. The lowest points are in the valleys of the Araks River and the Debet River in the far north, which have elevations of 380 and 430 masl, respectively. To the southwest of the Lesser Caucasus range is the Armenian Plateau, which slopes southwestward towards the Araks River on the Turkish border. The plateau is masked by intermediate mountain ranges and extinct volcanoes. The largest of these, Mount Aragats, 4,430 m high, is also the highest point in Armenia.

Lake Sevan, 72.5 km across at its widest point and 376 km long, is by far the largest lake. It lies at 2,070 masl on the plateau. Terrain is most rugged in the extreme southeast. Most of Armenia is drained by the Araks or its tributary, the Hrazdan, which flows from Lake Sevan. The Araks forms most of Armenia's border with Turkey and Iran as well as the border between Azerbaijan's adjacent Nakhidjevan Autonomous Republic and Iran (SOURCE: Mainly from ‘2004 CIA WORLD FACT BOOK’).

The RA is a typical mountainous country. Figure 2.1 is the slope gradient outline made by this study as a GIS output.



Slope Gradient (Degree: d)	Study Area	
	Area (ha)	Area percentage (%)
0 ≤ d < 5	1,038,753	35.0
0≤ d < 10	599,896	20.2
10≤ d < 20	816,286	27.5
20≤ d < 30	439,804	14.8
30≤ d < 40	72,550	2.4
d≥40	2,369	0.1
Total	2,969,658	100

LEGEND

Slope Gradient Ranges

- 0-5 Deg
- 5-10 Deg
- 10-15 Deg
- 15-20 Deg
- 20-25 Deg
- 25-30 Deg
- 30-70 Deg

- Rail Way
- High Way
- Landslides (Larger than 2 ha) identified by JICA Study Team landslide inventory survey in 2004

Figure 2.1 Slope Gradient Base Map of RA
(JICA Study Team 2005)

2.1.2 Geology

The geology of Armenia is divided into 9 geologic provinces. Figure 2.2 shows their distribution with active faults. 'Active fault' is defined as 'fault' with tectonic displacements and earthquake-related ruptures during the last 10,000 years.

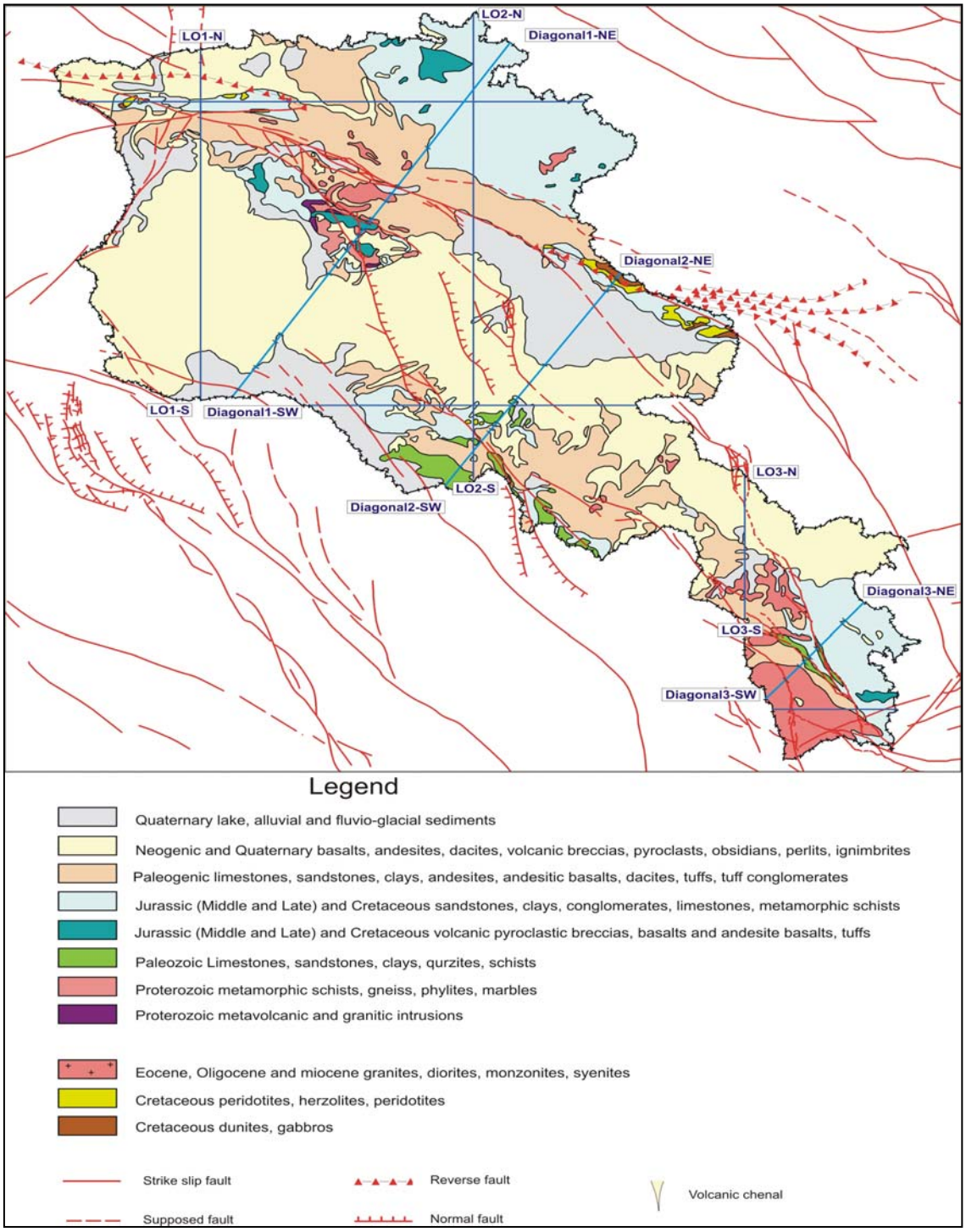


Figure 2.2 Geologic Province and Active Fault Map

2.1.3 Climate

(1) Temperature

Figure 2.3 demonstrates a correlation between average annual air-temperatures and ground heights, showing that the air-temperature decreases by 6.2 degrees Celsius every 1,000 m in elevation.

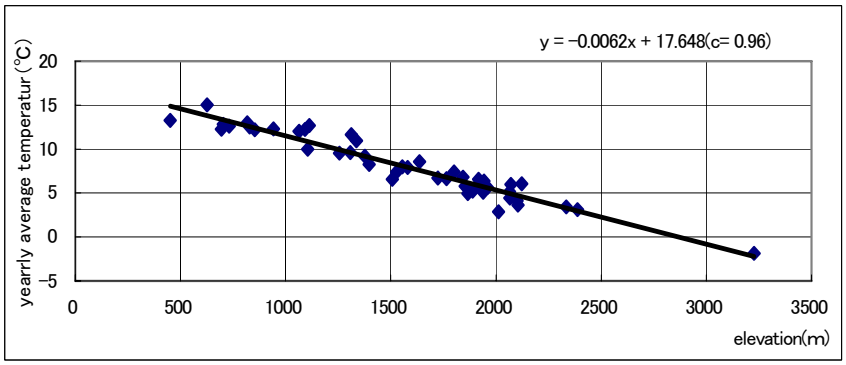


Figure 2.3 Correlations between Average Yearly Temperature and Ground Height (1993-2003)

(2) Precipitation

In general, higher precipitation is observed during the months of April to May whereas lower precipitation is observed from August to September. Details of monthly rainfall of Dilijan City situated at approximately 75 km north-east or Yerevan is shown in Figure 2.4 as an example.

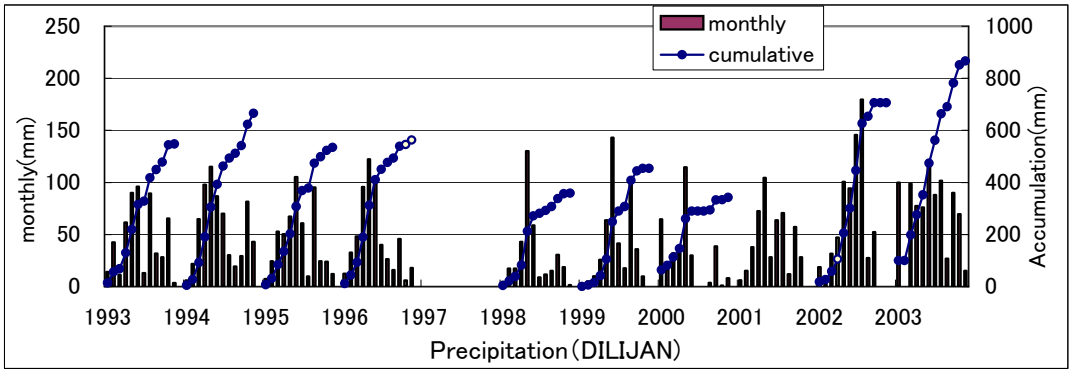


Figure 2.4 Average Monthly Precipitation in Dilijan

Figure 2.5 shows the average annual rainfall distribution (1993-2000). Areas of higher rainfall over 1,000 mm are observed in the northern part of the territory, whereas an area of lower precipitation below 300 mm is seen in the western parts of the country.

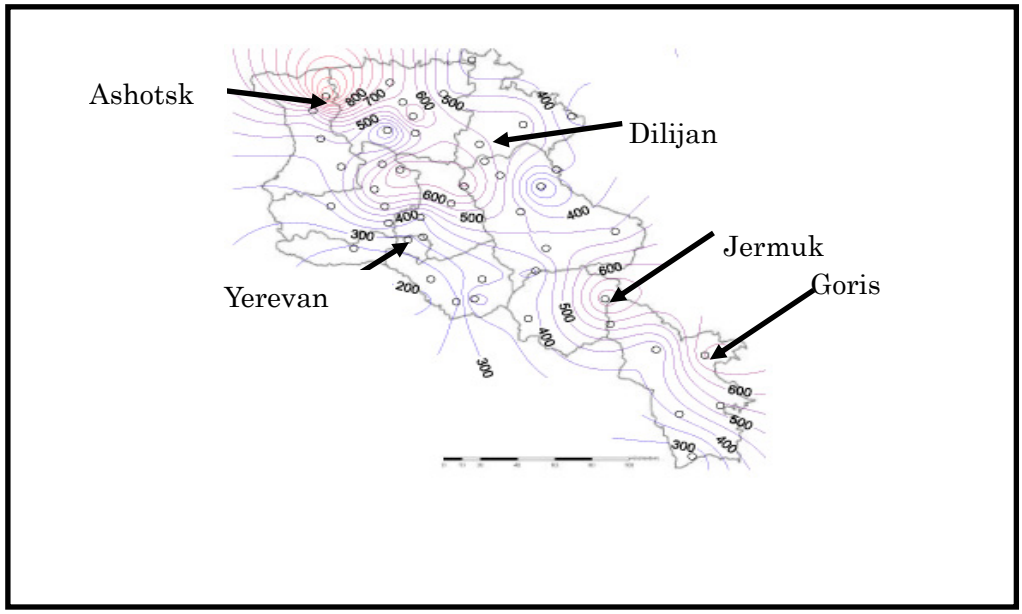


Figure 2.5 Distribution of Average Annual Precipitation

2.2 Landslides in Armenia

2.2.1 Numbers and Areas of Landslides

In the landslide inventory survey, 2,504 landslides were identified by the aero-photograph and counter map interpretation, and the 162 field inventory surveys where damages had been reported. However, many landslides in small sizes might not have been identified by the aero-photograph and counter map interpretation. The correlation equation in Figure 2.6 is obtained to extrapolate possible missing data in areas smaller than 20 ha. The numbers and areas predicted by the correlation equation are shown in Table 2.1.

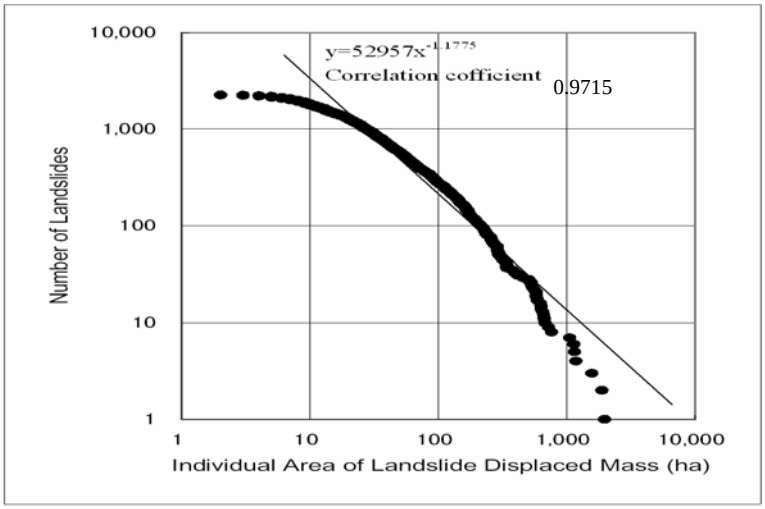


Figure 2.6 Correlation of Individual Area of Landslide Displaced Mass and Number of Landslides

Table 2.1 Numbers and Areas of Landslides Based on Displaced Mass Area

Displaced mass area	Numbers of landslide	Accumulated are of landslides	Area percentage of landslides to whole area of the RA
Identified numbers and area based on the landslide inventory study.			
Larger than 1000 ha	7	42,428	1.4%
Larger than 100 ha	276	68,442	2.3%
Larger than 50 ha	582	89,678	3.0%
Larger than 20 ha	1,296	222,780	3.8%
Estimated value according to correlation analysis based on the number and area of identified landslides (There are no identified landslides which are smaller than 20 ha and damages are not reported because they are too small for map and aerophotograph interpretation.)			
Larger than 10 ha	3,500	140,000	4.8%
Larger than 5 ha	8,000	170,000	5.8%
Larger than 2 ha	23,000	210,000	7.1%
Larger than 1 ha	53,000	250,000	8.2%

According to the extrapolation, more than 50,000 landsides larger than 1 ha (10,000m^2) could have happened in the RA.

2.2.2 Conditions Related to Landslides

(1) Landslides and Social Conditions

Statistical information of landslides identified by the inventory survey is shown in Table 2.2.

Table 2.2 Statistical Information of Landslides Identified

	Descriptions	Summing	(%)	
A	Number of landslides identified	2,504 landslides	-	
B	Number of populated places	965 places	-	
C	Number of landslides covering populated places	334 landslides	C/A	13.3%
D	Number of populated places located in landslide-displaced areas	234 places	D/A	9.3%
			D/B	**24.2%**
E	Number of landslides within a distance of 100m from stream center	1,046 landslides	E/A	41.8%
F	Number of landslides covering road network at 1:50,000-scale map	399 landslides	F/A	15.9%
Total length of road disturbed by landslide-displaced masses /total length of road			**3.9%**	
G	Number of landslides covering railway network at 1:50,000-scale map	14 landslides	G/A	5.6%
Total length of road disturbed by landslide-displaced masses /total length of road			**0.6%**	
H	Number of landslides covering historically important places[2]	6 Landslides	H/A	2.4%
Historically important places on landslide displaced masses /all 132 such places			**4.5%**	
I	Total area of the RA	2,969,678 ha	-	
J	Total area of populated places in the RA	32,032 ha	J/I	10.8%
K	Total area of landslide-displaced regions in RA	121,328 ha	H/I	**4.1%**
L	**Total area of populated places located in landslide-displaced region**	1,744 ha	L/I	0.6%
			L/J	**5.4%**
			L/K	1.4%

1 This report defined a 'populated place' as an area shown in maps at a scale of 1:100,000.
[2] Information from ICOMOS (NGO)

It is noted in the above table that: (i) a number of 234 populated places are located on landslides; (ii) at 399 places, road networks are disturbed by landslides; (iii) at 14 places railway networks are disturbed by landslides; and (iv) six (6) historically important places are located on landsides.

It is further noted that about 42% of the populated areas in hilly areas are located on landslides (Table 2.3) which may indicate that landslide areas are useful and convenient places to the people living in mountainous areas.

Table 2.3 Number of Populated Areas on Landslides

Slope Gradient (degrees)	The Total Number of Populated areas (a)	The Number of Populated Areas on Landslide Areas (b)	(b)/(a)	
0-4	538	53	10 %	
5-9	232 d=428	87 f=179	37 %	42 %
10-19	163 (d/c=44%)	80	49 %	(f/d)
20-29	28	13	47 %	
30-39	4	0	0 %	
Total	c=965	e=232	24 %	

(2) Land Use and Landslides

Land-use class was identified by interpretation of LANDSAT image acquired in 2000 and 2003. The area density of the landslide land in each land use zone is examined and shown in Table 2.4.

Table 2.4 Area Density of Landslide in Each Land-use Class Zone

Land-use Class	Study Area		Landslide Displaced Mass				Area percentage of landslide-displaced mass to each land-use class area
	Area in the study area	Area percentage in the study area	Number of related landslides	Number percentage in all landslides	Area in landslides	Area percentage in all landslides	
	(ha)	(%)		(%)	(ha.)	(%)	(%)
1: Water	132,829	4.5	1	0.0	62	0.1	0.0
2: Wetland	3,908	0.1	0	0.0	0	0	0.0
3: Urban	106,933	3.6	127	5.1	3,928	3.2	3.7
4: Intensive crops	95,704	3.2	3	0.1	322	0.3	0.3
5: Extensive crops	255,151	8.6	21	0.8	2,535	2.1	1.0
6: Bare	119,486	4.0	117	4.7	4,312	3.5	3.6
7: Grassland	1,669,022	56.2	1,336	53.4	72,540	59.7	4.3
8: Shrub land	91,808	3.1	136	5.4	6,232	5.1	6.8
9: Coniferous forest	1,771	0.1	0	0.0	0	0	0.0
10: Deciduous forest	428,060	14.4	690	27.6	27,605	22.7	6.4
11: Snow	513	0.0	0	0.0	2	0	0.4
12: Cloud	36,858	1.2	35	1.4	2,359	1.9	6.4
13: Shadow	23,200	0.8	32	1.3	1,579	1.3	6.8
14: Others	4,415	0.1	6	0.2	99	0.1	2.2
Total	2,969,658	100.0	2,504	100.0	121,575	100	4.1

(3) Geology and Landslide

Landslides are distributed in most of the geologic provinces ranging from Precambrian-age to Neogene-Quaternary (Volcanic and pyroclastic rock), except remarkably in the geologic province of Quaternary Sediments as shown in Figure 2.7. Distribution appears to be smaller in the Neogene geologic province.

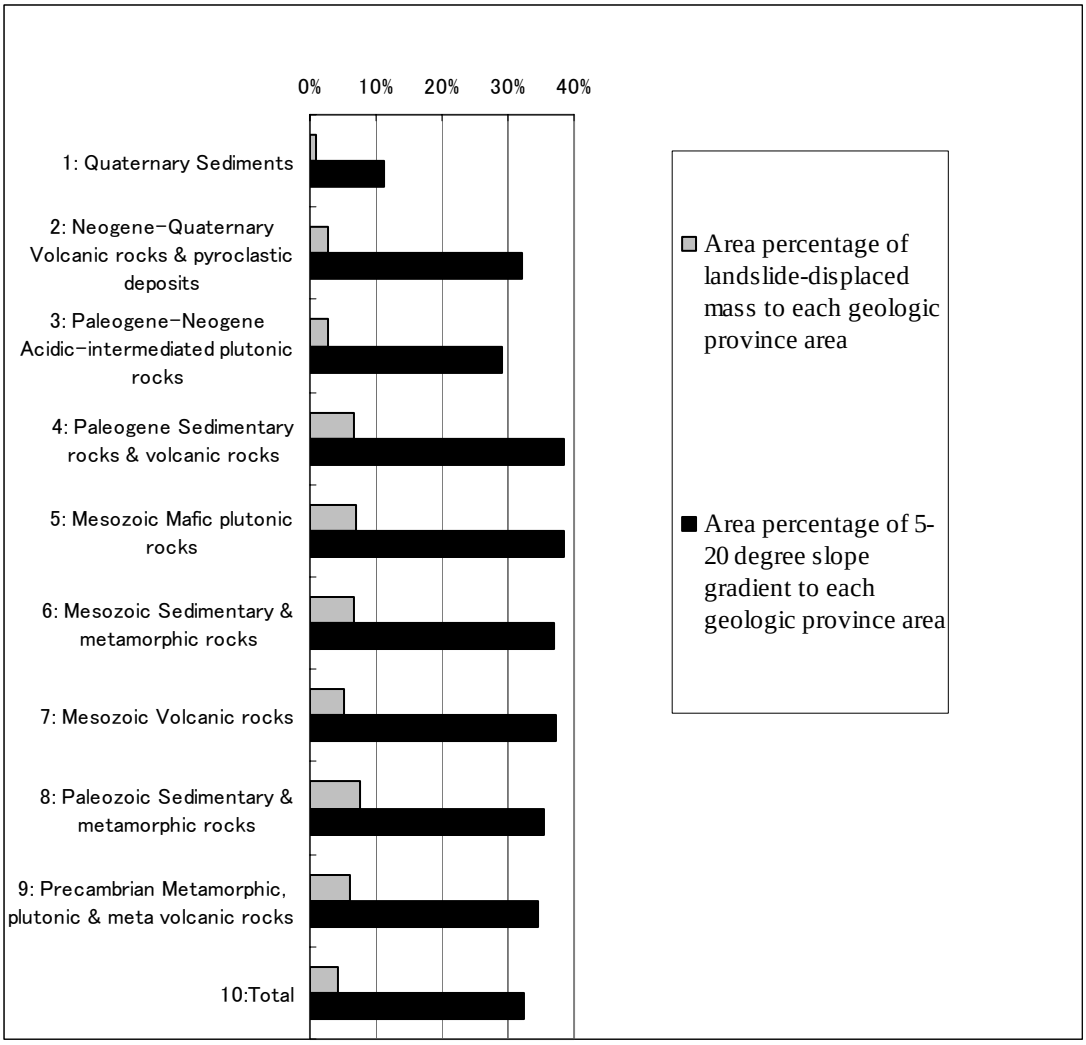


Figure 2.7 Area Percentages of Landslide Mass and Gentle Slope to Each Geologic Province

2.2.3 Landslide Category of Damage Level and Risk Object Importance Level

To determine the priority landslides for landslide management, the following criteria were applied (Table 2.5).

The landslides identified were first classified by their 'Damage progress level' in accordance with the 'Damage progress Level Code', thereafter classified by 'Risk Level' as shown in the 'Risk Level Code'. It is noted that a landslide with a high hazard level code is not always the one with a high risk code level. For example, an active damaging landslide does not always adversely affect human activities or the natural environment significantly. Finally, priorities for landslides for further study are determined with a combination of the risk level code and the hazard level code of a landslide as shown in 'Priority Rank for Management Code' shown in Table 2.5.

Table 2.5 Code of Damage Progress Level, Risk Level and Priority Rank for Study

<table>
<tr><th colspan="4">Damage Progress Level Type Code
(Damage activeness of landslides)</th></tr>
<tr><td>Level I</td><td colspan="3">Damages are progressing.</td></tr>
<tr><td>Level II</td><td colspan="3">Damages were reported or recognized in the past; effective countermeasures have not been performed.</td></tr>
<tr><td>Level III</td><td colspan="3">Landslide configurations are recognized, damages have not been reported/recognized.</td></tr>
<tr><th colspan="4">Risk Level Code
(Risk Object & Environmental/Economical Impact)</th></tr>
<tr><td>H</td><td colspan="3">Many houses, public facilities, or important infrastructures exist as risk objects.
Landslide is causing serious environmental impact.</td></tr>
<tr><td>M</td><td colspan="3">Houses, public facilities, or infrastructures exist as risk objects.
Landslide is causing environmental impact.</td></tr>
<tr><td>L</td><td colspan="3">Landslide has little relation with human activity.</td></tr>
<tr><th colspan="4">Example of Environmental Economical Impact</th></tr>
<tr><td colspan="4">Forming landslide dams and reservoirs
Flood due to collapse of landslide dams
Potential increase of debris flow
Inconveniences due to traffic suspension or blockage</td></tr>
<tr><th colspan="4">Priority Rank for Management Code</th></tr>
<tr><td rowspan="2">Risk Level</td><td colspan="3">Damaging Level Type</td></tr>
<tr><td>Type I</td><td>Type II</td><td>Type III</td></tr>
<tr><td>H</td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>M</td><td>B</td><td>C</td><td>C</td></tr>
<tr><td>L</td><td>C</td><td>C</td><td>D</td></tr>
</table>

The results are shown in Table 2.6

Table 2.6 Number of Landslides of Priority Rank

Number of Landslide of Priority Rank				Total
Risk Level	**Damage Progress Level**			
	Level I	**Level II**	**Level III**	
H	12	45	0	57
M	56	32	918	1,006
L	0	0	1,441	1,441
Total	68	77	2,359	2,504

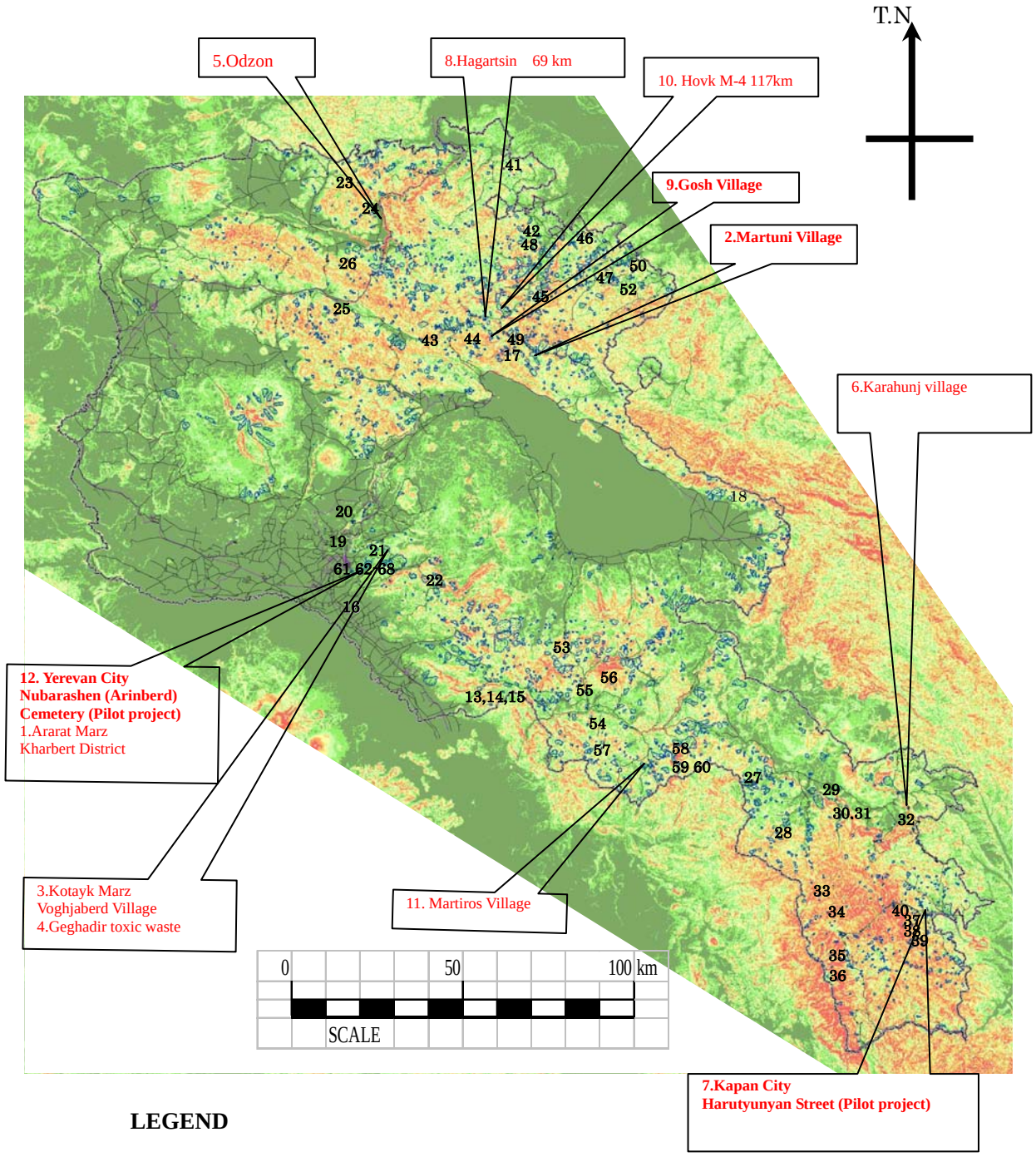
Priority Rank A	12	Landslides
Priority Rank B	101	Landslides
Priority Rank C	950	Landslides
Priority Rank D	1441	Landslides
Total	2504	Landslides

According to the classification, twelve (12) landslides have been identified as the Priority Rank-A for management. The landslides selected as 'Damaging Type I' and 'Priority Rank-A' are shown in Figure 2.8. and Table 2.7.

Among 68 damage on-going landslides (Type-I), 17 landslides have damaged inter-state, interregional railway and highway.

Table 2.7 Priority-A Landslides (Type-I Landslide of Progressing Damage)

No	Landslide/ Community Name	Martz /city	Area (ha)	Hazard &Damage type	Priority (12)	Existing Damage/ Potential Damage of Transportation Sector	
						Railway	Inter regional Road
Priority 12 Landslides							
1	Kharberd	ARARAT	24	I	A		
2	Martuni	GEGHARKUNIK	649	I	A		
3	Voghjaberd	KOTAYK	287	I	A		H-3,18,000m^2, 8Bridges
4	Geghadir toxic waste	KOTAYK	10	I	A		
5	Odzun	LORI	1	I	A	100m	M-6: 2,000m^2
6	Karahunj -1	SYUNIK	11	I	A		
7	Kapan Harutyunyan street	SYUNIK	15	I	A	600m	M-2 Bay-pass 800m^2
8	Haghartsin (Ijevan-Hrazdan railroad, road 69th km)	TAVUSH	49	I	A	95m	
9	Gosh	TAVUSH	42	I	A		
10	Hovq M5Road 117kn	TAVUSH	628	I	A		M-4: 1,000m^2,1Bridges
11	Martiros	VAYOTSDZOR	148	I	A		
12	Nubarashen graveyard	YEREBAN	11	I	A		M-15: 5,000m^2



LEGEND

Landslide Area

Landslide No.

1-12 Priority 12 Landslide for study (**Boldface: Pilot Project Landslide)**

1-68 Others with Type I of damage progress level: Damage are progressing

High Way

Rail Way

Figure 2.8 Landslide Location Map of 68 Progressing Damage Landslides

Table 2.8 Priority-B Landslides (Type-I Landslide of Progressing Damage)

No	Landslide/ Community Name	Region/City	Area (ha)	Type	Priority	Damages for Transportation Sector	
						Railway	Inter regional Road
Other Priority Landslide							
13	Lanjor-Lusashogh H-10 Road	ARARAT	57	I	B		H-10 2,000m^2
14	Lanjar	ARARAT	8	I	B		
15	Urtsalandj	ARARAT	35	I	B		
16	Bardzrashen	ARARAT	6	I	B		
17	Dprabak-Chaykend	GEGHARKUNIK	338	I	B		
18	Avazan	GEGHARKUNIK	175	I	B		
19	Kanakeravan	KOTAYK	12	I	B		
20	Arzni	KOTAYK	1	I	B		
21	Geghadir -1	KOTAYK	1	I	B		
22	Goght-road	KOTAYK	76	I	B		H-10 2,000m^2
23	Kachachkut	LORI	20	I	B		
24	Sanahin	LORI	1	I	B		
25	Vanadzor-Chemical plant	LORI	14	I	B		
26	Vahagni	LORI	1	I	B		
27	Angekhakot	SYUNIK	144	I	B		
28	Akhltyan	SYUNIK	44	I	B		
29	Noravan(Syunik)	SYUNIK	145	I	B		
30	Shamb-reservoir	SYUNIK	113	I	B		
31	Shamb-village	SYUNIK	1	I	B		
32	Karahunj -2	SYUNIK	13	I	B		
33	Ajibash	SYUNIK	26	I	B		
34	Gyard	SYUNIK	15	I	B		
35	Tashtun	SYUNIK	54	I	B		
36	Lichk	SYUNIK	1	I	B		
37	Kapan,Shinaraneri str., School N10	SYUNIK	6	I	B		
38	Kapan Geghanush district	SYUNIK	5	I	B		
39	Chakaten	SYUNIK	1	I	B		
40	Kapan-Norashenik (2nd km of the road)	SYUNIK	1	I	B		
41	Barekamavan-Dostlu	TAVUSH	16	I	B		
42	Sevkar	TAVUSH	8	I	B		
43	Diligen M-8 Road	TAVUSH	1	I	B		M-8 350m^2
44	Parz lich	TAVUSH	22	I	B		
45	Gandzakar	TAVUSH	56	I	B		
46	Aygehovit	TAVUSH	7	I	B		
47	Berd	TAVUSH	381	I	B		
48	Makaravank monastery	TAVUSH	195	I	B		
49	Khachardzan-Polad	TAVUSH	113	I	B		
50	Mosesgegh	TAVUSH	1	I	B		
51	Artsvaberd	TAVUSH	1	I	B		
52	Amaghu	VAYOTS DZOR	72	I	B		
53	Aghanidozar M-10 Road 27km	VAYOTS DZOR	1	I	B		M-10 1,400m^2
54	Agarakadzor	VAYOTS DZOR	1	I	B		
55	Getap	VAYOTS DZOR	36	I	B		
56	Vernashen	VAYOTS DZOR	18	I	B		
57	Bardzruni upstream dam	VAYOTS DZOR	79	I	B		
58	Akhta	VAYOTS DZOR	22	I	B		
59	Gomk-Gomur	VAYOTS DZOR	46	I	B		
60	Kapuyt	VAYOTS DZOR	11	I	B		
61	Yerevan Chemical plant	YEREBAN	8	I	B		
62	Yerevan By-pass road	YEREBAN	16	I	B		M-15; 5,000m^2
63	Yerevan hospital	YEREBAN	23	I	B		M-15; 5,000m^2
64	Summer houses and by-pass road-1	YEREBAN	31	I	B		M-15; 5,000m^2
65	Summer houses and by-pass road-2	YEREBAN	45	I	B		M-15; 1,000m^2
66	Summer houses and by-pass road-3	YEREBAN	10	I	B		M-15; 1,000m^2
67	Summer houses and by-pass road-4	YEREBAN	4	I	B		M-15; 500m^2
68	Ssummer houses and by-pass road-5	YEREBAN	88	I	B		M-15; 8,000m^2

2.3 Characteristics and Induced Causes of Landslides

2.3.1 Naturally Induced Causes of Landslides

(1) Precipitation distribution and landslides

The area density of landslides appears to be predominant in the areas of higher annual precipitation, indicating that precipitation may be one of the main causes of landslides as shown in Figure 2.9.

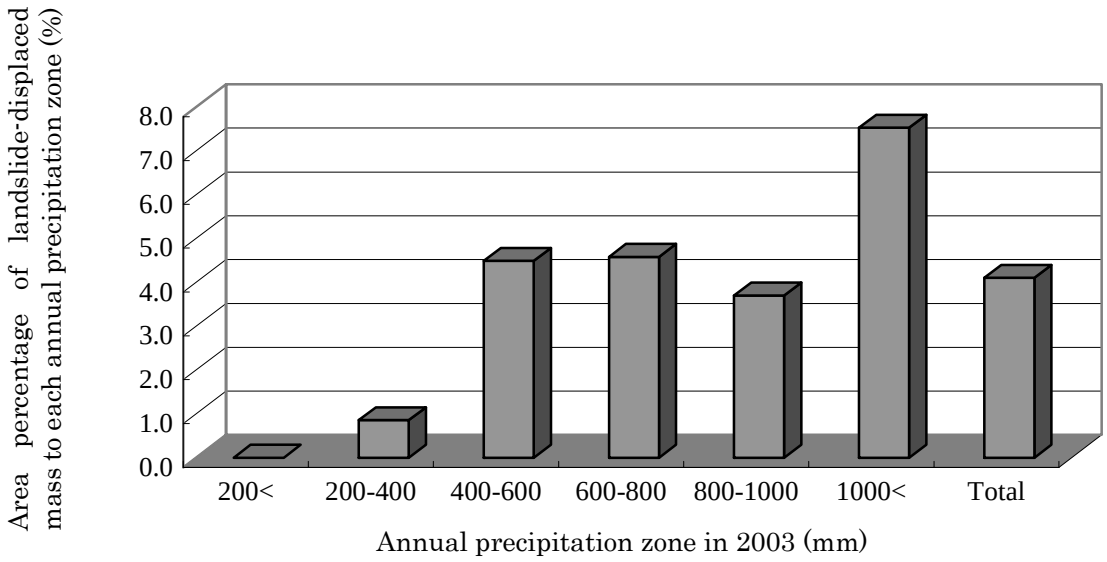


Figure 2.9 Area Percentage of Landslide Displaced Mass to Each Annual Precipitation Zone

According to existing monitoring records of landslide movement of the Ministry of Nature Protection, the collations among landslide activation and large intensity of monthly rain, 100mm to 120mm or more, are recognized.

(2) Snow melting

In the observation of the Gosh village in Tavush Martz by the JICA Study Team, the activation of the landslide with snow melting was identified as shown in Figure 2.12. It was observed that the landslide movements accelerated at the beginning of March and that it decelerated towards the beginning to the middle of April when the snow disappears from the ground.

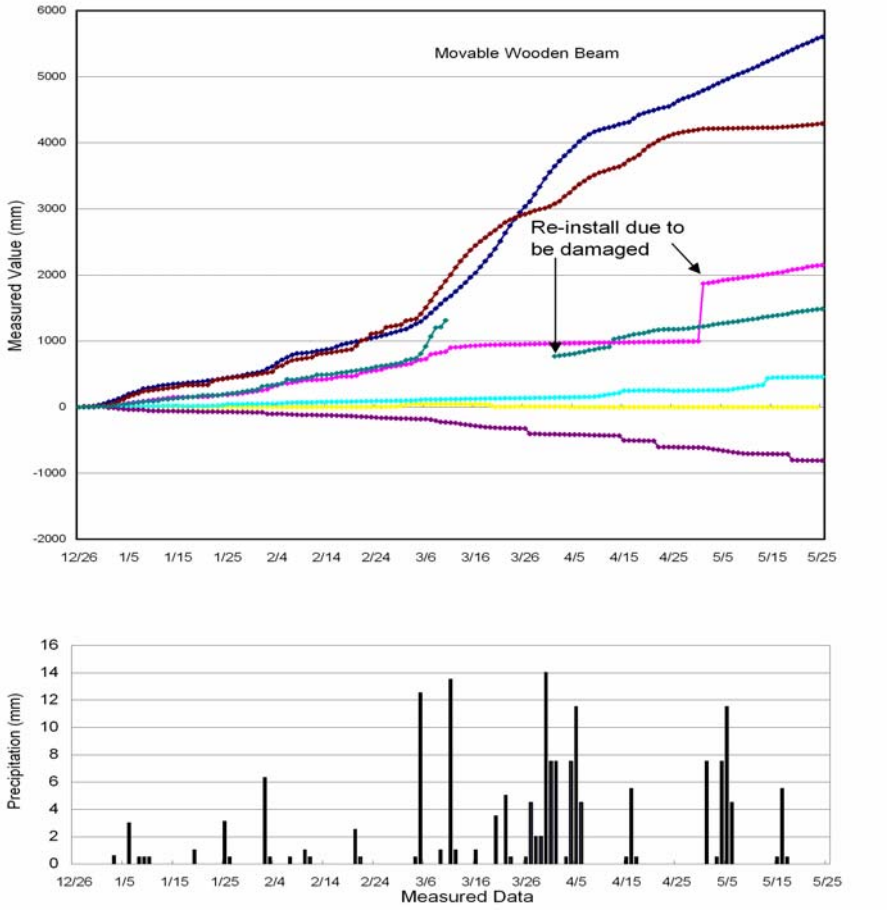


Figure 2.10 Landslide Movements in Gosh Village (2005: JICA Study Team)

(3) River Erosion

The river erosion is a main cause and activating factor of the landslides from the following observation.

Almost half (46%) the number of the landslides of 2 ha or more approach big rivers which are shown in 1:200,000 scale maps. The relationships between the field inventories survey (damage reported) on 145 landslides and rivers are shown in Table 2.9.

Table 2.9 Relations between Field Inventory Survey 145 Landslides and Rivers

	Relation between landslides and rivers (Category)	Number of landslides	Percentage
1	River undercuts landslides (If landslide masses sift the river, they are included in Category 2.)	33	23%
2	Landslides shift the river course (In case of river shifting landslide masses are undercut, they are included in this category 2.)	15	10%
3	Contacts, no mutual influences	39	27%
4	No relationship	58	40%

(4) Earthquake and Active Faults

Cases of the landslide slips due to the earthquake are known worldwide. In the RA, the following are the three (3)popular historical landslides due to earthquakes.

The Spitak earthquake generated at only one landslide on 7th December 1988. The landslide is 100 m width, 1,000 m length, and the depth presumption 7-10 m, 20 km north-northeast from Spitak.

In 1935, an earthquake (M>7.0) occurred in the upper reaches of the Arpa river valley. Large landslides followed across the entire basin of Arpa. The largest giant-landslide masses were dumped near the villages of Aratavan, Saravan and Terp. The Ganzak earthquake (M= 7.5) took place on September 30, 1939. A chronicle source reported about a vast area hit by the earthquake (from Tatev to Haghat, encompassing the entirety of N. and E. Armenia) and numerous landslides were triggered. The largest landslide was situated on Alagarik (Kiapaz) mountain. The Algarik mountain landslide is one of the largest giant-landslides that have ever occurred in the territory of Armenia.

Formerly, there was a perception in the RA that landslides are concentrated around the active faults, and the relationship between earthquake and landslide generation was being emphasized.

During the Spitak Earthquake in 1988, one distinct landslide occurred, and small slope collapses occurred in the vicinity of the epicenter and the earthquake faults. In 735 and in 1139 some landslides were recorded in the southeast region of the RA. However, these are a small part of all landslide cases in the country.

This study has examined the relationship between landslide distribution density and distance from landslides to active faults for the identified 2,504 landslides. This analysis indicated that higher density of landslides is distributed in zones far from active faults. Grounds that decreased relatively along the fault plain are mostly buried by sediments and water, and lakes and plain are formulated such as Sevan Lake, and Ararat Plain. In these plains and lakes no landslides are distributed. On the other hand, grounds that rose relatively formulate mostly new steep slopes. These new slopes are reasoned by weak weathering, undeveloped river systems, thus, landslides are not developed.

Though landslides are not developed in these steep slopes, they may develop in the feature. Earthquakes and movement of active faults are two (2) of induced causes of landslides. In these cases, new landslides and reactivation of landslides may occur.

2.3.2 Useful Aspects and Man-induced Causes of Landslides

In hilly-mountainous areas, almost 90% of communities are on gentle slopes (less than 20 degrees), while almost 40% of populated locations are distributed on the identified landslides.

Land affected by landslides has better resources than the surrounding mountainous areas. This means that landslides are not always active; most of them dormant. Landslide lands are usually enriched by fertile soil and abundant water in relatively barren mountain areas. Above all, the landslides-lands are flatter than the surrounding mountain slopes; which makes life much easier.

However, such landslide-land may have turned into hazardous, dangerous and menacing lands probably because they should have remained undisturbed. In particular, water has the greatest role in the re-activation of dormant landslides or worsens active landslides, even though inherent local geological conditions are also one of the root causes of landslides. On active landslides, community infrastructures, such as community roads, water supply lines, gas lines, drainage ditches and so on, are damaged. The damage on such infrastructures may in turn become causes of activation of landslides because of leaking water from water supply pipes or spilling water from side ditches and the like. All those may have formed a vicious circle as shown in Figure 2.11.

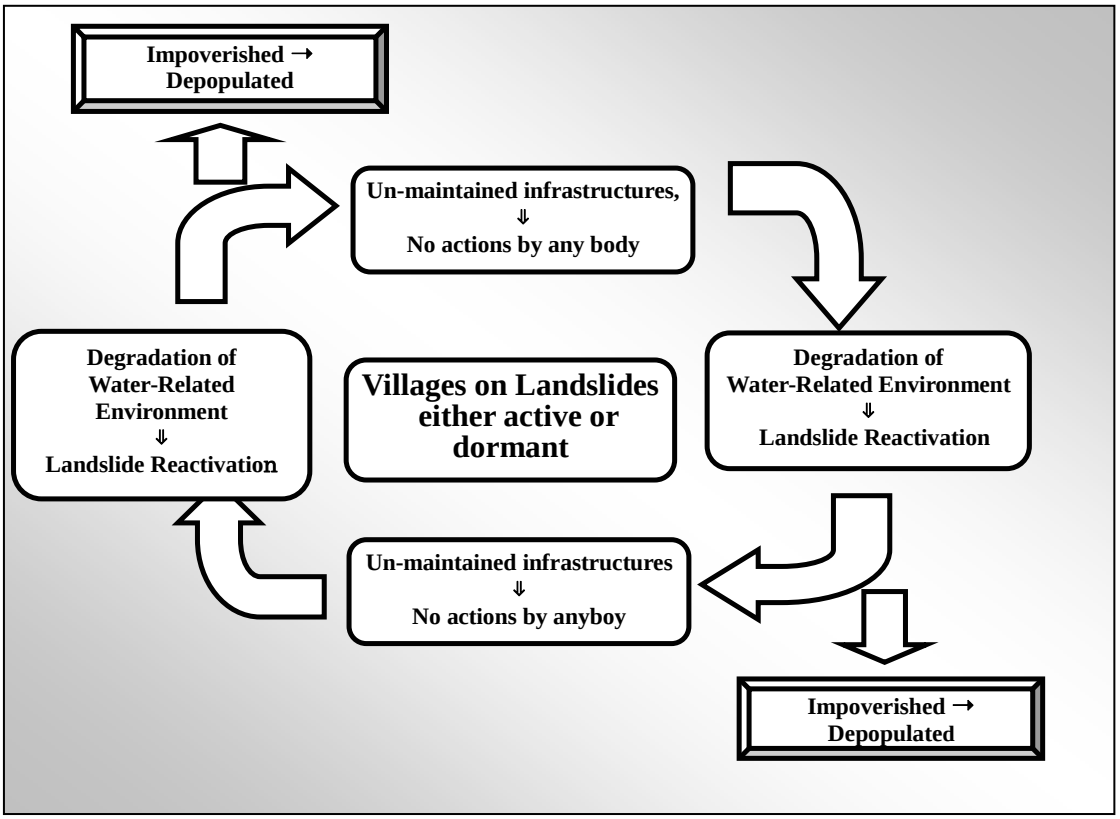


Figure 2.11 Vicious Circle of Communities on Landslides

To break up the vicious circle of landslides, proper landslides management, proper management for water use, proper maintenance of drainage networks, proper land use, etc. are definitely essential. By so doing, co-EXISTENCE with landslides as 'Useful Lands' will become possible. Once proper landslide management has been performed, it is believed that living conditions will be improved, workability of farm lands will be enhanced, and new industries may be introduced.

All parties concerned should draw their attention to these particular characteristics of landslide-displaced lands. And with these characteristics in mind, mountain community development could be implemented.

No ongoing damage has resulted in the majority (97%) of the 2,504 GIS-identified landslides. There is, however, a possibility that human activities (leakage from water supply system, watering etc.) have caused activation of landslides. In particular, water supplies in landslide-affected land can represent a major negative impact due to the stable slope associated with low precipitation (200-1200mm/year).

Landslides activated by these water supplies can potentially be reduced by introducing minor measures or reducing the causes, such as decreasing water leakage from water supply systems,

drainage maintenance, etc. For example, in the case of Ijevan city, the closing of factories and decrease in the water supply resulted in a settling in landslide activity.

There are also cases where migrating inhabitants suffered landslides, such as in Martiros village. Therefore, factors reducing the cause of landslides should be examined first.

Human activities (for examples, the use of water for living and irrigation, earth moving and embanking) have sometimes caused landslide activities.

The Study recognized on landslide areas that water was left flowing into landslide lands from water taps of dwelling houses, irrigation systems, leakage of water pipes and drainage not connected with the river. Sufficient attention is therefore necessary for such man-made causes of landslide activities.

2.3.3 Induced Cause of Wide-area Infrastructure-related Landslides

Many landslides affecting wide-area infrastructure are related to linear structures such as roads and railways.

Landslides on the Ijevan-Hrazdan railway at 69 km from Hrazdan (Tavush Marz, Haghartsin Village) the M-4 Highway at 117 km from Yerevan (Tavush Marz Hovk Village), and the M-6 Highway and Tobilishi-Vanadzor railway in Odzun Village (Lori Marz) are typical examples of landslides related to social infrastructure.

In general, when a linear structure passes over the landslide zone, the foot section of a large-scale landslide near a riverbed is often selected for the alignment. The cutting of this foot section often reactivates the landslide.

2.3.4 Confusion of Landslides and Other Causes

A field inventory survey covering 162 sites reported to be damaged was undertaken. Of these sites, 17 were not landslide areas; two (2) were due to fall-type movement, one (1) was due to a rapid-flow type movement, and the other 14 were located on very flat areas, and may have occurred due to ground deformation either by settlement, or by frozen heaves, or by deterioration of constructed structures. Thus, there are many cases where the cause is not thoroughly examined.

2.4 National Economy, Budget and Damage due to Landslides

2.4.1 Outline of National Economy

The economy of RA has grown by 6-13 % per annum for the last five years, as shown in Table 2.10.

Table 2.10 Indicators of Economic Growth

Indicator of Economic Growth	2000	2001	2002	2003	2004
Economic Annual Growth Rate	6%	10%	13%	7 %	10%
GDP billion AMD (billion USD)	1,031 (2.2)	1,176 (2.5)	1,363 (3.0)	1,623 (3.5)	1,893 (4.1)
GDP per/person thousand AMD (USD)	264 (569)	309 (666)	357 (769)	505 (1,088)	589 (1,270)

2.4.2 Outline of National Budget Related to Landslides

The budget allocated to landslide management has been expended from two fiscal resources, namely the regular budget and the reserve funds.

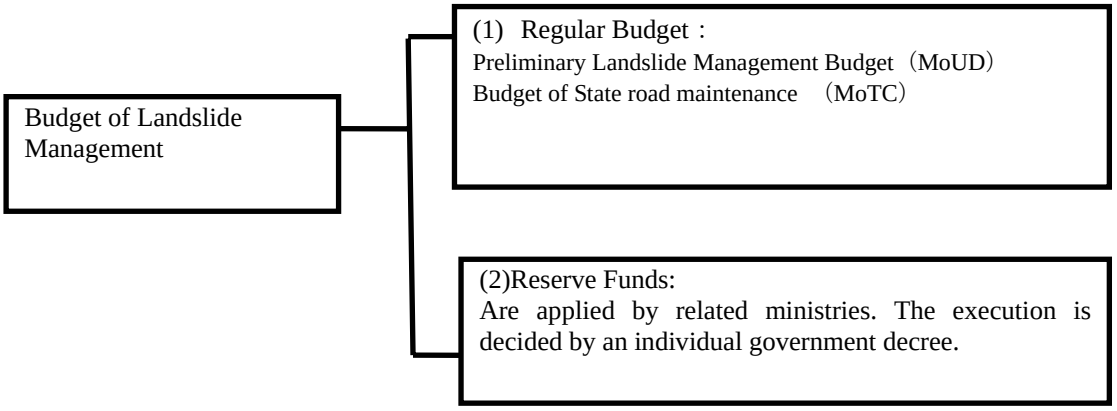


Figure 2.12 Budget of Landslide Management

(1) Regular Budget

Government Decree No. 1074 （27 November 2001) Program for preliminary landslide management " designated the MoUD as the overall management organization for landslide management in the RA". A budget for landslide management is set in the Medium Term Expenditure Frame: ＭＴＥＦ.

The budget was used for relocation, geotechnical investigation and construction. In 2005, however, the budget for landslide management was limited to geotechnical investigation only.

MoTC uses part of the road maintenance budget for restoration works in areas damaged due to landslides.

(2) Reserve Fund

Related Ministries apply reserve fund for emergency countermeasure works or local request to the Prime Minister. Government Decrees are issued to each project, with designated responsible organizations and budgets. The Ministry of Transport and Communication (MoTC), Ministry of Urban Development (MoUD) and Regional Government (Marzes), Armenian Rescue Service (ARS), etc. are designated depending on the type of risk objects. Examples of reserve funds have been for the relocation of houses in 2002 under MoUD, and inspection of the Geghadir toxic waste landslide in 2004 under ARS.

(3) Budget for landslide management

To address the landslide problem, MoUD prepared the program for 2002-2004, formalized as the GoA Decision No. 10741 "About the Approval of Landslide Primary Countermeasures Program in RA Territory".

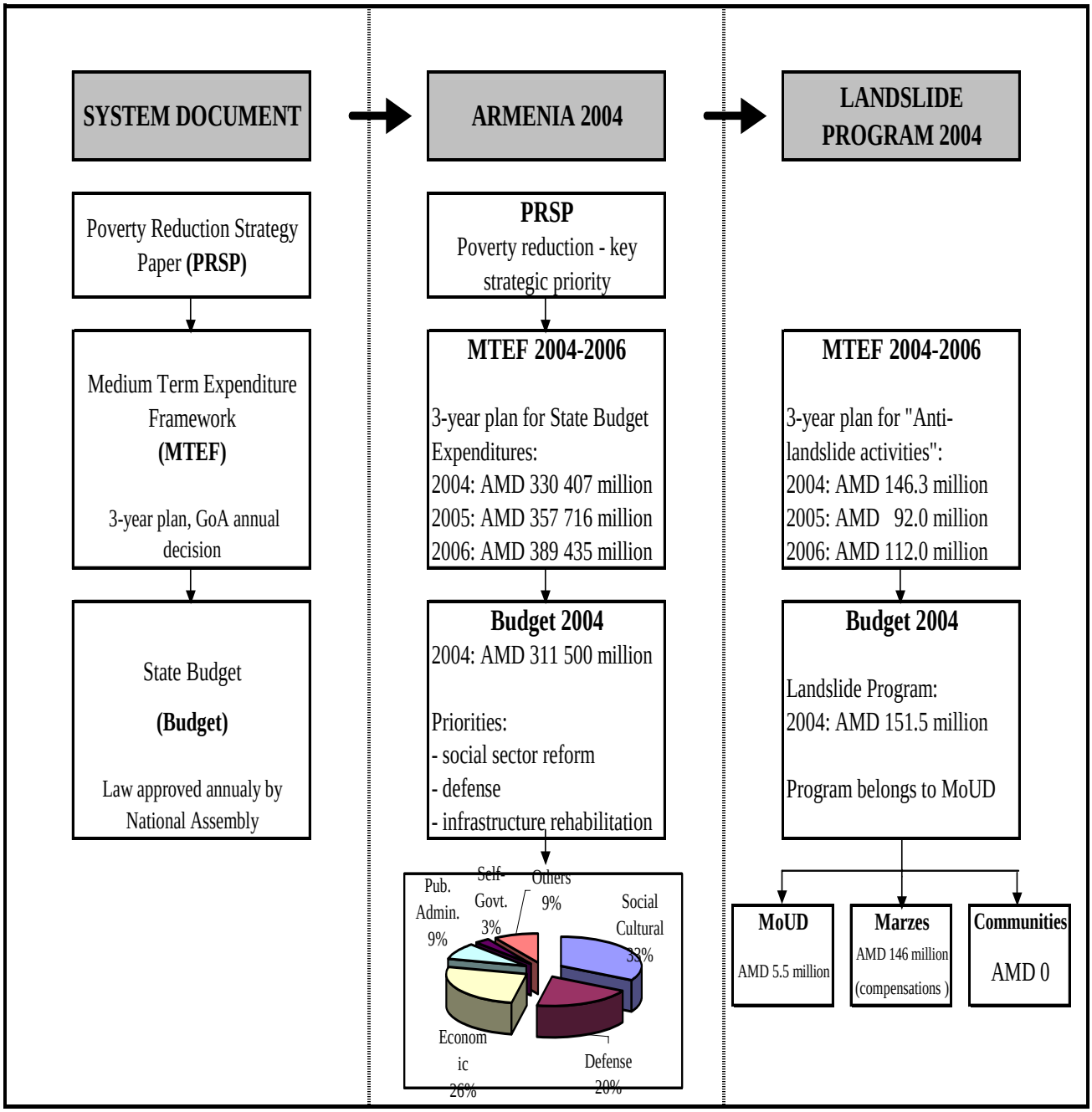
The Program was to be a part of "RA Government Activity Program, Government Decree No 473 on Protecting RA from Dangerous External Geological Phenomena". The Program was based on (i) "Master outline until 2000 for the protection of Armenian Soviet Socialist Republic's rural populated areas, enterprises, buildings, constructions from landslides collapses, thaws and mudflows", Hayinzhnkhagits, 1986; (ii) "Purpose program on complex study of basic issue on protection of RA from dangerous geological processes", ArmInzProy, 1997; and (iii) "Compendium on landslides and mudflows in RA", Geological Department of RA Nature Protection Ministry, 1999.

The Program initially listed the 31 priority landslide sites, assigned priorities, proposed measures and necessary expenses such as expenses categorized for: (i) preliminary study; (ii) survey and monitoring; (iii) exploration and design; (iv) construction; and (v) resettlement. The program was being modified over time, without clear criteria for selection or prioritization.

The Program assigns the overall supervision and systematization of countermeasure works to the MoUD. The Program mentions: "MoFE, while elaborating draft budgets 2002-2004, must consider the opportunities for accomplishment of works planned by the Program and provision of financial means for these purposes".

The Program attempted implementation "from the state budget, relevant communities' budgets, as well as from foreign credits, grants and long-term investment allocation."

Figure 2.13 presents the outline of the budgeting system: the column on the left shows the base for the budgeting system, the column in the center shows the budgeting system in 2004 for the whole State Budget in Armenia, and the column on the left shows the situation for the landslide program in 2004 in particular.



Source: (1) PRSP 2003, (2) MTEF 2004-2006, (3) 2004 Budget Law, (4) Budget System Law, (5) Public Expenditure Review of Armenia, WB 2003.

Figure 2.13 Budgeting Systems

Table 2.11 shows results of the allocated budget for landslide management by MoUD. Substantial amounts were allocated to the Kapan City Harutyunyan street landslide as part of the recovery construction works in 1996-1999. However, this restoration construction has not been completed yet.

The house relocation policy was undertaken in more recent years (2002-2004). However, because the budget was insufficient, only some sections of the relocation were completed. Doubts on the fairness of the relocation policy were being raised by residents. Additional expenditures from the Reserve Fund (in 2002, AMD 287 million for Voghjaberd and Ijevan-Hrazdan railway 69km) were allocated.

In 2004, the MoUD actual budget was AMD 5.5 million for geological investigation in Martiros village. The remaining amount of AMD 146 million was for compensation; resources were to be transferred from the MoUD to Marzs.

In 2005, the house relocation policy was excluded from the landslide management and only investigation and study were executed, totaling AMD 92 million (USD 200 thousand). It is a 'wide and shallow policy', with a budget allocated to 22 landslides and an average input of AMD 4 million (USD 9 thousand).

Table 2.11 Transition of Landslide Execution Budget under MoUD

Landslide Budget AMD million

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
State budget *				242,585	222,886	244,381	263,912	312,698	364,700	397,700
Landslide Budget	247	63	206	181	0	21	163	148	152	92
Ratio of landslide budget to state budget				0.07%	0.00%	0.01%	0.06%	0.05%	0.04%	0.02%
Breakdown of Landslide Budget										
Countermeasure works	247	63	192	181	0	0	19	8	0	0
Investigation and design and information	0	0	14	0	0	21	0	0	6	92
House relocation	0	0	0	0	0	0	144	140	146	0

*State Budget 1991- 2003 Statistical Yearbook of 2004.

The landslide management budget of MoUD over the last three years was approximately AMD 90-150 million (USD 0.2-0.3 million), which is a very low proportion (0.02%-0.05%) of the total state budget of AMD 313 -398 billion (USD 688 – 875 million) (by comparison, the budget for controlling erosion and flood in Japan is approximately 2% of the national budget of Japan).

MTEF (2003-2005) targeted poverty reduction as one of its basic aims. Its strategic priority fields were education, health, social safety and water supply, with focus on military expenses even though they have a social safety aspect. A territory disaster management fee was not listed as an item of expense.

In the MTEF for 2005-2007, landslide management budgets were planned as shown in Table 2.12. This budget was executed in 2005. However, it was not adopted for 2006, and no results were achieved by the end of 2005.

Table 2.12 Landslide Management Budget MTEF (2005-2007)

AMD million			
	2005	2006	2007
Total	92	112	112
Investigation budget	92	112	105
Countermeasure Works	0	0	7

2.4.3 Situation with International Assistance

Most of the countries and organizations currently represented in the communities are donors which include the following:

1. Armenian Social Investment Fund (WB) – community infrastructure rehabilitation and development programs; and

2. Community Self-help Fund (US Embassy).

DfID assists to formulate 'Marz development program'. This is a guideline to 3 Marzes (Tayush, Gegharkunik, Syunik) and includes international assistance and not direct assistance to the communities.

2.4.4 Landslide Damage Assessment

(1) Categorized Sectors for Damage Assessment

The damage was also categorized into the following sectors:

- Buildings, including (i) dwellings; (ii) schools; (iii) hospitals; (iv) other public buildings; (v) buildings for industry; and (vi) buildings for services.
- Transport, including (i) gravel roads; (ii) asphalt 1 lane roads; (iii) asphalt 2 lanes roads; (iv) bridges; and (v) railways.

- Water, energy, and communication including (i) gas system; (ii) drinking water and sewerage system; (iii) irrigation and drainage system; (iv) rivers; (v) energy and electricity; and (vi) telecommunications.
- Agriculture, including (i) crop land; (ii) grazing land; and (iii) timber production.
- Others, including (i) emergency expenditure; (ii) demolition removal; (iii) monuments; and (iv) remaining.

(2) Outline of Landslide Damage Assessment

Table 2.13 shows the landslide damage in the RA as calculated in this Study. The amount of damage is divided into 'direct damage', and 'indirect damage'.

Direct damage is an asset value of the damaged objects.

Indirect damage means the losses related to economic activities while the damaged objects recover (the indirect damage is only the amount related to those items that can be calculated).

In Table 2.13, human loss was not included as it was difficult to calculate in monetary terms and the occurrence of it wss extremely rare. Unaccountable damages such as losses due to anxiety, distrust, pessimism, and economic damage, etc., were also not calculated.

The existing damage (total existing damage of the risk objects as of August 2004) was USD 47 million. Moreover, the potential damage (amount of damage when all risk objects in landslide areas are completely lost) approached USD 59 million. This corresponds to 5.3% and 6.7%, respectively, of the 2005 state budget of USD 884 million and around 230 times and 300 times to MoUD landslide management budget of USD 0.2 million in 2005. In general, the benefit from measures for single target of landslide mitigation is small and does not exceed its costs. This can be the reason why investments for landslide management are not justified.

Deaths due to landslides totaled three people (Kapan City Harutyunyan street landslide and Chiva village landslide) in the 14 years since the independence of the RA in 1991. Casualties were avoided by relocation or evacuation before the collapse of houses.

Depending on management subjects, the landslide damages were subdivided into those 'under community management or private', those 'under private companies' management' and those 'under government organizations' management'. The damage related to 'under community management or private companies' management' landslides accounted for 80% or more of the overall damage as shown in Table 2.7.

Table 2.13 Damages Caused by Landslides

Existing Damage as at August 2004 (**AMD** million)												
Sector	Under community management/ private			Under private companies' management			Under government organizations' management			**Total**		
	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**
Buildings	3,640	500	**4,140**	0	0	**0**	0	0	**0**	**3,640**	**500**	**4,140**
Transport	6,870	450	**7,320**	0	0	**0**	1,590	630	**2,220**	**8,460**	**1,090**	**9,550**
Water, energy, and communications	0	0	**0**	1,000	40	**1,040**	950	40	**1,000**	**1,950**	**90**	**2,040**
Agriculture	5,550	0	**5,550**	0	0	**0**	0	0	**0**	**5,550**	**0**	**5,550**
Total	**16,060**	**950**	**17,010**	**1,000**	**40**	**1,040**	**2,540**	**680**	**3,230**	**19,610**	**1,680**	**21,290**
Potential Damage (**AMD** million)												
Sector	Under community management/ private			Under private companies' management			Under government organizations' management			**Total**		
	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**
Buildings	14,050	1,090	**15,150**	0	0	**0**	0	0	**0**	**14,050**	**1,090**	**15,150**
Transport	6,090	590	**6,680**	0	0	**0**	2,590	720	**3,320**	**8,690**	**1,310**	**10,010**
Water, energy, and communications	0	0	**0**	500	0	**500**	680	40	**720**	**1,180**	**40**	**1,220**
Agriculture	450	0	**450**	0	0	**0**	0	0	**0**	**450**	**0**	**450**
Total	**20,610**	**1,680**	**22,290**	**500**	**40**	**500**	**3,270**	**770**	**4,040**	**24,380**	**2,450**	**26,840**

Note： The management division is judged in the outline according to its sector for management and scale.

Existing Damage as at August 2004 (**USD** million)												
Sector	Under community management/ private			Under private companies' management			Under government organizations' management			**Total**		
	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**
Buildings	8.0	1.1	**9.1**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	**8.0**	**1.1**	**9.1**
Transport	15.1	1.0	**16.1**	0.0	0.0	**0.0**	3.5	1.4	**4.9**	**18.6**	**2.4**	**21.0**
Water, energy, and communications	0.0	0.0	**0.0**	2.2	0.1	**2.3**	2.1	0.1	**2.2**	**4.3**	**0.2**	**4.5**
Agriculture	12.2	0.0	**12.2**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	**12.2**	**0.0**	**12.2**
Total	**35.3**	**2.1**	**37.4**	**2.2**	**0.1**	**2.3**	**5.6**	**1.5**	**7.1**	**43.1**	**3.7**	**46.8**
Potential Damage (**USD** million)												
Sector	Under community management/ private			Under private companies' management			Under government organizations' management			**Total**		
	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**	Direct	Indirect	**Total**
Buildings	30.9	2.4	**33.3**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	**30.9**	**2.4**	**33.3**
Transport	13.4	1.3	**14.7**	0.0	0.0	**0.0**	5.7	1.6	**7.3**	**19.1**	**2.9**	**22.0**
Water, energy, and communications	0.0	0.0	**0.0**	1.1	0.0	**1.1**	1.5	0.1	**1.6**	**2.6**	**0.1**	**2.7**
Agriculture	1.0	0.0	**1.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**	**1.0**	**0.0**	**1.0**
Total	**45.3**	**3.7**	**49.0**	**1.1**	**0.0**	**1.1**	**7.2**	**1.7**	**8.9**	**53.6**	**5.4**	**59.0**

Note： The management division is judged in the outline according to its sector for management and scale.

(4) Existing Direct Damage

The results revealed that the cumulated existing direct damage caused by landslides up-to-date was USD 43 million. The following figure presents distribution of the existing direct damage among the sectors:

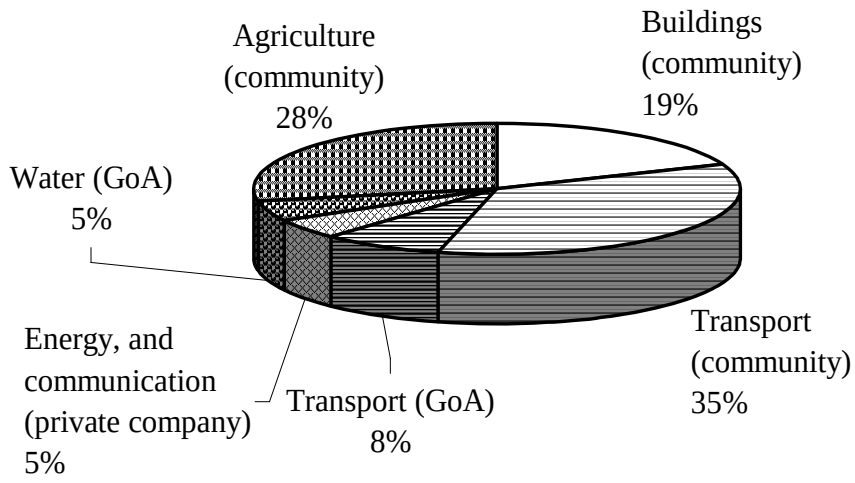


Figure 2.14 Existing Direct Damage

Table 2.14 Existing Landslide Damage – Results

	Direct Damage Cumulated Values Million USD	Potential Direct Cumulated Values Million USD
Buildings	8.0	30.9
Transport	18.6	19.1
Water, energy, and communication	4.3	2.6
Agriculture	12.2	1.0
Total	**43.1**	**53.3**

(a) Buildings

The above graph shows that buildings constitute 19% of the total existing direct damage caused by landslides (USD 8.0 million). That value is relatively small, contrary to the usual perception that the building sector suffers the most damage. The relatively small value of damage is the result of the situation in the real estate market in Armenia.

According to the Inventory Survey, 1.2% of the housing stock is located within the landslide areas, of which 0.3% has been damaged to date by landslides. Looking at the housing sector as a whole, landslide damage seems to be a minor problem. Still, it is a considerable problem from the point of view of individual rural communities.

Table 2.15 Housing Stock Area : Total and Damaged by Landslides

	Total housing stock in Armenia	Located within landslides		Damaged by landslides*	
Urban area	59.9% of total	-	-	-	-
Rural area	40.1% of total	-	-	-	-
Total	67,241,700 m^2	795,100 m^2	1.2% of total	198,900 m^2	0.3% of total

Source: (1) Total housing stock in Armenia from "Armenia – Country Profiles on the Housing Sector, UN, 2004" and MoUD Housing and Communal Policy Dept.; (2) Housing stock affected by landslides from "Inventory Survey, JICA Study September 2004".

(b) Transport

According to the Study estimation, the transport sector has suffered to date from USD 18.6 million direct damage (cumulated value).

The transport sector included motor-roads, bridges and railways. The motor-roads suffered the biggest share of the damage (81%) according to our estimations.

Table 2.16 Motor-roads Damaged by Landslides

	Total motor-road network in Armenia	Motor-road located within landslides		Damaged by landslides	
Interstate & republican	3,360 km	-	-	9 km	0.3% of total
Local & community	4,440 km	-	-	90 km	2.0% of total
Total	7,800 km	238 km	3.1% of total	99 km	1.2% of total

Source: (1) Total motor-road network in Armenia from "MTEF 2004 –2006, MoTC." (2) Motor-road located within landslides from "GIS Survey, JICA Study, September 2004"; (3) Motor roads damaged by landslides from "Inventory Survey, JICA Study September 2004".

As shown in the above table, 3.1% of total motor-roads are located within landslides, 1.3% of the total has been damaged, and 1.2% might potentially be damaged.

A conservative WB estimate[2] of financing only for road maintenance totals USD 30 million annually. The total 2004 budget of the MoTC for road rehabilitation and maintenance is USD 14.3 million.

[2] Including USD 20 million for the national road network, USD 5 million for the local rural roads, and USD 5 million for the city streets; after the Public Expenditure Review, Armenia, WB, 2003.

(c) Water, energy, and communication

The infrastructure sector (excluding transportation system) has suffered from USD 4.3 million direct damage (accumulated value). The following table gives the details of the estimation of existing damage in infrastructure by landslides:

Table 2.17 Existing Damage in Infrastructure by Landslides

	Length of Damage	Damage (USD million)
Gas system	4,860m	0.181
Drinking & sewerage	74,575m	1.790
Irrigation & drainage	71,002m	2.130
Energy & electricity	13,720m	0.137
Telecommunication	40,300m	0.067
Total		4.305

Source: (1) Damage [m] from "Inventory Survey, JICA Study September 2004", (2) Values for value assessment from: Gazprom, MoUD, and Armentel.

(d) Agriculture

The direct existing damage to the agriculture sector was estimated at USD 12.1 million (cumulated), which is 28% of the total landslide damage. The number of hectares of agricultural land affected by landslides (identified by the Inventory Survey) was assigned with the market prices of agricultural land (provided by the Cadastral Service for given locations). Still the value obtained this way is comparatively big3.

Table 2.18 Landslide Damage in Agriculture

	Area	Damage (USD million)	Damage(%)
Crop land	9,294 ha	10.2	84
Grazing land	1,400 ha	1.7	14
Timber	125 ha	0.2	2
Total	10,819ha	12.1	100

Source: (1) Direct existing damage from "Inventory Survey, JICA Study September 2004", (2) Values for market price of agriculture lands from Cadastral Service, June 2004.

[3] The indirect damage was not estimated.

(4) Mountainous Regions

(a) Geographical Distribution of Landslide Damages

Landslide areas offer gentler slopes, richer water and deeper soil in mountainous areas, which explains why communities settle there. According to the GIS Survey, about 234 (22.9%) out of 1,023 of the total residential areas in Armenia are located in landslide areas.

Figure 2.15 shows that the most landslide damaged regions /Marzes are Vayotsdzor and Tavush. These regions are the most mountainous areas in Armenia.

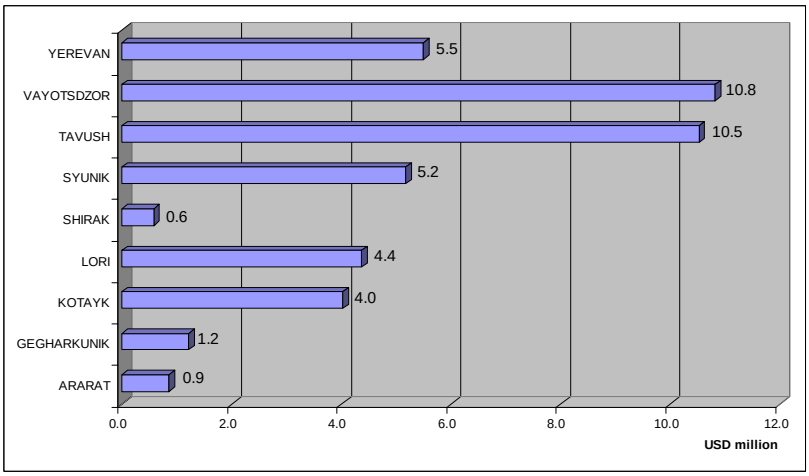


Figure 2.15 Existing Direct Damages Caused by Landslides of Each Region

(b) Poverty in Mountainous Regions

The PRSP provides with the evidence of the link between the poverty and mountainous areas as shown in Table 2.19. The communities that enjoy the resources offered by the landslide areas are also the most vulnerable to the poverty and landslide damages.

Table 2.19 Poverty and Height of Land

Indicators	Level 1: up to 1300m above sea level	Level 2: from 1301 to 1700m	Level 3: from 1701 and higher	Total rural areas
Share of population, %	39.0	26.0	35.0	100.0
Poor, %	42.4	54.9	57.9	50.8
Including extremely poor, %	16.4	24.8	28.2	22.5

Source: ISLC 1998/99, after PRSP 2003.

2.5 Legal System and Institutions

2.5.1 State Organizations

The RA has 15 Ministries and the Prime Ministerial Office under the Presidential Office.

The territory of RA is subdivided into 11 local administration regions, namely Yerevan Capital City and 10 regions referred to as Marzes. A Marz is a regional unit where a local branch of the central government to the region, administers the policies of the central government in the region. A Marz being not equipped with either assembly or budget is not an autonomous body.
The administrative frameworks are shown in Figure 2.15.

Armenian political system is a semi-presidential system which consists of President, Government (Prime Minister and Ministries) and National Assembly. The Government consists of the Prime-Minister and 15 Ministries and one (1) Cabinet Minister (Chief of Staff of the Government). The MoUD is one of the 15 Ministries.

Notable power assignments between the President and the Government designated in the Constitution are as follows (November 2005):-
Government member's nominations and dismissals are a presidential authority:

- The president is elected through a national election.
- The president nominates and dismisses the Prime Minister. Moreover, other government members are nominated and dismissed according to the Prime Minister's recommendation.
- The president nominates and dismisses the head of a local administration (head of the 10 Marzes, Yerevan Capital City is an elected body since November 2005).
- The heads of the communities (Yerevan Capital city is subdivided into 12 communities) are elected by the communities.

Therefore, presidential intentions are greatly reflected in management, and the actual power of the ministry and of the assembly is low. The decision takes the form of a government decree by presidential signature.

Duties and administrative ranges of the ministry are not clearly described in Armenian law. Also, under individual law such as the Water Code, ministries are barely specified. Therefore, the organization that plans overall policy, for example management of rivers, cannot be identified.

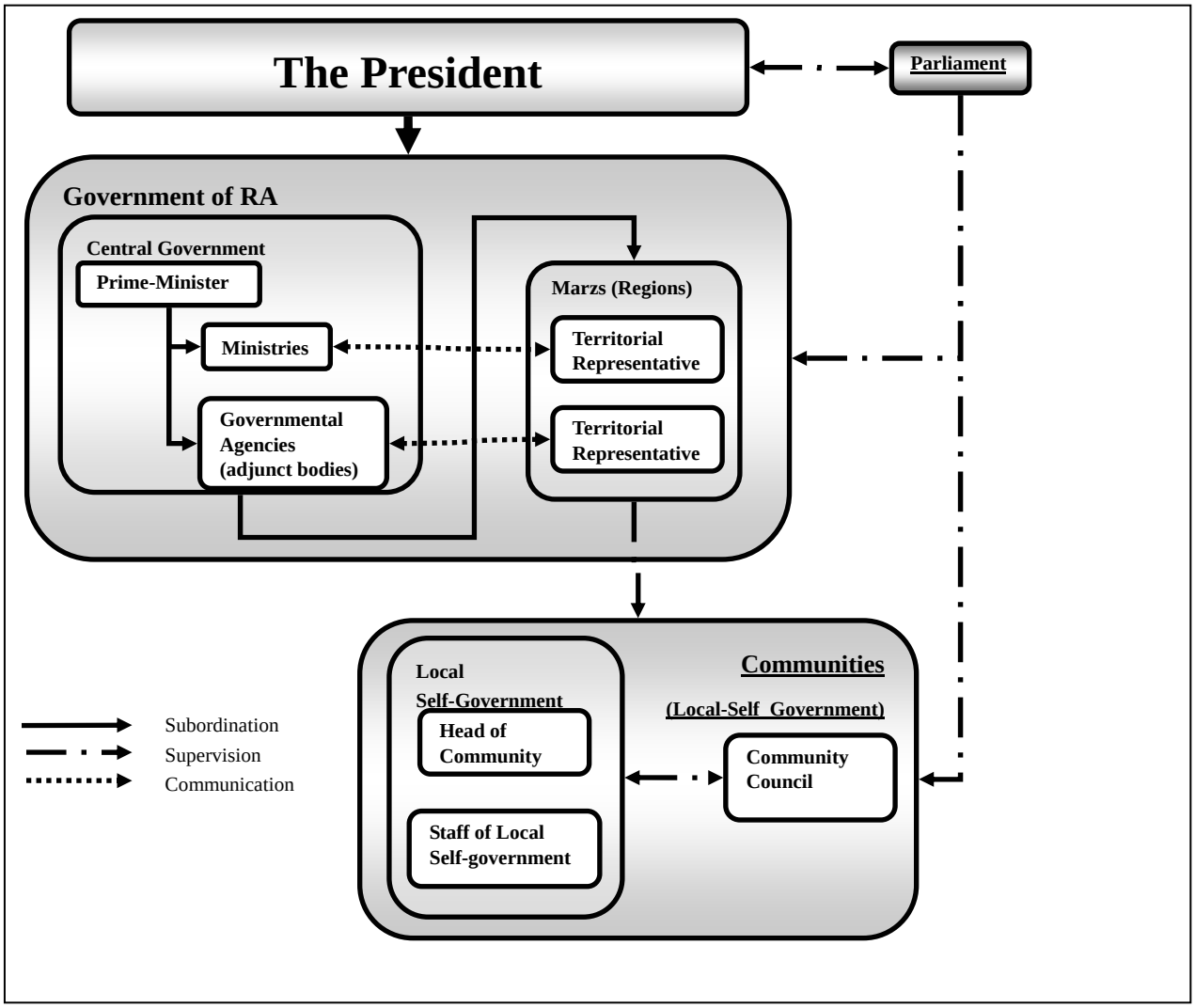


Figure 2.16 Administrative Frameworks of RA (November 2005)

2.5.2 Legal System

The actual practice and issues of the legal system related to landslides are summarized in Table 2.8.

Public laws stipulate the government responsibility for landslide prevention:

a) A broad interpretation of the Armenian Constitution, Article 10, would be: the state is responsible for landslide prevention, and therefore, the state shall implement prevention measures for prospective landslide areas.

b) Communities are delegated to ensure protection of land from sliding, flood, pollution by chemicals and other threats.

c) A community is responsible for formulating and implementing a land use plan for its territory.

d) A community is responsible for issuing construction permits.

e) The land use and planning for the land have to be implemented regardless of the rights of

ownership.

f) The actions of persons shall be stated in water basin management plans to prevent or minimize harm caused by floods, mudflows and landslides. However, the implementation of these laws has a limited budget. There is a large discrepancy between these regulations and actual practices.

g) Neither the central nor communities have conducted any work on landslide prevention.

h) Many of the communities have not recently formulated and implemented a land use plan for its territory.

i) Some communities may issue construction permits for landslide areas.

j) No community has conducted a restriction on private land ownership for the purpose of implementing a land use plan.

k) The actions of persons are not designated in water basin management plans to prevent or minimize harm caused by floods, mudflows and landslides.

The actual practices and issues of the legal system related to landslides are summarized in Table 2.20.

Table 2.20 Actual Practice and Issue of Legal System related to Landslides

Legal System related to Landslide	Actual practices and issue
State responsibility to preserve the environment Constitution: Article 10 State responsibility to preserve the environment Water Code: Article 91 State responsibility to prevent or minimize damage caused by disasters (floods, mudflows, landslides and others).	MoUD makes the investigation plan and house relocation plan for landslide management. This is issued as a governmental decree. Because the budget is insufficient or not executed, practical measures are not executed.
Trust of land management to heads of community Community Code: Article 45 Head of community is entrusted by state for protection of lands from landslide, flood, and pollution by chemicals.	Heads of community cannot execute their responsibility, because of lack of budget, specialists, and support from the Government.
Formulation and execution of land use plan Community Code: Article 37 Head of community compiles community development plan, land zoning and use schemes, and upon agreement with the respective authorized state body through the regional governor, submits to the community council for approval. Head of community can issue permits for construction. Land Code: Article 42 Head of regional administration implements control over community plans for land zoning and use and implementation of main plans of residents.	Generally, inhabitants' and specialists' opinions are not reflected in land use plans formulated by community heads. Inputs by specialists are not available. In general, there are no engineers who can judge the danger of earth and sand disasters, which are judged according to construction permission issued in a small-scale community.

2.5.3 Organizations Related to Landslide Management

(1) Outline of Organization related to Landslide Management

Table 2.21 outlines the roles of organizations related to landslide management

Table 2.21 Organizations and Roles

Organizations	Main Activities
Ministry of Territorial Administration : MoTA **Sub organizations** **Armenian security service** **Water Committee** **Regional administrations (Yerevan Capital City and 12 Marzes)**	-Support for community -ARS reacts on emergencies: wars, accidents, hazards. It sometimes investigates inhabitant-security related landslides (e.g. Geghadir toxic waste landslide) and corrects landslide-related materials and produces GIS database. Umbrella organization – Crisis Management Institute: CMI is in charge of disaster education. -Water committee administers water supply programs (Responsibility for river hazards is not clear among MoEP.)
Ministry of Urban Development: MoUD	- Government decree No. 1074 appoints MoUD for overall implementation organization of "preliminary landslide management program".
Ministry of Transport and Communication: MoTC	- Management of landslides related to state roads and railways
Ministry of Environmental Protection: MoEP	- Management of rivers (Responsibility for river hazards is not clear among Water Committee under MoTA.)
National Science Academy	-Geo-technological research（MoUD department of science and technical policy cooperates with this Academy)
Communities (Cities excluding Yerevan Capital City, Villages, Communities in Yerevan Capital City)	-Natural hazard management in communities -Land use planning and implementation -Issues of construction permits
Inter Community Unions, Community Unions **CU/ICU**	-Adjustment among neighboring communities on conflicts by projects (stake holder meeting or environmental assessment) -Transparent securing of account of the projects, organizing specialists, education, experience sharing among neighboring communities -Executive organization（receiver of funds from donors）

(2) Central Government

Although the central government is still in a mode of thinking that the central government shall be responsible for landslides, it has not been a priority policy for the central government to take serious actions to landslides. The central government appears not to have tried to prepare annual budgets constantly either from national or foreign funds. The central government, however, issues a

‘Government decision from time to time as, and/or when deemed necessary, for dealing with issues/problems arising from landslides. This type of ‘ad-hoc-based’ approach has resulted in (1) inconsistent/incomplete implementation of policies against problems arising from landslides; and (2) discouraging communities from nourishing a sense of being self-autonomous.

It seems that none of relevant parties have clear policies/ideas on how to tackle problems arising from the landslides, thus leaving the communities under landslides to deteriorate.

2.5.4 Execution System of Landslide Program

(1) Execution System

Government Decree No. 1074 in 2001 was drafted by MoUD and appointed MoUD as the organization with overall responsibility for the implementation of the ‘initial landslide management program’.

The supervising organization is a section of MoUD – Department of Science and technical policy responsible for the engineering survey, protection of territory and facilities (four engineers)..

Departments of urban development, under regional administrations/Marzes, are in charge of landslide management, and are instructed or incorporated with the MoUD.

The budget for landslide management is executed by tenders for consigning of investigation and construction works by MoUD or Marzes (transferred from MoUD). Tender documents, including specifications, are produced by MoUD with the affected regions, and the purposes and the amount are being outlined in the documents. The bid organizations produce detailed specifications and the estimate is based on the tender documents.

The Ministry of Territorial Administration (MoTA) has jurisdiction for community support and regional development. MoTA supervises the regional administration (Marzpetaran) and the Armenian Rescue Service (ARS). The Department of Urban Development under Marzpetaran is in charge of landslide management and is instructed by MoUD. ARS is in charge of crisis management of natural hazards, fires, etc., and has regional offices in Marzes, other from Marzpetaran.

(2) Present Landslide Management in Armenia

At present in the RA, post-disaster activities, i.e. “Response” and “Recovery” are the main activities against natural disasters including those caused by landslides. Such post-disaster activities are

undertaken mainly for (i) rescue of casualties; and (ii) urgent recovery works such as earth removal. Countermeasures for the 69-km Landslide in Haghartsin of Tavush Martz, and the Harutyunyan Street Landslide in Kapan of Syunik Martz are examples for post-disaster activities. Pre-disaster activities, i.e. “Mitigation” or “Preparedness” in DMC, have rarely been reported, except for one example in Ijevan where a drainage underground tunnel was constructed for stabilization of the landslide there. The undesirable disaster management is a reason why similar natural disasters have caused a similar scale of losses/damages repeatedly in the past.

To minimize/reduce the possible damages/losses by natural disasters, pre-disaster activities rather than post-disaster activities should be emphasized in the RA.

2.5.5 Community’s Situation

(1) Outline of Community’s Situation

The Community Code decides the following:

- Head of community must execute the means of ensuring the lawful rights of inhabitants and the community’s economic property.
- Head of community must prevent and remove man-made/natural disasters to receive the trust of government.
- Head of community must compile a community development plan (master plan).

On the other hand, there are 1,006 communities in the RA, and about 60 percent have a population under 1,000 people. Annual budgets of these communities on average is AMD 7.5 million (USD 17 thousand), with income from community property, income tax, land ownership tax and subsidies. Subsidies from government account for 40-50% of the revenue. Around 80% of the communities do not have invested expenditure, and in some communities, the entire budget is limited to personnel’s labor costs.

Because of lack of budget and shortage of specialists, heads of communities cannot execute their responsibilities involving natural hazard prevention.

Community improvement activities by mutual aid are hardly widespread. Events such as the festivals are also scarce. Under these social circumstances, substantial land preservation management has not been done by the communities.

In general, a small community below 1,000 is managed with a staff of 5 to 10 people (including its head) as shown in Figure 2.16.

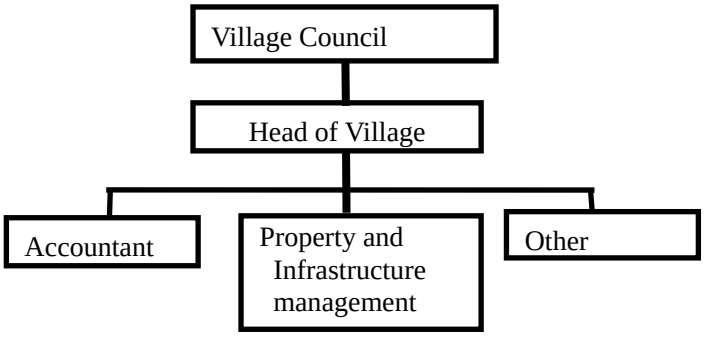


Figure 2.17 Organization of Small-Range Communities

(2) Organization of Community

The definition of "Community" in the RA is the same as that of "Community" and they are legal entities. They call such community as "Hamainks".

The Chief of a Community exercises his powers through his Staff, budgetary institutions and commercial enterprises and organizations of the community's subordination. The staff of the Chief of a Community includes the Deputy Chief of a Community, Secretary of the Staff, divisions, as well as other personnel envisaged in the staff-list of the community. The Chief of Community, at his own discretion and responsibility, carries out human resources policies and forms the staff of the Chief of Community, as well as appoints directors of the budgetary organizations, through his submissions and in agreement with the Community Council.

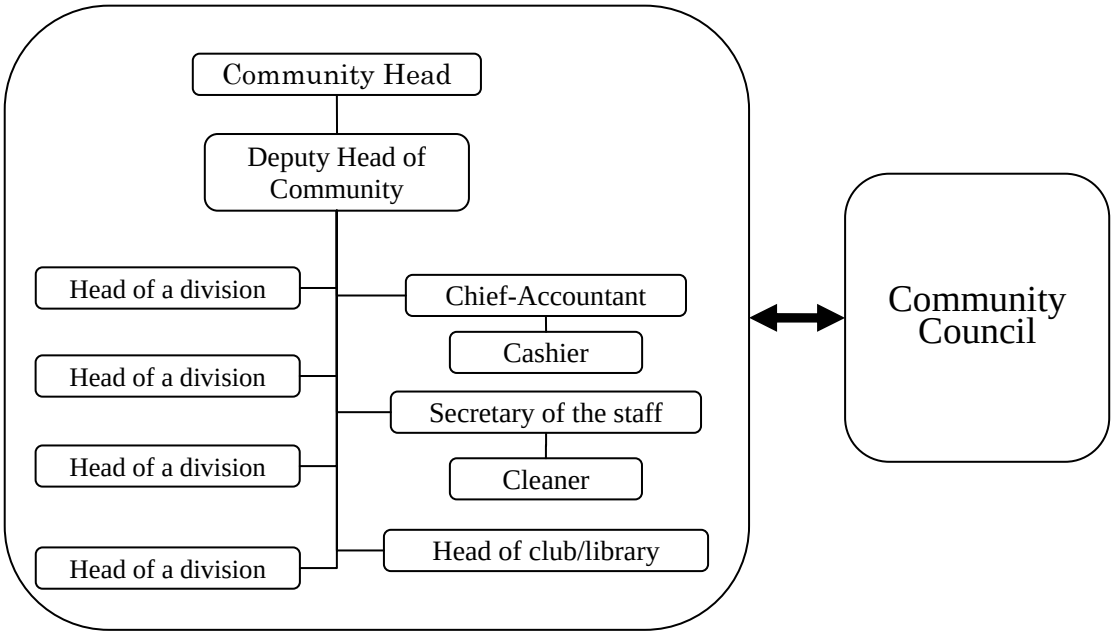


Figure 2.18 Typical Community Organization Structure

Since its Independence, the RA has introduced the concept of decentralization. At present, the RA has a large number of communities: 121 units. Currently, the incomes of the communities come from land tax, property tax, subsidies from the state budget, and other sources. However, it results in a shortage of financial power. There is quite a substantial difference in the population, industry, economy, social services and other characteristics among these units, which makes it difficult for them to cooperate with each other, or makes it difficult for a Marz to lead them to a unified plan.

(3) Communities in a passive mode, Lower State's priority for landslides

As was pointed out, in the RA where the modes of the former regime are still observed, communities on landslide lands are in a passive mode since they are looking forward to being given help by the central government. On the other hand, the central government places a lower priority to landslides, having given 'ad-hoc policies' from time to time, when and where deemed necessary. As no one has taken the proper and positive actions on this matter, the living conditions of communities on landslide lands have been left unimproved.

Under such circumstances, communities themselves have to initiate their courses of action by themselves to start with whatever they can do now to improve their living conditions. There seem to be many things for them to be able to start by themselves. However, the following issues have been observed in terms of 'Community Initiative'.

(4) Socio-Economy of Communities (Budgeting System)

A community budget is a financial plan of revenues (inflow) and expenditures for a period of one year targeted at implementation of the three-year program of the community and powers ascribed to a community by the legislation.

The Community Council on a yearly basis shall approve its community's budget. A community budget consists of administrative constituent (operational budget) and fund constituent (capital budget). Operational budget is mostly allocated from tax revenues, non-tax revenues and official transfers. Capital budget is allocated from targeted subventions from the state budget, loans and borrowings and allocations from the reserve part of the operational budget

To ensure harmonious development of the communities, subsidies are to be allocated to community budgets from the State budget on the principle of financial equalization. The community is not obliged to spend the financial resources received on the principle of financial equalization to cover specific expenses or for offset purposes.

The following is the financial equalization subsidy allocation formula:

A= (M-H) * B*G

Where :

A – amount of the subsidy, based on revenue per capita factor

M – average republican index on per capita property tax and land tax revenue

H – revenue per capita property and land tax, for the communities, wherein per capita property and land tax revenue index are lower than the average revenue per capita republican index

B – community population

G – total amount of subsidy, allocated to communities

The percentage of the local budgetary expenditure in the consolidated budget is very small in the RA. The total sum of subsidies allocated to the communities from the State budget on the principle of financial equalization is calculated based on no less than 4% of the actual revenue of the RA's cumulative budget during the previous budget year. The total amount of planned community budgets of Armenia in the recent years constitutes some 8.0% of Armenia's consolidated budget. For comparison purposes, it should be mentioned that the average of this indicator in the European countries is about 25-30%. The budget size of communities also amounts to very small figures. For example, in 2003 only 24.5 million drams was allocated for communities. In addition, the budget of the communities with population of less than 500 does not, as a rule, exceed 5.0 million drams.

(5) Deterioration of Living Conditions - Worsening the Poverty

Active landslides have worsened the living conditions of communities on landslide-lands, which might be considered to be one of the causes of poverty, or deterioration of community environment or rural exodus to either Yerevan City, the capital of RA, or abroad. Community infrastructures, some damaged by landslides, others simply over-aged; have been left unmaintained or unrepaired.

Such deterioration of community infrastructures have not only imposed on the inhabitants' economic and mental threads in their daily life, but also triggered or accelerated the activities of landslides by such causes as leakages from the water supply facility, improper draining of rain water, etc. Such reactivated landslides have further damaged community infrastructures, forming a vicious circle. Even dormant landslides may well be reactivated by improperly maintained water-related facilities.

According to the hearing survey performed by the Team, rural exodus (leaving rural communities to Yerevan or abroad) is one of the serious problems which have degraded mountainous communities.

Also, Yerevan, where more than 60% of total population of the RA has now concentrated, does not have sufficient capacity to receive people from the rural areas mainly because of economic reasons, i.e., there is not enough employment opportunities there. Exceeding concentration of population in a city may result in forming slums. This rural exodus therefore has to be prevented.

(6) Mutual Distrust in a Community

Distrust can be seen among citizens in a community. 'Community-based organizations: CBOs' or 'civil societies' are rarely seen in the RA. If there is any, the size of such social groups is too small that a group sometimes consists of only a handful of members. For example;

- Water user's association (WUA), under the principle of benefit principle has been legalized to be established at each community (Hamaink) by a government initiative with financial support from the World Bank. However, among the 31 communities surveyed by the Team, only five (5) communities have formulated WUAs. Furthermore the membership is a small percentage of the total number of households in a Hamaink.
- Communal properties are not usually owned and/or maintained by groups of people. There are only those individuals who have bought technical equipment from Kolkhoz usually act as those who have. They are somehow related with political power.
- Even though collective actions are taken, in which communities contribute their labors for free or for food, mainly for construction works such as road construction and water system re-construction; it should be noted that these people are mobilized only when the direct interests match with their own benefits.
- People have no trust in their depositing money with others. Thus CBOs have rarely collected membership fees. Even if collected, the collection rate was by far too low to accomplish the initial aim.
- Public spaces or facilities are usually left uncared for, hence there is no maintenance.
- Communities, however, all understand that mutual help or joint actions such as joint maintenance of infrastructures or joint cultivation will be very much helpful and effective. Dissolving distrust and building trust among community members is the first step for rural development.

(7) Situation of Community Initiative

In the former political regime, the central government was responsible for the maintenance of infrastructures in rural communities. After the independence of the RA, the responsibility for the maintenance of public infrastructures such as roads and water supply has been transferred to the respective communities in accordance with a law newly enforced.

However, the mode of behavior or thinking that was developed during the former political regime was not immediately wiped out in such a short period after the country's independence in 1992 or after the declaration of the new constitution in 1995. In other words, the sense of 'local autonomy' by a community has not sufficiently filtered to its population.

In such a transitional period of political regime, communities tend to be dependent on vigorous support from the central government for the maintenance of infrastructures (or sometimes for all matters in their administrative territories). Although, various donor organizations have introduced the concept of 'community-initiative' for their projects and some of the state organizations have come to understand, others including some communities, have not fully understood or even accepted the concept of 'community-initiative'.

It will be obvious from past experiences all over the world that any input from the central government to a local government/administrative-body will not be able to sustain its functions particularly if such local government is not sufficiently responsible for the inputs provided to it as a recipient, i.e. the recipient local government should be autonomous.

It has to be therefore clearly understood that communities are autonomous enough to be responsible for the maintenance of community infrastructures. Such understanding will lead to an awareness that communities shall be responsible for 'Community Landslides'.

(8) Interference from Marzes

It is pointed out that:
Marzpetaran (regional administration of the central government) unnecessarily interferes with the activities by communities, which weakens community initiative. Sometimes community heads themselves interfere too much with the communities' own activities.
Although all those negative aspects are said to have originated from the former political regime that is rooted deeply elsewhere in the RA, continuous efforts have to be made to overcome them for sustainable rural development.

2.5.6 Community Union

Community law states that a community may form inter-community unions (ICU) based on mutual agreement between communities. DfID supports ICU establishment but no ICU had been established as of December 2005. GTZ supports the establishment and project execution of Community Unions (CU) which conduct provisional activities until the establishment of ICU based on the law becomes

a reality. CUs were established in Syunik and Tavush Marzes and in the surrounding hub cities of other Marzes.

The functions of these community unions include selection of priority projects from the communities' proposals, provision of transparency in the implementation of projects including accounting, stakeholder adjustments such as the environmental problems between adjacent communities, human resource development (education and training), and receiving of project capital from donors and others.

2.6 Technology Related to Landslides

2.6.1 History of Landslide-related Technologies

In the Soviet Era from 1950-1980, investments were undertaken for agricultural development and infrastructure development. In projects, landslide problems were encountered and many landslide investigations were done. World-leading technological research was done at that time with integrated study, and the formulation of master plans of sediment disaster management was conducted in the 1980s. However, no systematic management guidelines were developed, and as a result, technology diffusion was not obtained.

Examples of countermeasure works were very rare. The drainage tunnel at Dilijan City is one example of a large-scale measure. To date, the main method of the landslide management is relocation of damaged houses.

Systematic management of landslides has not been practiced due to confusion in politics and the economy which have been obvious since the country's independence in 1991. During this time, large-scale landslides such as the Odzun Landslide（Lori Marz ; 1993）, Ijevan-Hrazdan Landslide at railway 69km（Tavush Marz ; 1993）, and Harutyunyan street Landslide（Syunik Marz ; 1994） have occurred. Different organizations have responded but without a systematic approach resulting in ineffective countermeasures.

2.6.2 Current Situation of Landslide Technologies

To improve the abovementioned situation, in 2001, the "program on Landslide Primary Countermeasure in the Territory of the RA" was formulated and issued as a Government Decision. The purpose of this program is systematic landslide investigation and effective landslide management. Actual investigations started in 2004 and data on topographic analysis and monitoring are now being accumulated. Planning and execution of landslide management was not, however, implemented.

2.6.3 Issues on Technology Accumulation

Public engineering-related departments are now privatized in the RA. Engineers are, however, few in the ministry. Therefore the following issues/problems have arisen and advancement of technology is being obstructed:

- Relevant engineering knowledge and skills are not being accumulated in the public sector and transferred between generations.
- Project management by a responsible ministry is not properly undertaken, including project management such as engineering plans, engineering collation/supervision, engineering evaluation, etc. These result in a lack of transparency regarding project justification, engineering justification, financial justification, etc.

PART-II MASTER PLAN

CHAPTER 3 BASIC POLICIES

3.1 Outline

The ideal landslide management is composed of the three basic policies as shown below, and is based on the financial and other capabilities of the RA:

- Community development as an overall target
- The state responsibility
- Appropriate management according to damage level

3.2 Community Development as an Overall Target

3.2.1 Outline of Policy

Policies-1: M/P deals mainly with those landslides causing damage to communities. Each community plans and implements its landslide management project, an ultimate goal of which is community development, with financial and technical public support.

3.2.2 Background of the Policy

Landslides in the RA are categorized into two types according to the objects affected by them:

- Community Landslide: Landslides that predominantly and directly affect the daily lives of communities situated on landslides, by damaging such objects as private houses, community public offices/houses, intra-community infrastructures (roads, water supply lines and etc).
- Wide Area Infrastructure Landslide: Landslides that predominately affect inter-community/inter-regional infrastructure such as national roads, railroads, inter-regional gas-pipeline, inter-regional water supply pipeline, inter-regional power line

More than 80% of the total sum of direct losses incurred by landslides relates to Community Landslides, while less than 20% is generated by Wide-area Infrastructure Landslides. Approximately 40% of mountainous area communities are located on sites of landslide areas. The Master Plan mainly deals with community landslides, because it is necessary to deal with the landslide issue as a common problem of mountainous areas of the RA.

The projects with single target of landslide damage reduction are generally not given a priority due to the lack of cost/benefit justification. Therefore, landslide management projects, which contribute to community infrastructure development such as drainage construction for improving muddy road

condition to ensure vehicle movement should be planned and prioritized. Such projects generate higher benefits, which assure economic validity of the investments.

Each community plans and implements its 'community development (income generation) project' by receiving financial and technical support from the Government. Communities should then invest their earnings to 'projects for landslide management and community infrastructure development' and in subsequent 'community development projects'. Communities can then gradually expand the scale of projects and their outcomes.

The purposes of Projects (effectiveness of projects upon completion) are given below:

- Reduction of casualty and damage
- Development of community infrastructure for livelihood and industry
- Increase of the inhabitants' income and community budget

It is realistic that communities concerned themselves in taking necessary self-actions to start with constructing/improving, in simple and inexpensive ways, intra-community infrastructures that are also useful for mitigating damages by landslides.

For communities to do so and to keep doing so, nourishing and enhancing the sense of self-action or self-dependence is essential.

Simultaneously, it is also essential to establish a financial and technical supporting system by the Government of the RA, donor organizations and NGOs.

From this point of view, the Master Plan shall mainly focus on the management of "Community-Related Landslides" as agreed with the MoUD in the minutes of meeting on 22nd February, 2005.

3.2.3 Legal framework for Community Landslide Management

The Law of the Republic of Armenia on Local Self-Government describes that:

- The chief of communities shall exercise a mandatory power: 'to take measure for the protection of the rights and legitimate interests of the community residents and economic entities (Article 33).
- The chief of communities shall exercise the power delegated by the state: to take measures for the prevention of technological and natural disasters band elimination of their

consequences (Article 33).

- The chief of a communities shall compile the draft of the community land zoning, and use schemes – (the rest omitted). (Article 37).

The above descriptions in the law indicate that the chief of each community shall be responsible for disaster management including landslide management for which proper water management shall be organized by the chief in accordance with the Article 37, although various constraints such as financial and technological capacities of each community hinder them in realizing their responsibility.

3.3 The State Responsibility for Landslide Management

Policy-2: The State (management authorities) has the responsibility to support the financial and technical requirements for nationwide landslide management by the various implementation bodies (communities or management organizations for wide area infrastructure landslides).

3.3.1 Necessity of State Responsibility for Management of the Community Landslides

The Community Code of the RA describes that the head of community must prevent and remove man-made/natural disasters to receive the trust of the government. However, around 80% of the communities do not have invested expenditure. Also, heads of communities cannot fulfill the obligation. Thus, technical and financial support should be the role of the state.

3.3.2 Significance of Landslide Management as the State Importance Issue

(1) Significance of Community Landslides

Landslide management budget has been low compared to the State budget. When the ultimate goal of landslide management is community development, and it is done by multipurpose projects, which contribute to poverty reduction (most important issue of the RA), consensus of state investments can be formulated.

The degraded water system and drain facilities have resulted in water leakage and activation of landslides. Landslides damage not only houses but also community roads and water, energy, and communication infrastructure. Deterioration of life and industry is an obstacle for working efficiently and for attracting industry. The poverty and landslide activities form a vicious circle.

After the collapse of the USSR, the conversion in Armenian communities from group or governmental agricultural method to individual farming method took place. The entry and

accumulation system of capital in the RA ceased, and poverty in the communities progressed. Therefore communities/ inhabitants are not able to have disposable income for development of dwelling houses and community infrastructure. As a result, the degradation of various facilities also progressed.

To prevent such a vicious circle and start the entry and accumulation of working capital, it is efficient to start from landslide countermeasures which contribute to community infrastructure management such as drainage (and in particular road drainage) and water supply systems. Among others, vehicle movements will be improved.

(2) Significance of Wide Area Infrastructure Landslides

In a Poverty Reduction Strategy Paper（PRSP 2003）the following three (3) items are given priority:

1) Inter-regional roads
2) Drinking water supply
3) Irrigation

The RA currently appears to be at the basic infrastructure development stage. Social infrastructure development projects create a big possibility for new landslide activities. These projects should be studied from the landslide point of view as a state responsibility.

3.3.4 Relationship between Implementation Bodies and Management Authorities

The relationship between management authorities and implementation bodies of landslide management is shown in Table 3.1.

Table 3.1 Relationship between Managing Authorities and Implementation Bodies for Landslide Management

Risk Objects	Management Authorities (Responsible organizations for the technical and financial side of landslide management)	Implementation Body for Landslide Management (Communities or management organization for wide area infrastructure)
Community infrastructure, private property	MoUD, MoTC, Urban Development Department of Marz	Communities
Wide area infrastructure		
Inter regional road	Ministry of Transportation and Communications (MoTC)	Transportation and Communication Department of Marzpetaran
Railway	MoTC	Private companies
Communication infrastructure	MoTC	Private companies
Energy supply infrastructure	Ministry of Energy（MoE）	Private companies
Water supply infrastructure	Water Committee of MoTC	Private companies
River	Ministry of Environmental Protection (MoEP)	Environmental Protection Department of Marzpetaran

MoUD has overall responsibility for community landslide management and integrated management of landslide-related information and technologies. MoUD gathers new information and technologies and disseminates to all organizations and personnel related to landslides.

3.4 Appropriate Management according to Damage Level

3.4.1 Outline of Policy

Policies-3: Implementation body manages landslides according to damage progress level.

Landslide risk management policy based on damage level is as follows and is shown in Table 3.2.

(a.) Landslides for which there are no reports of damages (2,359 in total)

The Government of RA **manages information and knowledge** to minimize the risks of new landslide damage which can result from new development activities.

The implementation body for landslide management is the management organization in daily activities (communities and management organizations for wide-area infrastructure) for (b.) and (c.). Management authorities are responsible for landslide management and for the provision of financial and technical support to the Implementation Bodies.

(b.) Landslides whose damages are dormant (77 in total)

Implementation bodies for landslide management investigate and assess the risks and perform **pre-disaster mitigation and preparedness** as necessary, and actions for abovementioned ‘a.’ should

be also implemented.

(c.) Landslides whose damages are progressing (68 in total)
Implementation bodies **manage the risks to avoid casualties and damage,** and actions for abovementioned (a.) and (b.) should be also implemented.

Twelve (12) Priority landslide sites were selected for study by severity of risks from 68 presently active landslides. MoUD should formulate the pilot project plans for these 12 landslide sites, including the conduct of geotechnical investigation, procurement of materials for countermeasure infrastructure, dispatch of specialists and technical support for the planning and implementation of projects through the Urban Development Department of Marzpetaran**.**

Table 3.2 Landslide Management Policies based on Damage Progress Level

Damage Progress Level of Landslides	**Landslide Risk Management Policies**
Level-(1): Progressive Damage **(68 landslides)**	**1.【For Level-(1) landslides】** **Purpose:** Avoidance of casualties **Activities:** **Security management**: Formulation and implementation of early warning and evacuation system based on landslide monitoring, etc. (by management bodies with public technical and financial support) Risk Management listed in items 2 and 3 shown below should also be executed.
Level-(2): Dormant Damage **(77 landslides)**	**2.【For Level-(1) and Level-(2) landslides】** **Purpose**: Risk reduction for buildings and infrastructure, etc. **Activities**: **Pre-disaster mitigation and preparedness** - Risk assessment for landslide mechanism, activity, hazard area, risk objects, damage amount → - Selecting of mitigation and preparation method → - Planning and designing → - Implementation Risk Management listed in items 3 shown below should also be executed.
Level-(3): Not Reported **(2,359 landslides)**	**3.【For Level-(1), -(2) and –(3) All landslides】** **Purpose:** Risk avoidance of new landslide damage caused by new development activities **Activities**: **Information, Knowledge Management** - Disseminating knowledge on landslides by MoUD (newsletter, technical bulletin) - Appropriate planning and designing by development bodies.

[1] Risk Management: It is defined as a method of examination and execution of effective actions towards potential risk (damage scale and probability of generation).

3.4.2 Background of the Policy

Landslides totaling 2,504 were identified by the Study through interpretation of aerial photographs. The 2,504 landslides identified above were classified based on the landslide inventory survey performed also by the study. The field inventory survey was performed for such landslides where any damage to risk objects due to landslides were reported. Classification was made based on the damaging levels namely:

- **Level-(1) Progressive Damage**: any damage to risk objects **due to present landslide activities** were identified by the field inventory survey,
- **Level-(2) Dormant Damage**: any damage to risk objects **due to past landslide activities,** but now dormant, were identified by the field inventory survey,
- **Level-(3) Not Reported**: **no field information available** on damage to risk objects or landslide activities for the landslides identified only through the aerial photo-interpretation; field inventory survey was not conducted due the absence of reports on damages or landslide activities. The classification is as shown below (Table 3.3). Note that ‘hazard level’ or ‘risk level’ are not considered for the classification of the 2.504 landslides, due to a limitation of information of the landslides identified only through the aerial photo interpretation.

Landslides associated with 2,504 events were classified into three damaging levels.

Table 3.3 Classifications of Landslides

Type	Survey	Descriptions	The number of Landslides Total 2,504
Level-(1): Progressive Damage	- Aerial photo interpretation, - Field inventory survey	Damages to risk objects **due to present landslide activities** were identified by the field inventory survey. Damage is progressing	68
Level-(2): Dormant Damage	- Aerial-photo interpretation, - Field inventory survey	Damages to risk objects **due to past landslide activities but now dormant**, were identified by the field inventory survey. Damages were reported in the past. Effective countermeasures were not performed.	77
Level-(3): Not Reported	- Aerial photo interpretation,	**No field information available** on damage to risk objects or landslide activities for the landslides identified only through the aerial photo interpretation. Field inventory survey was not conducted due to the absence of reports on damages. Landslide configurations were recognized. Damage by landslide was not recorded in the past. Landslide activities were unknown.	2,359

In addition, prioritization of the landslides for each 'Risk Level' had to be performed for actual implementation with due consideration of specific local social conditions, which need more complicated procedures including (1) explaining to the relevant parties, and (2) reaching agreements on various matters with various organizations and so on for implementation. This is beyond the TOR of the Study.

3.4.3 Explanation of Risk Management for Landslide

Risk Management is defined as examination and execution of effective action methods to potential risk (damage scale and generation probability).

Table 3.4 Landslide Management as Risk Management

Risk Management	Landslide Management Means of responding actions	Category of Actions
(1) Risk Reduction	- Countermeasures against landslides, - others	Hard-measures
(2) Risk Avoidance	- House Relocations, - Evacuation when necessary supported by landslide monitoring, others	Hard-measures, Soft-measures
(3) Risk Transfer	- Insurance, - Compensations, others	Soft-measures
(4) Risk Retention	- Continuing uses of damaged objects with repairing as necessary - Dissemination of knowledge on disaster to promote sense of risk avoidance when needed,	Hard-measures, Soft-measures
Hard-measures: tangible or materialized countermeasures against disasters Soft-measures: intangible precautions against disasters		

Risk management is also categorized into (1) tangible (physical or materialized) measures (hard-measures), and (2) intangible (informative or instructive) measures (soft-measures). The two measures are usually to be combined for the effective risk management.

Definitions of tangible measures (hard-measures) and intangible measures (soft-measures)

- **Tangible measures (hard-measures)**: such as implementing civil works against landslides, relocating risk objects (such as houses, roads, railroads and etc) and etc; will usually be costly; therefore these measures should and could be implemented if the risk objects are worthy to be protected with so much investment.
- **Intangible measures (soft-measures)**: such as dissemination of knowledge and information, evacuation drills (training), and etc; will not be so costly, but can be effective to minimize damages/losses caused by natural disasters; therefore these measures can be adopted for all the risk management program.

This concept can be applied to the landslide disaster management. The Master Plan therefore recommends that:

Pre-disaster activities rather than responding activities should be emphasized,

Not only tangible measures (hard-measures) but also intangible measures (soft-measures) should be adopted for the landslide management.

3.4.4 Management for Positive Aspects

As the landslide lands are considered as comparatively 'useful lands' in mountainous areas, the landslide lands can be utilized as practical as possible. Utilization can be made by: (i) improving/developing forests, pasture and/or arable lands; (ii) improving intra-community infrastructures of communities on landslides as convenient lands for living; and (iii) maintaining inter-regional infrastructures connecting communities on landslides. In the past, those activities without proper knowledge on landslides have sometimes triggered or worsened landslide activities. However, proper planning and implementation with adequate knowledge on landslides can realize the maximum utilization of the useful lands (landslide lands).

To start with, under severe financial constraint, the Master Plan proposes self-help actions of communities themselves by doing what they can do by themselves, with minimum support by the Government, donors and/or NGOs.

CHAPTER 4 COMMUNITY LANDSLIDE MANAGEMENT

4.1 Purposes

The landslide countermeasures made an improvement in security and safety of life. Landslide countermeasures sometimes cause negative effects such as spring water decrease by drainage boring. Fully positive effective plans after tradeoff of all effects by countermeasures are necessary.

It is incorrect that if landslides are mitigated, poverty is not improved and people leave the land. Landslide land has an appropriate aspect such as its gentle slope and abundant water. Co-existence with landslides and method of poverty reduction should be examined.

"Landslide countermeasures which contribute to community infrastructure development", such as road drainage works, indirectly affect income generation and expand beneficiaries/investors.

The purpose of landslide management is set from the abovementioned viewpoints.

Table 4.1 Purpose and Outputs of Community Landslide

Ultimate Goal	**Community development（income generation, poverty reduction）**
Project proposes	- Disaster prevention （avoidance of casualty, damage reduction） - Development of community infrastructure for life and industry
Project outputs	-Plan and implementation of landslide management and community infrastructure development - Plan and implementation of community development concept -Formulation of organization (Working Commission) for planning and execution promotion in the community -Organization and system for landslide monitoring and early warning -Civil works for landslide disaster reduction and community infrastructure development - Organization and system for maintenance of community infrastructure

4.1.2 Meaning of Landslides Management to be Built-in to Community Development

It should be noted that complete treatments (countermeasures) to thoroughly stop the movement of landslides are long-lasting, time-consuming operations and usually need a huge sum of investments. This type of operations specialized only for landslides can be implementable only if and when social capitals have been sufficiently accumulated to a level of surplus. In consideration of the severe budgetary constraints of the RA, the Study is of the opinion that the social capitals of the RA have not been so matured yet as to implement countermeasures specialized only for landslides.
Even though it is so, active landslides have to be mitigated and dormant landslides have to be kept dormant to allow co-existence to take place.

On the other hand, aged, damaged and unmaintained community infrastructures are one of the reasons that have hampered rural development. For example; damaged rural roads that usually get muddy in early spring hinder smooth traffic movement, improper irrigation channels/ditches feed more water than actually needed, and leaking drinking water supply networks force people to use improper sources of water and so on. As was pointed out before, the degradation of such community infrastructures may have formed the vicious circle.

For landslides as 'Useful Lands', properly planned improvement of community infrastructures that are useful for both rural development and landslide management will definitely be necessary; i.e. landslide management built-in to community development.

It is essential that landslide management in mountain communities should be regarded as an important part of 'rural development' to which a number of donors have committed their assistance. Sustainable landslide management requires an integrated approach including social development ('community initiative') and income generation through which sustainable maintenance can be continued. In particular, efforts have to be built-in in all the programs for social development, because a single program alone will not be able to attain the goal for social development. Income generation will also be an important factor not only for the program on landslide management but for all programs to be implemented. All other programs should be thoroughly integrated into one community development program.

Landslide management cannot stand alone at present in the RA. The Study emphasizes that landslide management should be built-in to the process of community development within the capacity and resources available at present. The following three categories of actions are therefore proposed for the integrated and holistic approach to the landslide management built-in to community

development.

- Improvement of Intra- and Inter- Community Infrastructures
- Promoting Income Generation
- Information, Education and Communication (IEC) for Landslide Management.

4.2 Community Based Approach

4.2.1 Public Assistance (Given Conditions and Issues)

The given conditions of community landslides and budgets for landslide management are summarized in Table 4.2.

Table 4.2 Outline of Community Landslides

Numbers of Communities for which Damage is Reported（1,017 communities in RA）	121 communities (12％ of all communities)
Total Potential Damage by Landslides to Communities and Inhabitants	USD 49 million (AMD 22.3 billion) (USD 400 thousand/ community)
Budget for Landslide Management（MoUD in 2005）	USD 0.2 million/ year (AMD 92 million/ year) (Approximately 1/245 to the total potential damage to communities and inhabitants)

The budget for landslide management (MoUD, 2006) was zero in November 2005. MoUD requested AMD 28 million (USD 62 thousand) from the Prime Minister as an annual landslide management budget in 2006 for selected landslide management projects and information services.

It is an issue that the Government of the RA has not recognized landslide risk and effect of measures and management. Thus, the consensus of investment has not been formulated yet. The Feasibility Study of the Pilot Projects shows that the landslide measures which contribute to community infrastructure development are economically feasible when willingness to pay of inhabitants (effectiveness of community infrastructure development) is included in the benefits.

Therefore, the Government of Armenia should formulate landslide management programs and investments into them.

The Study Team suggested to MoTA through MoUD the formulation of 'Community Support Program for Landslide Management and Infrastructure Development: subsidy systems'. However, this program has not yet been funded in February 2006.

There is an existing system of Honorarium for Work (HFW). In this system, AMD 1,200/day is provided to inhabitants as a worker fee for community projects. This system should be developed into the landslide management program (public technical and financial assistance program) which contributes to community infrastructure development.

Therefore USD 62 thousand/year (by MoUD) is a given condition for public assistance in the next three years. It is a re-proposed budget from MoUD to the Prime Minister in December 2005 as 2006 budget which is zero assessment once.

The average subsidy of small-scale communities (less than 1,000 people or approximately 60% of all Armenian communities) is AMD 3.4 million/year (USD 7.5 thousand/year). This is mainly used as salaries for staff and retirement reserve. Therefore, the greater part of Communities is in a difficult situation to execute the projects.

4.2.2 Given Conditions of Community Self Reliance Effort

For these pilot projects, inhabitants worked as general construction workers receiving AMD 1,200 (USD 2.6)/ day which is 1/3 of the market rate. Skilled workers were available from communities and neighboring cities for AMD 8,000-10,000 (USD 18-22)/day. Landslide monitoring teams and early warning systems in communities were formulated using labor from the communities In this case, inhabitants' labor input is possible to some degree.

Communities therefore have issues of starting and continuing the landslide management under limited financial conditions.

4.2.3 Given Conditions of Support from the International Organizations

Support programs for communities are available as follows, based on communities/ NGOs applying with a planning proposal and cost proposal:

- Japan: Grant Assistance for Grass-roots Human Security Projects （less than JPY 10 million, AMD 38 million scale)
- The USA: Save the Children NGO – Community Self Help Fund （less than USD 2,000, AMD 910,000 scale）

On the other hand, GTZ supports the establishment of Community Unions (CU) and the formulation

of community development projects through the CUs. CUs have the function of securing transparency of projects and their accounts, and the function of interest adjustments with neighboring communities. Most international cooperation organizations cite the abovementioned functions as the necessary conditions. Therefore, there are many cases when CUs are the receivers of donations instead of communities.

4.2.4 Rationality of Community-based Approach

Under a condition of limited finances, the Community Based Approach (CBA: planning by communities, implemented through community participation) is reasonable to start and sustain the projects for landslide management and community infrastructure development. The merits of CBA are as follows:

- Local inhabitants have detailed knowledge of the damages caused by the specific landslides and the resources, which can be used for landslide countermeasures and community development.
- Local inhabitants can check and maintain community infrastructure such as water supply and drainage facilities. They can undertake daily monitoring of landslides, if technical guidance from specialists is provided first.

Degraded intra-community infrastructures in communities may have worsened the landslide conditions, as can been seen in leaking pipelines of water supply systems, improper drainage of domestic wastewater, degraded roads without side-ditches for drainage and so on. It is considered that communities themselves should improve such intra-community infrastructures by themselves with minimal support from the government, donors or NGOs. Such improvement will also be useful for the development of the communities by themselves. In other words, it is very necessary, under such conditions that the financial status of the RA has yet to develop, that self-help actions by communities should be strongly promoted to improve their living conditions (intra-community infrastructures) that will also be useful for landslide risk reduction.

It is reported that in the former political regime, the population in the territory received public help for almost everything. The central government, for example, took care of such duties as cleaning and maintenance of common spaces of condominiums, although the people living there on voluntary basis could have performed such duties. It is then said that the system had implanted into the populace the sense that communal properties belonged to everyone, the implication being that nothing belonged to anyone. This has resulted in community-based organizations being rarely

formed to perform something necessary for public service that had once been done by the government. There seems to be the prevailing thinking that 'someone else (or 'they') may do something'. A self-help mechanism with collective effort of the population in a community is rarely observed.

Past experiences in various countries have presented a lesson that leaving communities' own matters to someone else ('they') will usually never correspond with the actions required. Actions have to be taken by the people living there first, although the first step would look valueless or unworthy to do. It is indispensable for the communities to recognize again the importance of 'Self-Help Action' of a community to solve the community's own issues at its level.

4.2.5 Role of Public Assistance

Public assistance is needed as described in "Policies-2 Clarification of Responsibility of the State in Landslide Management" of Chapter 3, even if the community-based approach is taken. Ideal public assistance is shown in Section 4.4.

The Master Plan (M/P) shows the plan without public financial assistance, and only public technical assistance as short-term plan. During short-term stage, the M/P shows ideal technical public assistance. And ideal financial public assistance is also shown as a target over the medium- and long-term. It is reasonable to advance the community based approach in building public financial assistance as soon as it is obtained.

4.3 Method of Planning and Execution

4.3.1 Resource Acquisition Plan

(1) Kinds of Resource Acquisition Plans and their Meaning

Resource acquisition plans are the basic elements supporting community landslide management. Resource acquisition plans are subdivided into two methods as follows:

- Resource acquisition as an effect of landslide measures which contribute to community infrastructure development, and
- Income generation plan.

Income generation is a resource acquisition plan of projects, and at the same time, it is the projects' ultimate goal.

(2) Planning and Execution of Landslide Management which Contributes to Community Infrastructure Development

(a) Meaning

In Pilot Project sites, the Study Team investigated the willingness to pay of inhabitants to their "landslide countermeasures which contribute to community infrastructure development". Willingness to pay of the whole communities is 1% of the potential direct damage of landslides. This may be expanded, as the multipurpose effects of the projects are recognized.

The ultimate goal can be achieved by inputting the disposable income of preliminary projects to continuous projects.

As stated previously, for landslide management, it is recommended that designs should be built-in within any types of development programs such as roads, water supply, sewage, surface water management, irrigation and agricultural development sectors.

Because disasters of any kind cannot be eliminated or significantly reduced by one single action/countermeasure, focus should be made only on a project that can be implemented at a certain stage of development within the financial and technological capacity of the society. It is then necessary that preparation for a disaster of any kind should be built-in step-by-step in accordance with the development of the society. In other words, the disaster management of any kind should be programmed, step-by-step as part of community development.

As for landslide disaster management concerns, essential risk reduction by civil works against landslides usually needs a considerable huge sum of expenses. Such expenses could be spent once the society has developed sufficiently enough to invest its surplus resources only for disaster management. A society that has yet to develop should not or could not afford to invest its social resources only for disaster management. It is then recommended again that designs for landslide management shall step-by-step be built-in within any type of development programs in such sectors as roads, water supply, sewage, surface water management and irrigation. Designs, for example, to be built-in as minimum requirement for landslide management are:

- Surface and underground water drainage,
- Earth moving; i.e. earth removal, earth embankment

The landslide management built-in in essential social development programs will form a preferable disaster management cycle shown as Cycle-b in Figure 4.1, which may develop to the desirable total disaster management cycle (Cycle-a in Figure 4.1).

In addition, for this purpose, the GIS-based landslide location maps produced under this Study should be referred to whenever new projects are programmed.

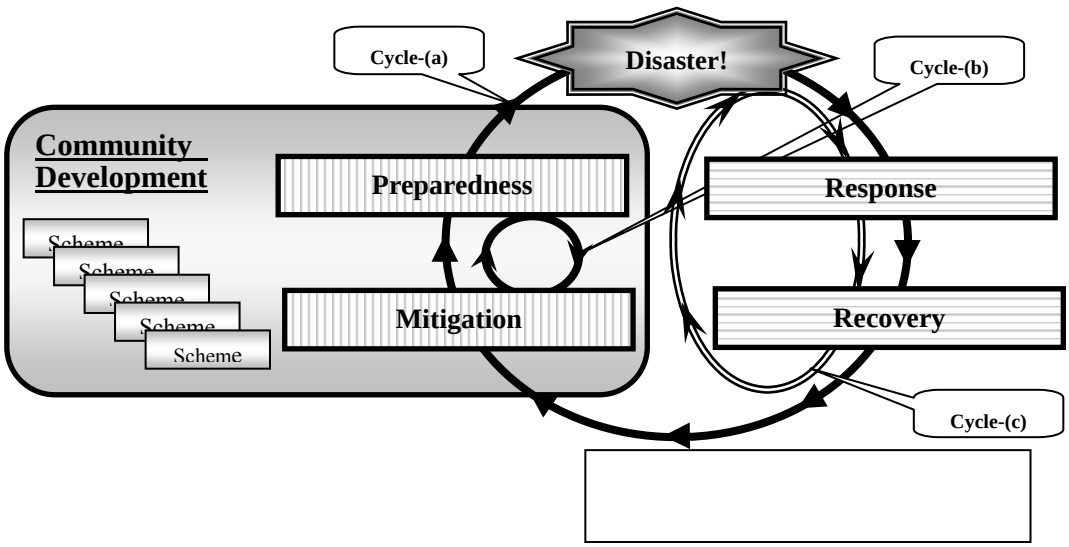


Figure 4.1 Disaster Management built-in to Community Development

(b) Examples of Landslide Management Plans Contributing to Community Infrastructure Development

In most community landslides, water supply systems exist but they are deteriorated and leaking. Most leaking and surplus water is not drained and flows in landslide land. Community roads do not generally have side ditches, and become muddy shortly after rainfall and snowmelt. In the landslide monitoring of the Gosh village, this was confirmed during the thawing of snow.

The influence of water supply leakages on landslide activation may be large because the landslides in the RA show stability with only minimal precipitation. The drainage works may therefore have a significant effect on landslide mitigation.

In the Pilot Projects, landslide mitigation and muddy road improvement by drainage works were included.

From this viewpoint, "landslide countermeasures to contribute to community infrastructure development" are summarized as shown in Table 4.3 and Figure 4.2.

Table 4.3 Landslide Management which Contributes to Community Infrastructure

	Gradual Improvement (Short-term)	Ultimate Target (Medium and long-term)	
Community Roads	-Constructing road-side ditch drains	Improving Community Roads by landslide-friendly method (masonry pavement road is recommended)	The structure should be simple one to be repaired according to the ground displacements. Drain should be lead to out from the landslide borders.
Water Supply	-Repairing leakages, -Leading spilling water from storage tanks off from the landslide areas	Rehabilitating/reconstructing water supply system by landslide-friendly method	
Sewage	-Connecting sewage water to side ditch drains	Installing sewage drain networks by landslide-friendly method	
Irrigation	-Repairing leakages, -Minimizing water-use	Rehabilitating/reconstructing water supply system by landslide-friendly method	
Community Drainage	-Installing surface, underground drains, and/or borehole drains	Installing of entire network of drainage system by landslide-friendly method	

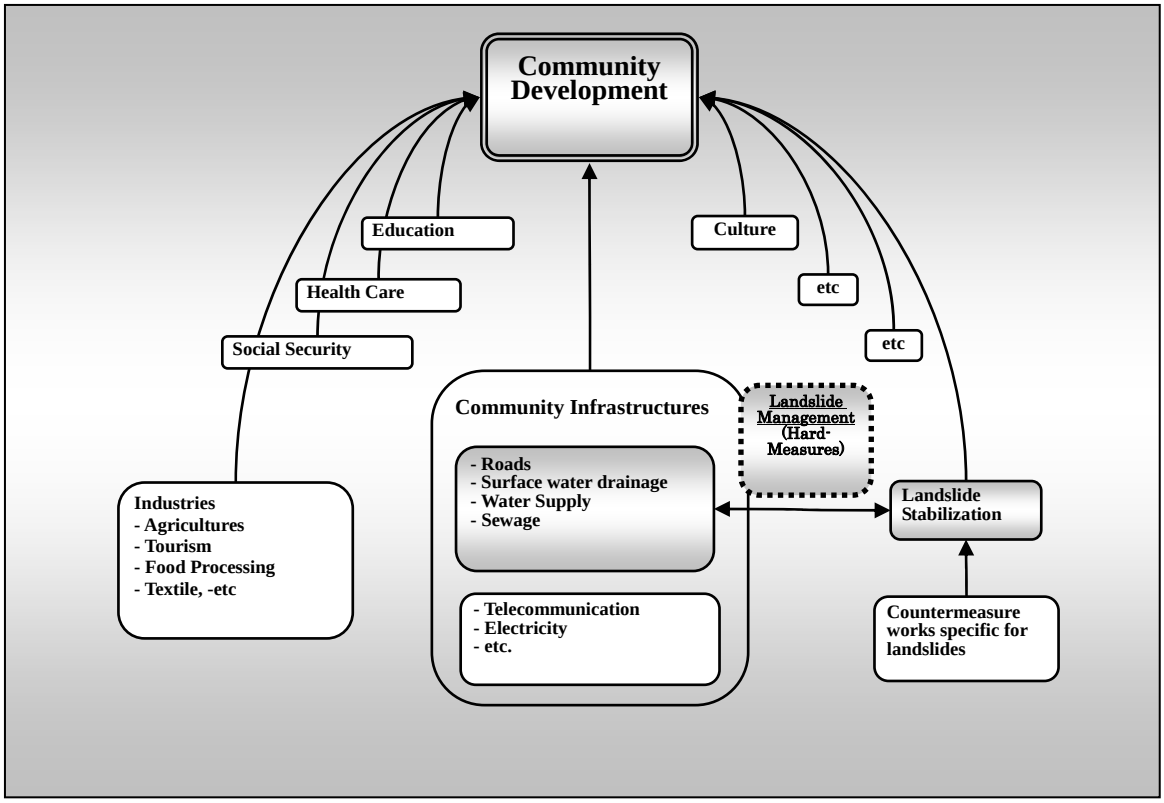


Figure 4.2 Landslide Management Useful for Community Development

(c) Attention points for Improving Intra- and Inter- Community Infrastructure

It is an observation of the Study that improper water management may have triggered the landslides in the communities. Such improper water management at the same time has worsened the living conditions; – i.e. muddy roads and ground during the rainy and snow melting seasons. The worsened conditions have also impaired the workability of vehicles for industries, which may seriously affect the productivity of industries. It is the opinion of the Study that the improvement of the water management will be effective not only for landslide mitigation but also for community development in terms of the improvement of living conditions and increasing industrial workability/productivities. The following are the identified present conditions of water-related intra- and inter- community infrastructures:

- Roads: no new construction/ maintenance since 1988
- Water supply systems**:** no proper maintenance
- Sewage systems: insufficient or no networks in a community
- Irrigation systems: improper design and networks in a community

1) Community roads

a) Condition of community roads

Community roads are constructed in areas within or near landslide areas as important infrastructure for people and agriculture. Conversely, roads are often damaged due to landslide deformation. Roads are, nonetheless, a passage of water from upper hills to lower unstable slopes that activate landslides.

Generally, there is no side drain ditch included in the road structures in the RA. The same practices are applied to community roads. Nationwide, annual precipitation is 480 mm, which is a major reason for the exclusion of drain ditch arrangement for the road structure. However, in communities at hilly areas, several sources of water concentrate towards the roads. This includes rainfall, thaw water, springs, sewage water, dirty water, irrigation water, and so on. In the wet season, community roads often lose their traffic function and become channels for water to pass through to lower unstable slopes.

b) Improvement of Community Roads

Community roads constructed in hilly areas should have side drain ditches to lead/drain water properly to maintain the traffic function even during the wet season. Such side drain ditches in community roads could be trunk lines of domestic drain water.

Communities could implement the works step-by-step, as the structures and civil works are simple, if some assistance in supplying engineering services and material procurement from government or

donors is provided.

2) Water supply system

a) Condition of water supply system

Communities are receiving spring and valley water through pipelines. These pass through landslide areas and are often leaking, resulting in the discharge of water into the landslide mass. For example, as mentioned in the Chapter 1, in Dilijan City in Tavush Marz, the estimated water leakage through pipelines into landslides was similar to the annual precipitation of 500mm until 1990, resulting in continuous movement of the landslide. Following a drastic reduction in population which reduced water consumption significantly, the landslide movement was reportedly reduced. This is a good example of how water leakage from water supply lines to landslide masses, induces the landslide movement.

b) Improvement points

Leaking pipelines should be repaired.

Spilling water from storage tanks should be led off the landslide masses with lined structures.

Flowing water from domestic taps and drains should be led to main drainage lines to be installed.

Overall rehabilitation/reconstruction of water supply system should be implemented for the ultimate target.

3) Lack of sewage system

a) Condition of sewage system

A sewage system has not fully developed in hilly regions. Used water therefore flows down the slope, and this is considered to be a cause for destabilizing the slopes.

b) Improvement points

Sewage water affecting the unstable areas should be immediately directed to the natural drainage system (rivers/streams) or side drain ditches where lined structures are available.

Overall rehabilitation/reconstruction of sewage water system with minimal treatment systems should be implemented for the ultimate target.

c) Crude usage of irrigation water

Crude usage of irrigation water is a cause for activating landslides. Irrigation water should be properly distributed both quantity-wise and area-wise. The scientific approach for required quantities and water-feeding timing will assist in the planning process.

Surplus irrigation water should be led to as near its natural drainage as practicable. If this proves to be expensive, water should be led to safe places where it will not impact on unstable slopes.

4) Undertaking Community Maintenance

a) Actions to be taken

Maintenance systems should be formulated through open community meetings. Required items to be prepared are as follows:

- Research and prepare the water supply system
- Establish a regular patrol program for each facility, in which the following issues shall be decided:
  - Persons in charge of patrol
  - Timing of regular patrol
  - Recording format and method
  - Budget for patrol

b) Points to be taken into account – whose action?

Government officers often point out that improper water usage by people is a major cause of activating landslides. Also, people living on landslide lands tend to acknowledge it to be a reality. However, such improper water usage in the landslide areas has remained unimproved. Authorities often criticize people of improper water usage, saying that people do not practice what the officers have instructed them on water-usage. No one has taken even a step to improve the situation, i.e., no self-help actions on physically improving the situation and no persistent public-assistance actions on continuing information, education and communication.

Actions have to be taken gradually from what can be done. The following is a conceptual guideline on actions required for the development of community infrastructure.

Table 4.4 Actions required for Community Infrastructure

Present conditions	Actions required for development	
	Short term	Medium-Long term
Insufficient resources of self-government for maintenance	Gradual increase in local tax collection/ donors' projects/ cooperation between communities/ priority investment by community unions (CUs)	Sustainable tax revenue (based on increased income), strong community unions, subventions from central government, water users fees, peoples' contribution for community projects
Insufficient management and technical skills of self-government	Necessary assistance from Marz/ central government/ donors/ emerging specialized private companies, CUs	Self-government capable to manage infrastructure
Lack of sense of ownership of community infrastructure	Gradual shift from securing own basic needs to community property; users associations, contributions of community	People supporting community infrastructure

(3) Income Generation Plan

(a) Activities for Income Generation

In most communities which have landslide issues, the following fields of productive resources are typically identified.

Table 4.5 Existing Resources related to Income Generation

Category	Resources
Agriculture	Wheat, Bee keeping, Fruits, Vegetables, Forage, Medical herbs and trees
Animal Husbandry	Cows, Pigs, Goats, Sheep, Poultry
Food Processing	Cheese, Milk, Juice, Wheat flour, Meat
Tourism	Logging, Eco-tourism, Souvenir shops, Local guides
Others	Rock Mining
Employment	Local kiosks, Office of local self-government, Small-scale construction laborers

The levels of utilization for those resources at present are generally low. This is most likely due to lack of technique / skills, investment capital, means of transportation, knowhow of marketing, and so on.

The current likely conditions of rural communities and examples of expected conditions regarding the income generation activities in the short-term and medium- to long-terms are shown in Table 4.6.

Table 4.6 Present Conditions and Expected Conditions for Income Generation

Present Conditions	Expected Conditions	
	Short term	**Long term**
Agriculture / Animal Husbandry		
Small productivity and scale; production for self-consumption	-Trial production of large value-added products	-Shift to processing and value added agricultural production
	-Gradual increase of own income/ external finance to develop production	-Savings and credit groups; -Agricultural loans
	-Gradual increase in landholding	
Lack of skills/ technology/ capacity for individual farming	Development of: -Agricultural support organizations; -Service extensions; -Better use of resources	Strengthened skills: -Agricultural techniques, -Use of water, -Facilities, -Business plans, etc.
	Gradual improvement of: -Irrigation system management, -Operation/ maintenance	-Water systems adjusted and maintained for agricultural production
Lack of markets for sales of agricultural products	-Market organizations middle-men/ intermediaries to sell products, cooperatives	-Developed markets to sell products
	-Market information for agro-products	-Production responding to demand
	Inter-Community roads gradually improved - Dissolving physical isolation to sell products	-Improved market accessibility -Telecommunication infrastructure to be developed linking with major consumption locations
Employment		
Unemployment, few opportunities for additional sources of income	-Promotion of self-employment and small business development	-Self-employment as strong additional source of income
New ideas of self-employment, entrepreneurship, private small business	-Support for food processing companies, local manufacturers, services -Private capital to be invested on the communities for new industries (i.e., food, beverage, dairy products, hides and skins, leather-related products)	-Small business consulting and training services -Infrastructure development to cater to new industries

Based on the above identified resources and present conditions generally encountered by communities, the following conceptual framework can be formulated as illustrated in Figure 4.3.

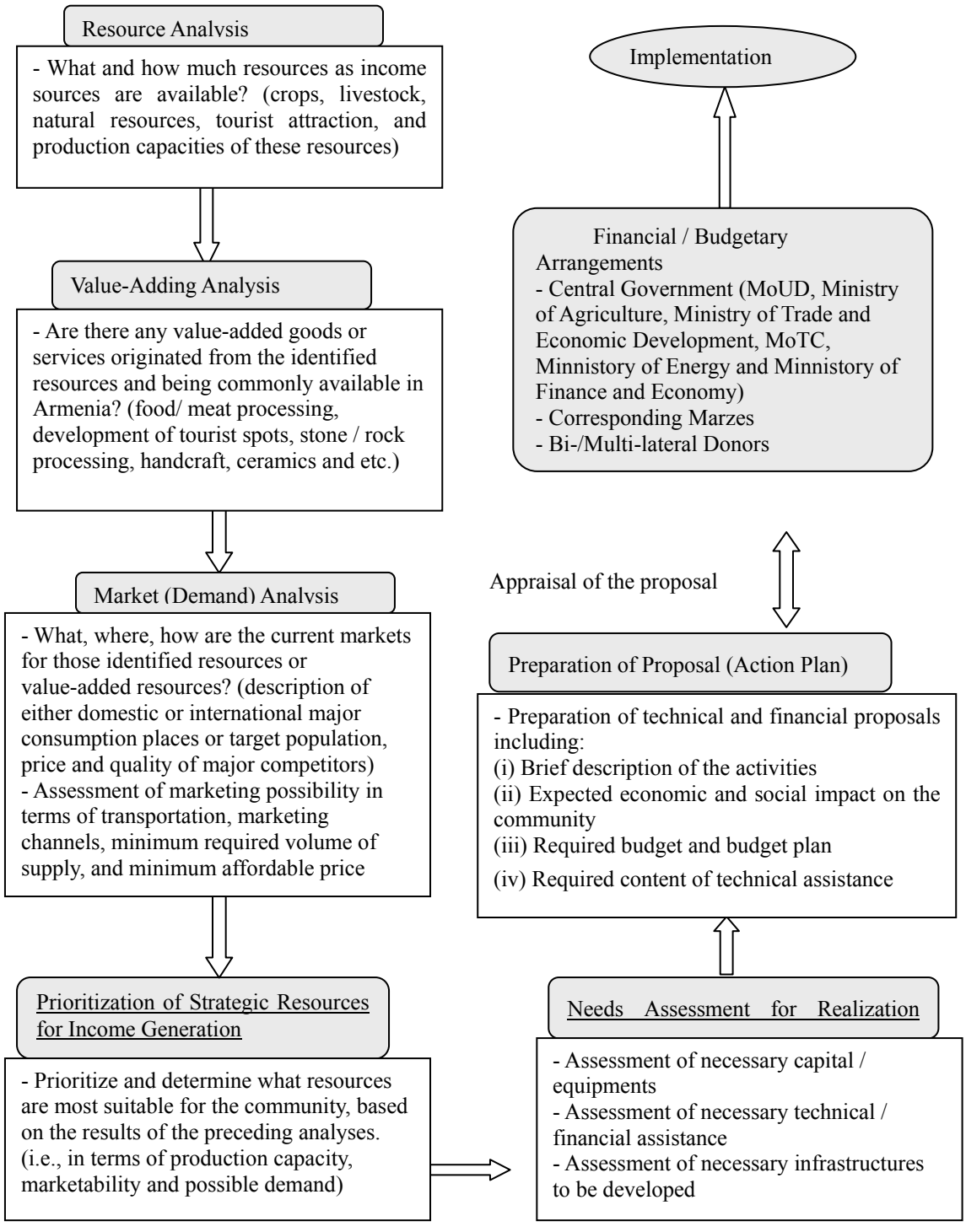


Figure 4.3 Conceptual Framework for Implementation of Income Generation Activities

The analyses and work items shown in Figure 4.3 should initially be conducted by communities. The Pilot Projects of the Study have demonstrated the capability of communities to somehow prepare their development plans and prioritize their resources to be developed with assistance from the Study.

Assistance by local or external experts will be needed in taking steps for the implementation of plans. Experts should do analysis of resources, marketing and distribution. And they also should do human capital development.

Human Capital Development

Most people in rural areas have encountered difficulties in adapting to the new market economic system. An effort to promote income generation activities should be made in parallel with human capital formulation (i.e. capacity building). One of the most important goals of the specialists' activities (in Pilot Projects) is to create entrepreneurship among the community's members.

As a starting point, a necessary action is that the local or external experts should pay attention to digging up a hidden progressive talent as a basic target in transferring their knowledge and providing on-the-job training during day-to-day work. As a result, the project develops in a sustainable way.

Necessary Conditions of Sustainable Income Generation Activities

i) The surplus should be not equally but proportionally distributed among participants as their own benefits subject to volume of works and production, for the purpose of enhancing one's incentive (more work should get more reward).

ii) Disposable income should be used for projects on "landslide management and community infrastructure development" and "community development".

iii) Expenditure decisions should be a subject for approval by the village leader and the village council, while a working commission should prepare investment proposals.

iv) Audit unit (internal / external or both) as a check system should be introduced to monitor the revenue and expenditure records.

Moreover, in the longer term, if sufficient public investment funds are already accumulated, it is

recommended that a certain type of community credit union or credit institution be established. Such credits can be pooled into a revolving fund to support various activities of inhabitants at an individual or group basis.

(b) Background of the community development plan

Article 37 of the Law on Local Self-Government describes that the chief of a community shall compile the draft of the master plan of the community urban development as well as the community land zoning and use schemes. Upon agreement with the respective authorized state body through the regional governor, the chief of the community shall submit said master plan to the community council for approval.

However in actual practice, a community master plan is not seriously taken into consideration and sometimes, is not updated by a newly elected chief of the community. Because only a few items in the plan are usually realized, the population of the community is indifferent to the plan and so on. Mixed with indifferences to others' business in a community, an agreed and concentrated desire to realize the plan is not easily formed. Based on such observations, the Study proposes that the WkC should prepare a draft community development master plan, in consultation with the general assembly, so that the chief of the community could adopt the draft into his/her draft plan. By doing so, it is believed that a sense of participation of the population to the issues on community development will be enhanced, and the chief of the community will pay greater attention to the realization of the plan. Consequently, an agreed and concentrated power of the community can be expected.

For the Pilot Projects under the Study, a community development plan for the WkC, in consultation with the general assembly, was formulated with the following three categories assembled:

- Industry Development Plan
- Intra-community Infrastructure Development Plan
- Culture Development Plan

This exercise, i.e. forming the community development plan by the WkC in consultation with general assembly, was proven to be effective in the following items;

Clarifying their common needs,

Identifying the resources the community presently has,

Noting the resources the community presently does not have,

Agreeing on the resources that the community can input, and

Recognizing the resources that the communities should bring from external sources; among the population in the community.

Through this type of exercise, a sense of participation will be enhanced and the effort to realize the plan will be promoted.

(C) Promoting Income Generation in the Community

The Soviet regime left people with the perception of being passive in terms of production activities, because the State was responsible for securing jobs and providing infrastructure and social services. Thus, taking the initiative to adjust and respond to the new socio-economic reality in Armenia has been a difficult process for individuals, communities and their local self-governments.

The low purchasing power of the population, the collapse of the former trade-economic relations and the blockage of the external communication brought a reduction in production capacities, as well as means of marketing. Serious problems arose in the selling of agricultural and agro-processing produce, as well as in the supply of inputs. Most of the households' income depended on private sector activities such as the sale of food and cash crops, livestock, or on wages of laborers and other services. These activities were affected by the quantity and quality of infrastructure services and by the reliability of access to these services.

Income generation as one of the important driving forces for community development would shed light on such recessive rural economy in the context of built-in disaster management. Income surplus of the population beyond their subsistence level would provide a choice of financial resource allocation on disaster management, which would then give an assurance in generating stable economic fundamentals for the rural communities.
The level of utilization for those resources at present is generally low, most likely due to: low production level, lack of technique / skills, investment capital, means of transportation, knowhow of marketing, and so on.

4.3.3 Development of Community Organizations

(1) Basic Policies

(a) Policies

The plan for the improvement of solidarity and development ability for project sustainability is shown in the following:

In the Pilot Projects, the Community Based Approach (CBA) was conducted, and the germ of local society solidarity was confirmed. The continuation of CBA in development activities in other communities is desirable.

MoUD should organize an advisory committee and conduct information services involving the sharing of experiences on the subject.

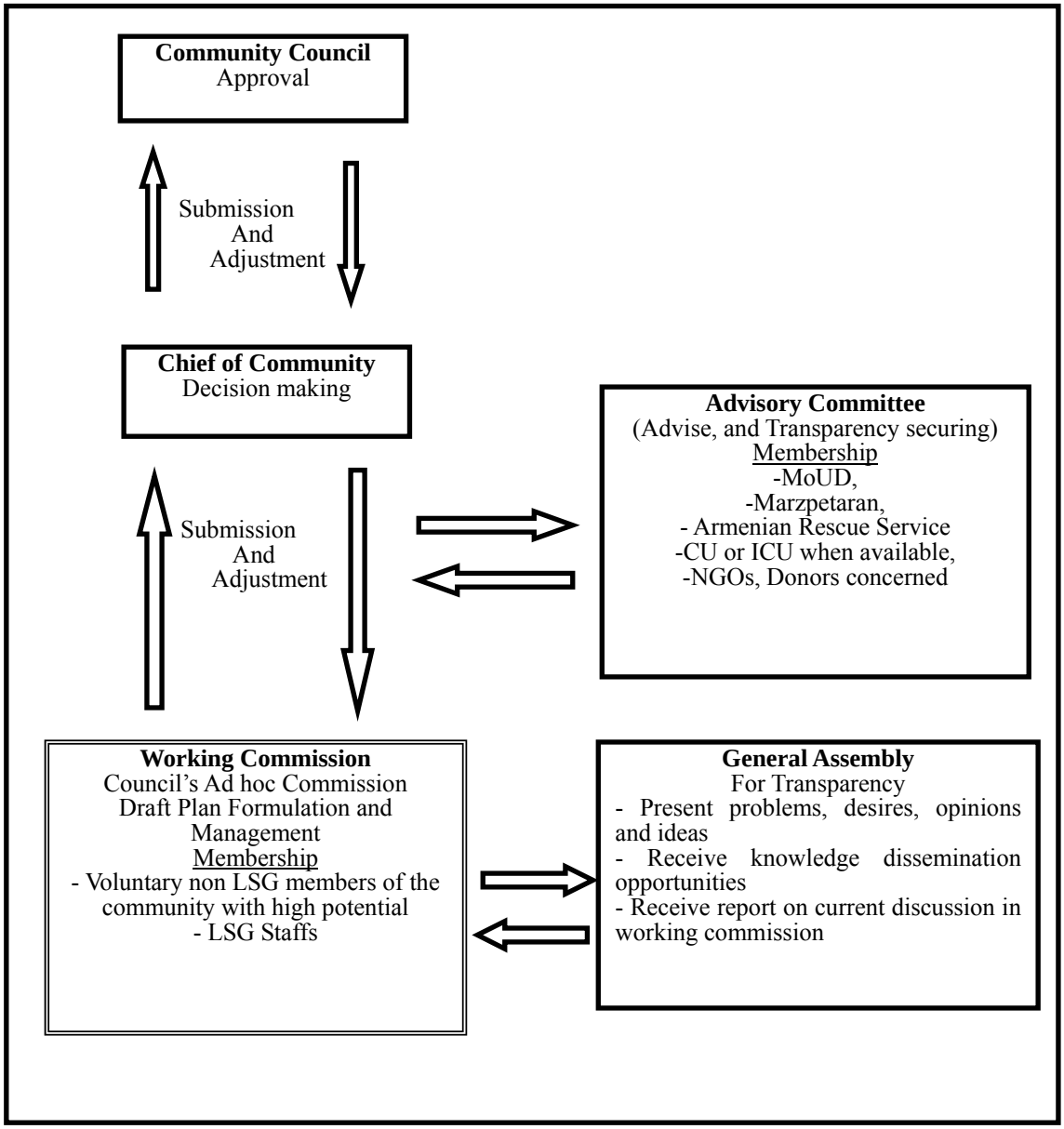


Figure 4.4 Planning and Implementation of Projects by Community Based Approach

(b) Background of Policies

In the former political regime, the head of any region, smaller rural settlement, city or community was elected from among the council members elected by the population in the given administrative and territorial unit. These councils represented local government authorities and formed part of the national government system. Each council was considered to be a local branch of national authorities empowered with quite a large scope of powers envisaged by the then legislation.

The new system of administrative and territorial institution by the Constitution plays a two-fold role in the building of statehood: one is the system of regional authorities as a part of national government, and the other is the system of local self-governments with a status of 'municipality'. The chief of local self-government is elected through public election. However, the population can think of the local self-governments as 'they' as was the case during the former regime. It is usually observed that the community members keep silent before the chief of the local self-government. Under such circumstances, direct public opinion may not be reflected in the policy of a local self-government.

Given the above considerations, the Study proposes to form an ad hoc working commission (WkC) on a voluntary basis, to discuss issues necessary for the community. The working commission shall be comprised of non-LSG members and LSG members, excluding the chief of the community. The Pilot Projects conducted under the study have proven that heated discussions happen when the chief of the community is absent from the working commission.

The proposed organization of 'Working Commission' is as shown in the Figure 4.4. In this Figure, the WkC shall exchange information with the general assembly which is not a legal organization. The general assembly is called for whenever necessary by the WkC among the population whoever wish to participate. It is intended that wide and direct opinions can be reflected on prevailing issues by the people and for the people without un-appealed constraints often seen when the WkC sessions are held with the presence of an authorized personnel.

The opinions shall then be submitted to the chief of the community for his/her decision-making processes. This mechanism will assist the population of the community in promoting a participatory approach to issues directly affecting them, without leaving their initiatives to upper administration systems. This is believed to be the first step in promoting the community initiative.

In addition, an advisory committee (AdC) is proposed mainly to support the WkC and to maintain transparency of the decision-making processes.

Through the pilot projects performed under the Study, it has been proven that this system is efficient and effective. Continuation of this system is therefore strongly recommended.

(2) Method

(a) Working Commission (Planning and Promotion) and Community Council (Approval)

Working commission (WkC): voluntary organization that formulates "plans of landslide management and community infrastructure development" and "community development plans". At the WkC, the committee discusses the issues and formulates the management plan. The Community Council approves the plan and the implementation starts. Voluntary discussions and implementation of the plan's contents should improve community solidarity.

The WkC organizes a maintenance system of community infrastructure such as water supply and drainage. For these activities, the participation of many inhabitants such as in the resumption of "SHABATORYAK (Saturday Volunteer)" should be promoted.

The WkC should not include a formal officer such as the village head, who has power to decide, because most villagers remain silent in his/her presence.

The plans would then be reported to heads of communities from WkCs and approved by the community councils.

(b) General Assembly (Compiling of Opinions, Transparency Securing)

Transparency of plans and activities would be secured through the general assembly and through information dissemination using, for example, the bulletin board.

(c) Formulation of Landslide Monitoring Team and Early Warning System

The landslide monitoring team should be organized in the communities. The head of the community should formulate an early warning and evacuation system in cooperation with the monitoring team, inhabitants and community staff.（At this Study's Pilot Project sites, Japanese monitoring equipment were installed, although in other communities a simple movable beam, the Nuki-ita, was installed on a first stage.)

Inhabitants would be not only the receivers of a warning or evacuation recommendations but also the reporters of hazard forewarning. To secure the system and dissemination of knowledge of landslides,

the inhabitants dwelling in the vicinity of the watch points should be trusted in the monitoring.

(3) Planning and Implementation of "Landslide Management and Community Infrastructure Development"

(a) Activities by WkC and Use of Specialists and Information

The WkC should plan. The implementer should be the inhabitants with WkC and community staff promotion. The specialists' assistance is necessary for these activities. Table 4.7 shows the planning method according to given conditions of public assistance. When public assistance is not available, specialists in the community or the vicinity, organizations are brought into play. When specialists' assistance is not available, information on the experience in the Pilot Projects, which is disseminated by MoUD by newsletters or technical bulletins, should be used.

Table 4.7 Use of Specialists and Information for Community-related Landslides

Given Conditions of Specialists	Planning Methods
Specialists are turned in （Selected projects such as this Study's Pilot Projects）	WkC should make the plan; specialists who contract with MoUD will assist in the planning.
Specialists are not turned in （Most communities）	- Specialists in communities (e.g. former engineers of the Kolkhoz) make simple plan (maintenance of water supply system, drainage etc.) - Make use of specialists of the vicinity hub city, CU, and ICU if possible. - Refer to newsletters, technical bulletins of MoUD - MoUD and Urban Development Department of Marzpetaran declare the intention of the consultant for community's planning in newsletters by indicating telephone number

(b) Investigation of Basal Conditions and Assessment (Risk & Resource Assessment)

To specify the landslide outline and predict assumed hazard area and activity, technical expertise is necessary, e.g. MoUD employed contractors to undertake geotechnical surveys in several selected communities.

Without geotechnical survey, the WkC should organize the following activities to confirm basic site conditions.

a. Risk Mapping and Listing: mapping and listing of damaged risk objects, mapping of ground cracks, collapsed slopes (lists of risk objects were made by communities in Jul – Aug 2004, as part of this Study's landslide inventory survey). Lists should be updated as necessary.
b. Simple Landslide Monitoring: Installing simple movable beam (Nuki-ita) or movable stakes. Results of the monitoring (e.g. movement amount per month) should be shown on the risk maps.
c. Resource Mapping and Listing: mapping and listing of public facilities, farmlands, springs, etc.
d. Installation of simple movement measure board (Nuki-ita) to remarkable open cracks and showing of measurement results (monthly movement results).

(c) Planning and Implementation

The WkC should formulate a draft plan and promote its implementation with the community government.

The basic policy for landslide countermeasure works by CBA in terms of lack of resources is as follows:

- Simple method, which is possible to be executed by the inhabitants, should be implemented as the first stage (e.g. drainage works, maintenance of water supply system).
- Landslide countermeasures, which contribute to community infrastructure development, are priority activities.
- To avoid casualties, an early warning system should be formulated (associated work of landslide monitoring team and community staff).
- Community infrastructure maintenance system should be formulated to avoid leakage of water supply and drainage systems.
- Resource acquisition (income generation) should also be planned and implemented.

(d) Information-Sharing Activities in Communities

All information associated with landslides has to be open to the public. For example, the hazard and risk maps should be presented for public viewing on a wall of a public space. Landslide monitoring results should be periodically presented on a notice board of the community hall, and inhabitants' opinions of the plan should be compiled.

(e) Maintaining Landslide-related Information in Communities

The landslide management can be done more efficiently with accumulated knowledge of past experiences. Landslide monitoring data and information obtained from inhabitants should be maintained in the form of documentation. The following information (shown in Table 4.8) is recommended to be maintained at the community level.

Table 4.8 Documents and Data to Keep in Community

Information/Data	Form of Files	
	Hard Copy	Electronic
Plans for "Landslide Management and Community Infrastructure Development" and "Community Development"	○	○
History of Landslide Management (Hazards, Countermeasures)	○	○
Records of Seasonal/After Rain Inspections	○	○
Landslide Monitoring Data	―	○
Other Observations Data (Precipitation, Snow Depth, Spring Water Amount etc.)	―	○
Investigation Reports by the RA Government	○	―

(f) Community Risk Management – Information, Education and Communication: IEC

1) Notes on this section

The recommended concept that landslide management should be built-in to a community development program, can be reworded as landslide risk management should be incorporated in a community development program. Community development should include a component of landslide risk management.

This section deals with the activities for 'Information, Education and Communication: IEC', which the Master Plan considers to be a part of risk management.

2) Knowledge Dissemination on Landslide – Education by the Central Government

It is observed that people living on landslide lands are not even aware of it. Even if they know it, they sometimes do not know what the landslide is and how the landslide is activated.

The Crisis Management Institute of ARS conducted an educational program for pupils of primary schools (for 2nd, 5th and 6th grade for 24 hours/year) and college/university students for 48 hours/year. However, the program is rather 'Crisis management oriented' during and after events.

In line with the recommendation of 'Risk Management', i.e., 'pre-disaster activities against

disasters', the Master Plan recommends that the existing education program should be reviewed from the risk management point of view. The following points have to be highlighted in the education program:

i) Principle mechanisms of landslides;
ii) Predisposing factors and inducing factors of landslides;
iii) Points for mitigating the movement of landslides;
iv) Points for monitoring activities of landslide movements;
v) Points for early warning/information to the community; and
vi) Crisis management.

The Study has prepared a booklet that summarizes the above points in Armenian language (as enclosed in the Sectoral Report-III). The Master Plan recommends that the booklet should be fully utilized at various levels. In particular, the education of younger generations is extremely useful and effective in disseminating updated information to a 'conservative' society. The Master Plan also recommends that the booklet should be utilized in schools at the community level.

3) Knowledge Dissemination on Where They Live – Hazard and Risk Maps

For a community located on landslide lands, knowledge of potential hazards and potential risks will be useful for the risk management, because people will be aware of potential hazards and risks in their community, and therefore, they will be able to prepare by themselves against possible risks. The Pilot Projects conducted by the Study have proven the usefulness of the preparation of hazard and risk maps.

A hazard map is a map that shows all possible hazardous phenomena including ones that will not damage anything relevant to human activities, whereas a risk map is a map that indicates possible damages to human activities by hazardous phenomena. Preparation of either a hazard map or a risk map requires professional knowledge on natural disasters. Large-scale, time-consuming and expensive researches and investigations will not be required, however. A reconnaissance type of field survey by experienced professionals will be sufficient enough for the first step for a community risk management. It may be the responsibility of MoUD to assist communities with the engineering professions.

On the other hand, to prepare a risk map, assets that may be damaged by possible hazards should be identified. Such assets have to be identified by the community.

It may be said that the former political regime had maintained a policy of 'Let people depend' by not providing information to them. All the decisions were made at established levels who were keeping

the necessary information to decide. This is a typical example of a regime controlling innocent people who are under the regime. It is now obvious that the central government alone does not have the capability of managing every aspect of communities' development in the RA.
All the information regarding landslides has to be open to the public. The hazard map and risk map should be presented in a wall of a public space, for example. Landslide monitoring results should then be periodically presented on a notice board of the community hall.

4) Enhancing Self-Help Activities of the Community
An observation: It is sometimes observed that the garden (precinct) of the church in a community is grassed down; the roof of the church is left unweeded. A respectable world heritage is found to be so too, disappointing visitors and/or tourists from far within or out of the RA. The explanation for it was that churches were under the control of the Ministry of Culture and Youth Affairs and 'they' shall take care of it. It is hardly believed that the ministry is able to maintain the numerous numbers of historical churches and monasteries within the territory of the RA. Self-help actions have to be encouraged by the government to do simple maintenance works of the church, for example, in a community; because the church should be considered as a traditional spiritual property of the community, although it may be under the control of the central government. Communities should also take a necessary action to improve things on their own, instead of leaving things to someone else.

Similarly, there are a number of matters that can be done within the capacity of a community in improving their living conditions, or developing the society, which may further be effective for the mitigation of landslides where their economic and social activities are prevailing.

- It is understood that "SHABATORYAK (Saturday Volunteer)" was in place during the former political regime, for which people had conducted public, benevolent maintenance works on a Saturday of every month. This may be a starting point to instigate a self-help mechanism of a community. Re-naming it may be recommended if so required by the people in the communities.

- It is also understood that 'Honorarium For Work (HFW)' was in place, under which community people were encouraged to serve their labor forces for public works with minimal wages to be subsidized by the central government. However, an example was reported wherein the wages paid to community people were not reimbursed to the community by the central government. Such an episode will entirely discourage the 'self-help action'. It is therefore recommended that HFW has to be concretely in place.

There may be a lot more activities that the communities can perform by themselves before leaving things to someone else. A series of small improvements will accumulate to significantly appreciable improvements of the society.

(g) Landslide Monitoring (Community Landslide Monitoring Team)

For the landslide risk management, early detection of any tokens of landslide movement (changes of movement patterns) will be essential, because people living on landslide lands can feed back the detected tokens in their daily activities. To do so, it is recommended that a landslide monitoring team in a community on landslide lands be formed.

In the Pilot Projects conducted by the Study, community members formed a landslide monitoring team. The team carried out landslide monitoring activities using simple but fundamental monitoring tools such as 'Nuki-Ita (a pair of wooden movable beams), groundwater detectors (dip-meters), extensometers and borehole strain gauges. The monitoring results were recorded and summarized in a graphical manner. The members of the monitoring team were all keen to perform the activities because the landslide movement was made visible on the recording charts that they prepared by themselves with information (filed data) they obtained.

The landslide monitoring team should communicate with the people in the community to obtain any other information that ordinary citizens may notice in their daily lives. This is particularly important to let the ordinary citizens be aware of landslide issues as inherited issues that need to be managed.
MoUD should take the necessary action when a similar type of project is to be implemented in other sites, so as to provide the landslide monitoring team recommended to be formed in said community with the necessary technical advice.

(h) Mutual-Assistance Mechanism among Communities

In Armenia, the types of administrative and territorial units include 'Marzes (Region)', the city of Yerevan with the Marz status, urban and rural as well as Yerevan neighborhood communities. In accordance with the Law of Administrative and Territorial Division of Armenia, the territory has been divided into 10 Marzes and the city of Yerevan with the status of a Marz. There have been 1,017 communities created in Armenia. Communities (Hamainks in Armenian) are administrative and territorial units, where local self-governance is fulfilled. Note that there are sustainable differences among communities in terms of both numbers of population and areas, as well as social economic infrastructures. For example:

- 36 rural communities with population of less than 100,
- 163 rural communities with population of less than 300,
- 176 rural communities with population between 301-500,
- 185 rural communities with population between 501-1,000,
- The biggest community in population: Akhourian (10,049 people, Shirak Marz); the smallest: Qashouni (37 people, Syunik Marz) (all of the above as of 1999)

The above demonstrates that 560 among 1,017 communities (meaning about 55% of communities) have population of not more than 1,000. The administration system is fragmentally divided into small-scale systems not only area-wise but also population-wise. This has resulted from various historical backgrounds.

It is reported that the division into communities has increased the role and importance of local self-government (community) as the basis for sustainable development of democratic institutions and the economy. On the other hand, the creation of numerous small communities has resulted in the creation of weak and incapable administrative bodies for rendering their administrative services to their population.

A logical conclusion is that communities need to be united or cooperated together for 'Mutual Assistance'. The following are major proposals for development of local-self government system (2005, UNDP and WBI):-

- Consolidation of communities
- Strengthening capacities of local self-government
- Assignment of new power to local authorities
- Allocation of financial resources adequate to their power

However, it is pointed out that 'consolidation' or 'merging' communities into communities of large sizes will have many obstacles to overcome. Instead, unification of neighboring communities to such organizations as union of legal entities, NPO, NGO, has been proposed by GTZ and pilot-implemented in Tavush Marz and Syunik Marz, forming 'Community Unions (CUs)' on the following legal bases.

"Article 78 The Right to Form Inter-Community Unions of Law on Local Self-Government: Local self-government bodies may form **inter-community unions** for the purpose of providing solutions to problems faced by the communities and decrease of expenses. Inter-community unions have the status of a legal person."

Recently, it is informed that DfID is forming an 'inter-community union' in Gegharkunik Marz.

The Master Plan recommends 'Mutual-Assistance' as part of community initiative and affirms the formation either of 'Inter-Community Unions' or 'Community Unions' for the effective development of rural communities.

Table 4.9 Community unions/ Intercommunity Unions

Present condition	Action required/ development	
	Short term	Long term
Legal bases		
1. Community Unions (CU)– allowed by the Law on Local Self-Government; supported by GTZ[1] 2. Intercommunity unions – sharply defined by the Law on Local Self-Government[2]	Intercommunity unions (ICU)– better defined by amendment to the Law on Local Self- Government (MoTA)	CU or ICU might be the base for creating bigger and stronger communities (limiting total number of communities in the RA)
Scope of works		
Solving basic problems of small communities - small scale infrastructure projects (rehabilitation of community roads, drainage, drinking water, irrigation systems)	Improvement of drainage facilities, including underground drainage for active landslides	Improvement of roads, water supply and sewage facilities, and irrigation systems
Advantages		
CU have practical experiences and procedures in community-based infrastructure projects, especially: (i) criteria for prioritizing and selecting projects, (ii) simple procedures and systems for community-based projects, (iii) efficient use of small resources and mobilization of local labor, (iv) transparent and accountable	1. Partner for donors and the Government to introduce small scale community-based infrastructure projects 2. Gradually becoming self-reliant (increasing share of community contribution)	1. Priority partners for State Budget to develop community infrastructure network 2. Develop profit making companies for realization of small scale infrastructure projects for communities

4.4 Ideal Public Assistance

4.4.1 Pilot Project Development by MoUD

These Pilot Project sites are still at the stage of implementing self-reliance. The plans have been formulated but implementation has stayed on the stage of execution.

The guidance of the central government is necessary for the continuation of this Study's Pilot Projects or to start up projects in new communities. MoUD should continue and develop the Pilot Projects.

[1] Fifteen (1) CUs have been formed: 4 in Tavush Marz, 5 in Lori, 1 in Ararat, 5 in Syunik

[2] Including the pending (March 2005) amendment, promoted by the MoTA

The purposes of Pilot Projects development by MoUD are the following:

- To enforce communities' self-reliance efforts and abilities, and ensure the success of the projects;
- To share successful experiences among communities affected by landslides; and
- To provide consensus that landslide management contributing to community infrastructure development and targeting community development is a priority program of the RA.

4.4.2 Technical Assistance

For initiation of a project and experience sharing, the first priority role of public assistance is information services. MoUD should continue to publish newsletters and technical bulletins (information which can be used for "landslide management and community infrastructure development").

Secondly, MoUD should provide technical assistance to selected projects centering on the continuation of this Study's Pilot Projects. This includes continuous landslide monitoring, geotechnical investigation（drilling survey etc.), and horizontal drainage boring as countermeasures. MoUD should direct the activities to contractors using donated equipment from this Study (GIS, landslide monitoring, boring, etc.).

Other necessary activities to be taken by the central government will be recommended in Chapter 7 hereafter.

4.4.3 Technical Support by Advisory Committee

MoUD should form an Advisory Committee consisting of officers from the central government, Marzes, community head, ARS, donors, CU/ICU, NGOs, etc. The advisory committee should be called to obtain advice, provide transparency in the decision-making processes within the community, decrease negative environmental effect, and adjust conflicts among the communities.

In view of the existing capacity of MoUD, its representative should participate as a chairman in only three (3) existing pilot projects (Gosh village, Martuni village, Kapan City). For other pilot projects as advisory committee support, Marz/ CU/ ICU representatives should be the chairman under the guidance of MoUD.

The advisory committee should coordinate seminars/ study tours to neighboring communities when the output of a project becomes available to some degree.

4.4.4 Public Assistance of Finances

(1) Time Frame Targets

The time frame targets of public financial assistance with the given conditions of stakeholders are shown in Table 4.10.

Table 4.10 Given Conditions of Public Financial Assistance and Roles

Time Frame	**Given Conditions/ Roles**		
	Public Assistance	Self-reliance Effort and Mutual Aid	External Assistance
Short Term Steps	- MoUD and MoTC plan the pilot projects (continuation of the study's projects and additional new projects) and provide inputs to the communities on geotechnical investigation, specialists in civil engineering and income generating activities.	- In pilot projects, communities formulate "landslide management and community infrastructure development plan" and "community development plan" and execute them.	- External assistance available as experts dispatch or materials procurement
Medium Term Targets	- MoTC and MoUD examine and select communities applying for "Community infrastructure development and landslide management plan" preparation and provide subsidies for selected projects.	- Successful examples are disseminated. - Germ of self-reliant effort is outlined to other communities.	
Long Term Targets	-Subsidies to communities are substantial. Role of subvention to selected projects is small.	- Communities implement landslide management as a part of the community development plan.	-External assistance has finished its role

It is difficult to predict the development speed and to set clear borders thus the time frame figure cannot be provided.

(2) Geotechnical Investigation and Specialists Dispatch by MoUD (Short-Term Steps)

At present, the community generally has no abilities with respect to risk and resources assessment and planning. MoUD should provide inputs to the geotechnical investigation and specialists by tender and contract for selected pilot projects.

- Geotechnical investigation, horizontal drainage boring
- Materials procurement, construction machines leasing, skilled workers, honorarium for inhabitant workers

Information service is also conducted for supporting voluntary start-up of new projects (see Chapter 7).

(3) Subsidy Program for Selected Projects among Applications from Communities (Medium-Term Targets)

(a) Outline

The Study Team suggested a ”Support Program for Landslide Management and Community Infrastructure Development” in October 2005 to the Ministry of Territorial Administration (MoTA) through MoUD. This is a subsidy system to promote community plans both financially and technically. In this support program, MoTC/MoUD examines “Landslide Management and Community Infrastructure Development Plan with Cost Proposals”, which is to be applied by communities. It supports materials procurement and skilled/ general workers’ fee. The subsidy is not directly offered to communities but is offered through a contractor.

MoTA/MoUD retains guidance of the program to communities, showing successful examples of pilot projects and explaining the form of application.

At this stage, projects are selected by the importance and efficiency, depending on the State financial conditions.

If target communities (or ICUs) have been judged to have become capable enough to handle ‘Community based Landslide Management’, the Support program may be implemented. This was the case in Gosh, Martuni and Harutyunyan in Kapan City where the pilot projects were already implemented, once the mechanism of the program had been approved by the Government. However, the Master Plan assumes that some six (6) years (2 terms of a MTEF planning period) may be required in formulating consensus and finalizing legal arrangements for the mechanism of the supporting program. By that time, MoUD will have to continue the pilot projects in the prioritized communities.

(b) Detailed Plan

1) Limitation of Self-help Activities

Although self-help and Mutual-Assistance are widely recognized throughout the world and deemed essential for all the development aspects in terms of sustainability, necessary resources still have to be made available; i.e. initial investment will be needed. On the other hand, the budgetary status of mountainous communities on expenditure basis as shown in the table below, ranges from AMD 5.4 to 7.8 million (USD 12,000-17,000) in Gosh community with 1,145 population and from AMD 1,3

to 3.0 million (USD 3,000-7,000) in Martuni community with 686 population.

Table 4.11 Budgetary Status of Communities (Examples) (unit: AMD)

Year	2001	2002	2003	2004
Gosh Community (population 1,145 in 2004)				
Revenue	6,659,900	6,101,200	N/A	7,454,800
Expenditure	6,435,700	5,417,000	N/A	7,871,520
Balance	224,200	684,200	N/A	-416,720
Martuni Community (population 696 in 2004)				
Revenue	N/A	1,788,000	N/A	3,057,000
Expenditure	N/A	1,262,300	N/A	2,982,000
Balance	N/A	525,700	N/A	75,000
The information above was collected by the Team from the communities of the pilot projects.				

It is seen that initial investment may be virtually unrealistic/impossible from the budget of a community to, not only disaster management, but even also community development for themselves. Under this circumstance, public assistance to communities will be indispensably needed for the communities to instigate a development scheme.

2) Proposing a Mechanism for National Assistance – Subsidy Mechanism

a) Background

In line with the concept that community based approach has to be emphasized for sustainable, economic and social development; the communities who wish to develop have to take the initial actions, and such actions have to be seriously considered by the government to encourage communities' further self-help actions by themselves. At present, communities in trouble or in need tend to write 'petitions' to higher ranking politicians (such as the prime minister or the president) to seek for a special personal attention/intervention for their own community. Decisions have sometimes been made as a form of 'government decree', which seems to be ad-hoc basis. This type of 'ad-hoc based decisions' has seriously impaired the motivation of the communities for self-help activities by leading them to think that 'they' decide.

Instead, a systematized subsidy mechanism has to be realized, wherein decision procedures should be transparent in the sense that one who is really in need and always self-helps himself shall be assisted..

b) Proposing a Subsidy Mechanism – Support Program

As a systematized subsidy mechanism, the Study proposes 'A Supporting Program' for Community Infrastructure Development useful for Landslide Management.

i) Framework

Table 4.12 Framework for Subsidy Mechanism

	Action required/ development	
	Short term (Preparation Stage)	**Medium term (Implementation Stage)**
Legal bases		
1. Budget System Law Art. 20: Allocations to Communities Budgets, p.4b: State Budget expenditures can provide for the communities budgets subventions, i.e. gratis and uncollectible financial resources for the purpose of executing a specific program by the community. 2. Law on Local Self Government Art. 57: Sources of formation of community budget, p.4.b: Subsidies from the State Budget for financing capital spending.	1. Issuing the Government decree about allocating part of the Landslide Program budget in the form of subventions to communities (*Government)*; 2. Incorporating subventions allocation into MTEF 2006-2008, and respective State Budgets (*MoUD, MoFE*).	Incorporate the decree on subventions in the future MTEFs and State Budgets (*MoUD, MoFE*)
Scope of work		
Existing subventions are mostly donor-imposed: 1. Armenian Social Investment Fund (WB) – community infrastructure rehabilitation and development programs (i.e. community roads, '04) 2. "Marz development program"[3]	Improvement of community also useful for landslide management (multi-purposes) most efficient for community- initiative landslide management.	Communities, community unions will suggest other appropriate works (*communities, Marzes, MoUD*).
Criteria		
	1. Work out set of criteria (participatory*: Supporting Committee, communities*). 2. Incentive-driven criteria: based on community involvement; monitoring and evaluation of results. 3. Incorporate in the Government decree on subventions (*Government*)	Improving process based on the feedback from the communities, community unions (*communities, Marzs, MoUD*).

ii) Principles for the Subsidy Mechanism

Preamble: National attention shall be drawn to communities situated on landslide lands where inhabitants have been living under degraded conditions caused by landslides from the view point of poverty alleviation.

[3] For Gegharkunik, Tavush, Syunik – but resources were transferred in reality to Marzes not communities.

Purpose: The **support program** shall be in place to assist the communities situated on landslide-lands where living conditions are being affected or will be potentially affected by the landslides, for community development by assisting them in the implementation of community infrastructure development projects useful for landslide mitigation.

Applicable Landslides: The **support program** shall be applicable for the communities where Damage Progress Level-(1) and Level-(2) landslides (see Table-3.2) have been identified by the inventory survey that the Study conducted, but are not limited to those. If those which may be classified in Level-(1) or Level-(2) are identified, the supporting program shall also be applicable

Applicable Projects: Under this supporting program, applicable projects shall be intra-community or inter-community infrastructure improvement/development relevant to landslide mitigation.

Eligible Applicants: An applicant community shall have, within the community, one or more residential area(s) or community(ies)- which is/are located on (a) landslide land(s) categorized as Level-(1) or Level-(2). Inter-community unions or community unions are encouraged to apply to this program.

Conditions to Applicant: In line with the concept of Community Initiative, an applicant community shall bear a certain percentage of the total cost to be incurred for the project it is applying for. It may be in any form such as providing local materials, local labor force, locally available equipment, but at a minimal cost to be proposed by the applicant.

iii) Stakeholders and Their Roles

The following are, but not limited to, the stakeholders: the community (or ICU, CU as identified), Marz, MoTA, MoUD, MoEP, relevant NGO, relevant donor. Their expected roles are shown in the table below.

Table 4.13 Stakeholders and the Roles

Stakeholder	Main Roles	Main Activities	
Community CU, ICU (Applicant)	-Initiator, -Beneficiary, -Responsible for Operation &Maintenance -procurement(*1)	- preparing application, - preparing project planning, - inputting resources available with minimal cost, -procuring a contractor for the project implementation(*1)	- implementing the project, - reporting the results
MoTA	-Coordinator of overall program	- coordinating the supporting program together with MoUD, - organizing review committees and advisory committees,	- being a member of the review and advisory committee, - coordinating for fund arrangement.
Marz	- Coordination - Procuring contractor(*2)	- coordinating the central and local self government, - procuring a contractor for the project implementation(*2),	-being a member of the review and advisory committee
MoUD	- Technical Coordinator	- advising on project planning, - assessing application from technical point of view,	- supervising the project, - being a member of the review and advisory committee.
Review Committee(*3)	- Review of application	- consisting of MoTA, MoUD and MoEP, - reviewing application.	-To be formed mainly for transparency of selection of project.
Advisory Committee	- Advising on project execution	-consisting of MoTA, MoUD, Marz, CU and relevant Donor and NGO, in charge of giving advice	- to be formed for transparency of project execution

(*1) When found capable and appropriate
(*2) The role to be transferred to applicant when appropriate
(*3) ARS and Water Committee of MoTA shall be members of the Committee.

iv) Main Points of the Program

The implementation flow of the support program is illustrated in Figure 4.5. The main points for the supporting program are as follows:-

Preparation of project application (Preliminary)**:** Preliminary application shall be prepared by the applicant. In line with the concept of 'Community Initiative', the applicant shall clearly declare that the applicant shall bear a certain percentage of the project cost of any form such as local material, local labor forces, locally available tools and equipment at minimal charges. Ten (10) percent of the total cost may be appropriate as may be practiced in other projects.

Submittal of the application: Application shall be submitted to MoTA through Marz. Due to the fact that MoTA at the central level is not provided with sufficient staff to handle the applications, then each Marz may be the coordinator between the applicant and the central government. For

transparency purposes, a copy of the application may be sent to MoTA directly.

Preparation of Preliminary Project Planning: Project planning shall need professional knowledge on landslide and civil engineering. MoUD, upon instruction from MoTA, shall provide the applicant with necessary technical and engineering advice to formulate preliminary project planning, including cost estimation for further consideration of the applicant on whether the applicant can afford to bear the cost as his input. The plan shall cover the overall program from investigation/researching to implementation, and shall consist of (1) short-term, urgent implementation (say, for 1-3 years), (2) medium term implementation (say, for 3-10 years), (3) long-term implementation (say, for 10 years or more). Prioritization shall be determined through participatory approaches. The WkC organized by the pilot project will be useful for this purpose.

Assessment of the application: MoUD shall assess the finalized application from the technical point of view.

Review Committee: MoTA as a 'powerful ministry[4]' within the present governmental framework shall organize an Review Committee consisting of MoTA, MoUD and MoNP including EMA and SCWS being merged into MoTA. The main purpose of the committee is for the transparency in selecting project sites. The committee may be organized by MoUD upon consent of MoTA.

Decision[5] for project selection and subsidy: MoTA as a 'powerful ministry' shall decide/endorse the project implementation based on the MoUD's recommendation, after having undergone a discussion with the Advisory Committee. At the same time, MoTA shall organize (or instruct the relevant organizations to organize) the funding arrangement (planning); based on which MTEF may be formulated by the relevant governmental organizations such as MoUD.

Geotechnical investigation and design: MoUD shall be responsible for geotechnical investigation/researching. The investigation program shall be prepared as implementation/project-oriented, not for academic-research-oriented (or investigation for investigation sake). Based on the investigation, MoUD shall be responsible for design works of the community infrastructure that will also be useful for landslide mitigation. The design shall be a scale within the capacity of the nation and the applicant who shall bear a certain percentage of the total project cost. It shall be borne in mind that improvement shall be realized step-by-step and within the resources/capacity available at present. Do not plan for unrealistic things which may only be realized in the future when more resources/capacity may be made available.

[4] This is based on the observation of the Study. The Master Plan does not necessarily endorse the present political mechanism.

[5] Such decision seems to actually be made by the higher level –i.e. the Prime Minister or the President, although the Master Plan does not necessarily endorse the present political mechanism

Procurement of contractor: A contractor shall be procured by either the Marz or applicant (CU, a community) as appropriate. Upon procurement, a tender announcement shall be placed in one or more local newspapers. Tender prices shall be opened in the presence of tenderers who wish to be present. All the procurement procedures shall be open to the Advisory Committee (to the public) at any time.

Technical advice and supervision: It was observed in past cases that civil works were not properly supervised by responsible parties, which resulted in the interruption of works half-way into the project's implementation as can been seen in the 69-km Landslide in Haghartsin of Tavush Martz and the Harutyunyan Street Landslide in Kapan of Syunik Marz, exposing ugly bear slope to the public for many years. MoUD should be responsible for technical advice and supervision of the implementation of civil works for community infrastructure improvement, which also useful for landslide mitigation. MoUD should also be responsible for supervision of works in progress.

An organizational framework for MoUD to pursue its responsibility will be proposed in the latter part of this report, as MoUD is not satisfactorily organized to perform its duties.

Advisory Committee: MoTA shall organize an Advisory Committee which shall consist of MoTA, MoUD, Marz, CU, relevant donor and NGO. The committee shall monitor the project activities from the viewpoint of: community participation, transparency of fund disbursement, technical suitability, progress and others as required.

Reporting: The applicant shall be responsible for reporting the completion of the project.

v) Time Framework for a project

One project shall be within an appropriate scale that can be implemented within the present budgetary, technical and social capacity of the RA. Considering that all unrealistically large scale projects had been left uncompleted, do not input surprisingly huge scales of investment into a small community, otherwise the society will be disturbed or may cause a social unrest. The Master Plan proposes three years to be the maximum time framework for one project.

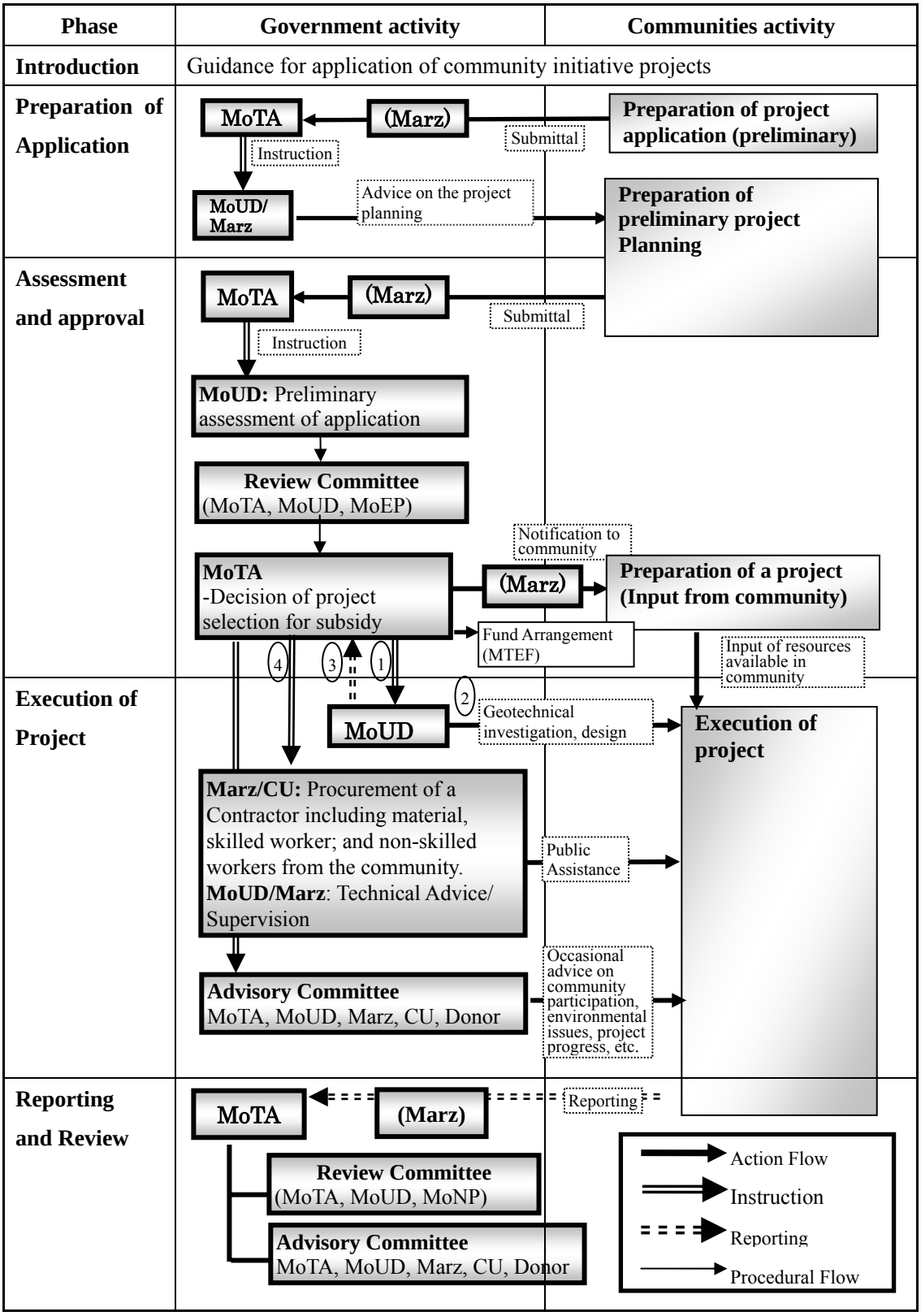
Preparation of Application**:** one to two months

Assessment and approval**:** one month

Execution of Project**:** half a year to three years for one project. If the first project is found to be effective and is worthy to be continued, the applicant shall make another application.

Reporting and Review**:** half – one month

Figure 4.5 Support Program for Community Infrastructure Development useful for Landslide Management



vi) Budgetary Arrangement

Presently, budgetary proposals for MTEF by the Ministries are made on supply-driven basis. For example, MTEF of MoUD is prepared by the ministry in such a way that small scales of investigation in many places are to be carried out. This seems to be no more than a supply-driven and politically appealing; rather than demand-driven and results-oriented fund arrangement. Instead, the Master Plan recommends that resources shall be concentrated in selected places to where inhabitants are eager to draw a strategy of selection and concentration based on demand-driven approach.

The MTEF budget arrangement for landslide-related projects shall be made on application-basis (i.e. demand-driven basis), so that the effective input of national resources can be realized.

In principle, the national fund shall be allocated as the community development shall be the first priority of the country. However, the relevant governmental organization, in particular MoTA, shall organize funding arrangements from various external organizations such as donors, foundations, NGOs and others.

(4) Enhancement of Subsidies (Long-Term Targets)

One-sided investments of capital from the central government could ensure that the communities remain dependent on the central government's constitution. This is not a sound basis for sustainable community development. Therefore the long-term targets of public assistance of finance are the enhancement of subsidies that do not specify use.

4.4.5 Attracting External Assistance - Basic Principle for Attracting Investments

It may be worthy to describe that the key words for attracting investments from external resources are: (i) Poverty, and (ii) Sustainability.

Amongst all the key words for attracting assistance from external resources such as donors, foundations and NGOs, the above two are the most important criteria for project selection. External resources will not tolerate seeing unmentioned, degraded things which the external resources assisted.

Besides, without 'sustainability', poverty may not be alleviated. 'Sustainability' therefore will be the topmost essential key words for drawing attention from external resources.

'Sustainability' is usually evaluated mainly by self-help effort by the beneficiaries themselves and continuous support by the government (public assistance) as a high priority subject though such effort may be minimal.

With this world-accepted notion, self-help actions and subsidy mechanisms are proposed.

CHAPTER 5 WIDE AREA INFRASTRUCTURE LANDSLIDE MANAGEMENT

5.1 Outline of Management Method

Implementing bodies responsible for wide-area infrastructure maintenance (government organizations or private companies) formulate and implement landslide management plans. Management authorities financially and technically support the planning and implementation activities.

Regarding landslide management undertaken by various implementing bodies and managing authorities, MoUD should coordinate these agencies to avoid overlapping and to improve efficiency.

To wide-area infrastructures not only direct damage is caused but also much indirect damage from the interruption of services and traffic. As a result, the influence on the state economy is also large. Therefore the state should identify the priority landslides and plan pre-disaster measures. Of the selected 12 priority landslides (see chapter 2), 8 are wide-area infrastructure landslides as shown in Table 5.1.

Table 5.1 Priority Wide Area Infrastructure Landslides

Landslide/ Community Name	Area (ha)	Potential Risk Objects of Wide Area Infrastructure
Kapan City Harutyunyan Street Landslide	15	600m length railway, 800m^2 area of detour of state main road M-2, (Kapan tunnel of M-2 road is bottleneck for large tracks traffic, and sure traffic of the Harutyunyan street is necessary).
Voghjaberd Village	287	18,000m^2 area of H-3 inter regional road, 8 bridges, wide area gas supply pipe etc.
Odzun (Tbilisi-Vanadzor Railway and Road)	1	100m length railway, 2,000 m^2 of state main road M-6
Haghartsin (Ijevan-Hrazdan Railway 69 km)	49	95m length railway, 120m length Agestev River.
Hovk Village M-4 Road 117 km	628	1,000 m^2 area of state main road M-4, 1 bridge
Yerevan Cemetery	11	5,000 m^2 area of state main road M-15
Geghadir village Toxicity Waste Reclaimed Ground	10	Pollution by cyanide in upper stream of Yerevan Capital City

The RA law doesn't clearly assign organizational responsibility for landslide management according to sector nor is the organization in charge of landslides clearly defined. For example, the Armenian Security Service is sometimes responsible for landslides from the crisis management viewpoint, while MoUD is sometimes responsible from the housing viewpoint. Responsible organizations are determined by 'Government Decisions' on an ad-hoc basis, which appears to result in inconsistent implementation of state policies.

And private companies also managed the wide area infrastructure such as railway, water supply, energy and gas supply, and communication systems.

Based on Government Decree No. 1074 accepted in 2001, the MoUD has been appointed as the general executing organization for the initial landslide management program. The section in charge of engineering surveys and protection of territory and facilities, which employs four engineers, is in the science and technology policy department of MoUD.

Wide-area infrastructure landslide management should include a wide-area infrastructure development strategy. Table 5.2 outlines the proposal for organizations responsible for landslides affecting various risk objectives. Regarding landslides managed by various implementing bodies and managing authorities, MoUD should coordinate information sharing and program adjustment.

Table 5.2 Recommended Managing Institutions

Risk Objects To be Protected	**Crisis Management**	**Division of TOR**	
		Plan and Finances (Project Owner)	**Entrusted Engineering Implementation Agency**
Railroads	Armenian Rescue Service (ARS) (MoTC cooperates)	MoTC	Ministry of Urban Development: MoUD
Interstate, Interregional, and Intercommunity Roads		MoTC	MoUD
Rivers	ARS (Ministry of Environmental Protection: MoEP cooperates)	MoEP	MoUD
Community Infrastructure, Community and Private Asset	Community (Supported by ARS, Ministry of Territorial Administration: MoTA and MoUD)	Community (supported by MoTA and MoUD)	Community (supported by MoTA, MoUD)

Regional government administration (Marzpetaran) has Department of Transportation and Communication, Environment Protection, Urban Development. MoTC, MoEP, MoUD and other related departments keep combination and correspond on related matters.

Detailed explanation of the knowledge management of landslide-related technologies is presented in Chapter 7.

5.2 Present Status for Role Allocation to Ministries

5.2.1 Ambiguity of Organization in Charge

When a large landslide affects important infrastructure, society becomes concerned. At such times, the various ministries or institutions in RA apply for a budget for the investigation, design

and construction of works whether or not they were in charge of the infrastructure.. There has therefore been an ambiguous demarcation in responsibility for landslide management.

5.2.2 Origin of Ambiguity Inferred

In the former police regime, ministries in the economic sector were generally considered as national companies rather than policy making political bodies. Policy making was a matter for the ruling party during that time. Consequently, assigning a mandate to ministries was based on technical or implementation abilities rather than on policy-making criteria. The RA Government Decision No.1074, 2001, that assigns to the MoUD the overall supervision of implementation and systematization of works related to the landslide primary countermeasures program, appears to be related to the above-mentioned sense of demarcation.

5.2.3 No Responsible Organizations Appointed – Rivers (an example)

Rivers may not be truly defined as infrastructure, but they are basic and important national systems and so should also be considered here.

Landslides sometimes block river flows resulting in the formation of natural dams. This can cause significant upstream flooding and major disasters downstream when the dams eventually fail and water gushes out. The Water Code, Article 91, prescribes that "The programs of protection of inhabited areas. Although MoEP may be the responsible governmental organization for river systems, it is not clearly defined in the Water Code.

Similarly, responsible organizations for other infrastructure are not clearly defined/mentioned in the laws. Accordingly, government decisions seem to have been issued on ad-hoc basis.

> **Recommendation**: Allocation of responsibility to relevant governmental organizations shall be defined in the laws, instead of responsibility being assigned on an ad-hoc basis by a 'government decision'.

5.2.4 Prevailing 'Sectionalism' - Water Gas Services (an example)

Water and gas pipelines as well as electric and communication lines, operated by the private sector, are also affected by landslides. Damage to gas pipelines during the Voghjaberd landslide was one of the most extensive damages ever observed. The ARM-GAS-PROM Company had to cope with all the damages alone, even though roads and water-pipelines were also affected. Separately, MoUD was assigned for a compensation/relocation program for damaged houses. No collaboration among

the responsible parties was reported in the case of Voghjaberd landslide, possibly because there was no government decision issued for such collaboration. 'Sectionalism' seems to be a consequence of the centralism of the prevailing political practices in RA.

Recommendation: All relevant institutions shall be called upon to cope with common disasters, such as the Voghjaberd landslide, with one representative institution for landslide management being entrusted with funding.

Another Example for 'Sectionalism' A 117 km Landslide on Yerevan-Ijevan Highway (M 4): A huge landslide (3 km long from the mountain) is damaging a 300 m stretch of the highway, probably due to the earth under-cut performed for the road improvement. The lower part of landslide is obviously active and the mass will possibly fill up a river running parallel below the road. Because the situation is considered serious and a simple countermeasure will not solve the whole problem, the Team proposed the formation of a technical commission consisting of relevant organizations. Nothing was done. Moreover, further earth under-cutting is being done for the repair of the damaged part, further destabilizing the landslide.

5.3 Landslide Control Measures for Infrastructure as Investment

5.3.1 Organization to be in Charge – MoTA for traffic facilities

Landslide control measures for maintaining roads, railways, and other traffic related infrastructure are primarily aimed at providing safe traffic conditions for passengers. Landslide control measures shall be considered as investments in the same way activities such as installing signals, renewing pavements, replacing iron railings, etc., are considered as investments. The feasibility of investing in landslide control measures shall be evaluated by Ministry of Transport and Communication (MoTC), the institution in charge of the infrastructure for this case. If the ministry has insufficient capacities in planning and implementing such landslide control project (in terms of such specific aspects as engineering, supervising the civil works, etc.), the ministry shall outsource those resources which are not available within the ministry to other public or private institutions, while retaining financial responsibility. It shall be noted that effective landslide management can only be accomplished by taking into account the sense of investment; i.e. feasibility of the investment. Organizations not in charge of the landslide-affected facility shall not be allowed to apply for budgets from the government.

Recommendation: The organization responsible for a public facility shall be responsible for landslide control measures for that public facility.

5.3.2 Managing Institutions Recommended

Taking into account the above-stated observation, managing institutions have been identified and recommended by the Study. The principles are:

- ARS in MoTA shall be responsible for crisis management of landslide disasters.
- The owner or organization in charge of infrastructure in danger from landslides shall be responsible for planning, financing and ensuring the protection of endangered infrastructures against the landslides.
- MoUD shall be responsible for all the engineering aspects of landslides affecting public infrastructures.

5.3.3 Over-Privatization of Technical Sections

Due to the rapid enforcement of privatization of governmental organizations, the Ministry of Transport and Communication had, until recently, no department responsible for roads or railways. Instead, the government-owned Closed State Joint Stock Companies which were in charge of operation and maintenance of the transportation related infrastructure, although there is no clear assignment to the company for policy making. Under this situation, responsibility for any issues was allocated between the ministry and company. Allocation of responsibility is unclear on who is responsible for policy making and who is responsible for policy execution. Although the Armenian Road Company was integrated into the Road Department in the Ministry of Transport and Communication at the end of 2004, similar 'over privatization' of technical sections are still observed in various governmental organizations.

MoUD has virtually no in-house engineers who can prepare technical plans, assess/evaluate technical proposals submitted by private companies, supervise implementation of various works by private contractors, evaluate the output of such works that the MoUD orders to implement, and so on.

Recommendation: Minimum engineering capacity has to be retained in governmental organizations for effective implementation, accountability, and the transparency required for public sector projects.

CHAPTER 6 CRISIS MANAGEMENT PLAN

6.1 Definition of Crisis Management

Stages of disaster management are classified into three, namely (1)a stage before the event (disaster), (2) a stage during/just after the event, and (3) a stage a certain period of time after the event. Actions are usually defined as (1) Mitigation, (2) Crisis (Emergency) Management and (3) Rehabilitation, respectively. The stage of Mitigation is sometimes divided into two stages as (1-1) Mitigation and (1-2) Preparedness. In reality, actions for Mitigation and Preparedness shall sometimes be made during the same period of time. Needless to say, human lives or structures may be lost or severely affected during a crisis stage.

In this Chapter, 'Crisis Management' during and just after a sudden disaster, is discussed.

6.2 Past Crisis Events Caused by Landslides in RA

The general landslide type with secular movement is not usually accelerated sharply in RA possibly due to dryer climate than in Japan where sudden landslides have sometimes occurred. In RA, only several casualties were reported over the last ten years; i.e. three causalities in Harutyunyan street landslides in Kapan, Syunik Marz; which possibly indicates the calmness of landslides in RA. Relocation before the landslides, either systematic or not, may also contribute to the fewer causalities recorded. In the history of RA, some tragic landslides have been reported. Sharp activation of a landslide in the Lernadjour river valley, Vanadzor in 1968 led to a disaster where that landslided-soil material covered the small village of Nerckin Kilissa totally and killed almost all inhabitants. Also, other chronicle records report many casualties by earthquake-induced landslides.

6.3 Outline of Crisis Management Plan

6.3.1 Community Landslides

Community public offices should organize the landslide monitoring team for the early detection of disaster signs. Community leaders warn and recommend evacuation of concerned inhabitants depending on the "index value (threshold)" of landslide monitoring, including precipitation levels, signs, etc. When disaster occurs, the safety and/or recovery of victims are done by the command of the head of community with support from the ARS, Marzpetaran, and local inhabitants.

6.3.2 Wide-Area Infrastructure Landslide Management)

Management organizations formulate the crisis management plan (landslide monitoring and warning, control of the use of facilities such as road closures for safety of users, system for restoration of facilities and system for providing alternative facilities) and implement landslide monitoring and regular patrol.

The heads of Marzes for interregional road and heads of the regional offices for other infrastructure of private companies, should direct the management organization staff patrol during emergency situations, limit the use of facilities, and notify ARS depending on the "index value (threshold)" for landslide monitoring, precipitations, and results of the patrol. The patrol, during emergency situations, should limit facilities use (install barricades on roads, etc.) jointly with the staff of the management organizations for wide area infrastructure and ARS.

When the landslide disaster occurs, the victims' protection and disaster recovery are led by a head of Marz command with the support of ARS, Marzpetaran, management organization staff and local inhabitants.

6.3.3 Technical support by MoUD and ARS

MoUD and ARS should provide technical support for the setting of the "index value (threshold)" for landslide movement, precipitation, and other signs of early warning, as well as recommendations on site evacuation and limitation on the use of facilities.

Some minor phenomena may be observed before rapid and abrupt movement of a landslide. Therefore, minimizing the level of disaster may be possible by implementing suitable crisis management measures.

Characteristics of crisis management for both community and wide area infrastructure landslide types and their appropriate crisis management methods are outlined in Table 6.1.

Table 6.1 Crisis Management according to Landslide Types

	Community Landslides	**Infrastructure Landslides**
Management organization	Community	Public Organizations, Private Companies
Purpose of Crisis Management	Evasion of personal loss Aid for victims	Evasion of personal loss Aid for victims Functional recovery at early stage
Main Means of Communication	Management of early warning and evacuation by community office and slide monitoring team Rescue and aid activities after disaster by community, supported by Armenian Security Service	Early warning and use limitation measures (risk avoidance) by management organizations with ARS Recovery of infrastructure or securing of alternatives

Notifying the ARS is the accepted means of correspondence in the event of community landslides. Because early detection and implementation of actions in the case of landslide activity is an important factor to avoid casualties, actions by local inhabitants are necessary. From this viewpoint, an early warning and evacuation system should be developed based on cooperation between the landslide monitoring team, community public office and ARS.

Index value such as landslide monitoring for early warning and evacuation should be set by technical public support (MoUD and Armenian Security Service) and policies shown in Table 6.2.

Official announcers of early warning and evacuation recommendations are the heads of communities for communities, and management organizations for wide-area infrastructures.

Index values should be reviewed to accompany the accumulation of data of precipitation and hazards.

Methods of setting the index values for early warning and evacuation recommendations are shown in the technical bulletin of landslide Volume 1, (December 2005), Appendix 7 Landslide Monitoring Manuals, and the Early Warning Manuals that the Study Team and MoUD have prepared jointly.

Table 6.2 Methods of Early Warning and Evacuation Recommendations

Index Value of Landslide Monitoring	- Early Warning; daily movement of 1 mm, monthly movement of 10 mm - Evacuation Recommendations; daily movement of 2 mm, monthly movement of 500 mm
Index Value of Rainfall Gauge	No reliable hazard database is available. Only daily precipitations at cities are available. According to Japan Meteorological Agency's analysis of 10 years sediment disasters, around 90% of disasters occurred in the cases of maximum modified accumulation rainfall index during 10 years. Therefore index values are set as follows: - Early warning index: 1/2 of maximum 24 hours rainfall for 10 years - Evacuation recommendation index: 2/3 of maximum 24 hours rainfall for 10 years

6.4 Essence of Crisis Management for Community Landslides

6.4.1 Early Caution and Quick Response

In most cases, there are pre-indications or omens of rapid landslide movement, which are usually observable. The most important issue in crisis management for community landslides is an early caution and a quick response. Even with less equipment or financial resources, communities have more site information, are ready to take early precautions, and are able to react immediately, if attentions are drawn to such pre-indications by periodical landslide monitoring/observations with proper but fundamental knowledge. For normal community landslide disasters, locally available resources–including landslide activities for monitoring/observations with proper but fundamental knowledge– are generally good enough to respond.

6.4.2 Autonomous and Self-Help Actions

An authorized textbook on disaster management in RA instructs people "To ask the local executive bodies to organize preventative measures" as soon as a real danger occurs. It takes time in general to mobilize more powerful institutions. In a disaster an autonomous and self-help countermeasure and rescue work by neighbors is essential for a fast response.

6.5 Essence of Crisis Management for Inter-Regional Infrastructure Landslides

6.5.1 Response with Powerful Equipment

Infrastructures are highly vulnerable to landslides. Even a landslide movement of a few centimeters may reduce or destroy their functions. The landslides affecting infrastructures are sometimes larger than those of communities because the slopes are very often precipitous with under-cutting. Therefore powerful earth moving equipment will be required for crisis management

once such landslides activate On the other hand, the probability of killing human lives is rather small because they are generally in less populated areas and traffic is not usually dense. Quick response for crisis management of infrastructure-related landslides may not be as essential compared to community landslides.

6.6 Importance of the Armenian Rescue Service (ARS)

The Armenian Rescue Service (ARS) is one of the military organizations that originated in the area of civil defense against air attack in residential and factory areas. It therefore has an effective structure able to cope with the top-down order system and to provide efficient operation during emergencies. On the contrary, local self-governments and institutions in charge of infrastructures do not have sufficient authority to mobilize local construction companies, other institutions and people, or sufficient potential of their own to cope with the occurrence of sudden landslides. Under such situations, it is rational in the short-term that the power-centralized ARS be appointed as an organization to deal with disaster management during landslide disasters.

6.7 Shifting from Crisis Management to Mitigation and Preparedness as Disaster Management

6.7.1 Comparison of Hazard Characteristic of Earthquake and Landslide

Hazards caused by a strong earthquake are normally more devastating than those caused by landslides. Though various ‘preparedness’ and ‘mitigation’ programs have been worked out and practiced, the risk level of earthquake hazards is still higher than that of landslides not only due to its devastating destructive power but also due to extraordinary expenses required to minimize damages. Because of this reason, ‘crisis management’ is still the essential activity for earthquakes. On the other hand, risks caused by landslide hazards are usually not so devastating, manageable to some extent; and countermeasure works are implementable within the resources available in the society.

6.7.2 Shifting From Post-event Management to Pre-event Management

- From Crisis Management to Mitigation/Preparedness -

To date only crisis management (post-event activities) has been performed by EMA as landslide disaster management. Limited resources have been invested for mitigation, including preparedness by infrastructure institutions. This is a cause of huge scale landslides which have damaged the major public infrastructures. Such larger landslides could have been prevented if mitigation and preparedness measures had been taken. Policy for landslide management shall be shifted from

Crisis Management to Mitigation and Preparedness.

Table 6.3 Comparisons of Hazard Characteristics of Landslide and Earthquake

	Landslide Hazards	Earthquake Hazards
Disaster areas	Limited area, community area	Relatively wide
Time to dangerous Event	Intermittent, relatively slow	Sudden; quick
Forecast	Mostly possible	Difficult
Countermeasures	Rich in variety, possible customization for each case	Reinforcement of building; earthquake-resistant construction or building
Cost performance	Possible to expect B/C;	Difficult to expect B/C; costly,
Possibility of countermeasures	Possible to implement concrete countermeasures	Difficult to implement concrete countermeasures
Investment or other aspects	Possible to upgrade fundamentals of a landslide in a community	Speculative

In the long-term, the Government should assign those national institutions and local self-governments for supervising infrastructures, such as roads or railways, to play a major role in landslide management.

In addition, for landslides affecting communities, prior countermeasures or investment may contribute not only to landslide management but also to upgrade fundamentals in a community.

6.8 Importance of Technology Expertise – Professional Engineers

ARS is currently in charge of crisis management. It therefore implements civil works such as removing earth and sand only for emergency cases. In other words, ARS is not ordinarily involved in landslide prevention works and therefore has limited technological expertise to generally control landslides. A secondary landslide could occur during emergency works implemented to remove earth and sand. These emergency works might often destabilize the landslide areas, causing secondary disasters.

Accordingly, when ARS carries out emergency earth removal works, professional advice has to be sought from organizations with technological expertise. Joint operation shall be recommended.

CHAPTER 7 PLAN OF TECHNOLOGY APPLICATION FOR LANDSLIDES

7.1 Introduction and Application of Practical landslide-related Technologies

MoUD collects new information on disasters, etc. in addition to technical materials provided by this study including landslide location maps, inventory and countermeasure examples. MoUD then disseminates this information through newsletters on landslide management and other technical bulletins, etc.

An important role of MoUD is the dissemination of technologies related to landslide management, which should be undertaken under existing conditions.

Table 7.1 outlines the results of the Pilot Projects and applied policies.

Table 7.1 Introduction and Application of Policies for Practical Landslide Management

Item	Community Landslides	Application Policy
	Landslide Monitoring	
Landslide Monitoring Equipment and Rain Gauge	The monitoring equipment was effectively used by the pilot projects and the early warning system has been formulated.	The early warning system will be continued and reviewed in one year. For applications excluding these pilot projects, installing such expensive monitoring equipment will be avoided, because maintenance is difficult for most communities.
Simple Movable Measuring Beam (Nuki-ita)	This was applied to pilot project sites and other sites such as the national road slope and MoUD budget investigation sites.	This method will be disseminated as a cheap, practical monitoring technique.
	Landslide Countermeasures	
Drainage	Open ditch with sub-drainage and horizontal drainage boring were conducted; the works mitigated landslides and improved muddy roads.	Newsletters, technical bulletins will be handed out, with the aim of sharing experiences.
Earth Works	Some examples of landslide recovery earthworks are only partially or improperly completed.	When earthworks were conducted at Kapan Harutyunyan pilot project, specialists guided the works to ensure its success.

7.2 Development of Information Services

7.2.1 Disclosing Technological Materials to Related Organizations

The Study has created a GIS-based landslide distribution map, which covers the entire territory of the RA and is more comprehensive than the previously available one. The map needs to be distributed to relevant organizations as a part of the technical bulletins on landslides in the RA and also should be available on the web.

MoUD continually provides technical support to the communities through the Department of Urban Development of Marzpetaran on appropriate landslide management.

Earthworks and water flow caused by wide area infrastructure development may cause new landslides. Planning and implementing organizations (government organizations and private companies) should use the landslide-related technical materials collected by MoUD for project planning, design and construction works.

Managing authorities have the responsibility for the projects and should guide the planning and implementing organizations. MoUD, as the responsible authority on the technicalities of landslides, should review the infrastructure development plans and provide guidance to correct these plans.

It is planned that these materials will be used in the "Millennium Challenge of Armenia": an inter-regional road and irrigation feasibility study to be commenced in 2006.

Examples of utilization of technical materials of this Study are shown in Table 7.2

Table 7.2 Utilization of Technical Materials of this Study

Governmental agencies	Examples of utilization
Ministry of Urban Development (MoUD)	- Establishment of policy for housing and land use
Ministry of Environmental Protection (MoEP)	- Establishment of policy for erosion prevention - Establishment of policy for preserving forestry
Ministry of Transport and Communication (MoTC)	- Inspection of roads or railways in landslide areas - Planning of construction or rehabilitation of roads
Ministry of Agriculture (MoAG) Ministry of Territorial Administration (MoTA)	- Planning of construction or rehabilitation of irrigation and water supply systems
Armenian Security Service under MoTA	- Preliminary training for emergency response - Planning of policy for emergency response
Educational institute, Crisis Management Institute under MoTA	- Education for knowledge and know-how for landslide

7.2.2 Dissemination of Information to the Public

The most distinctive cause of community landslides is watering without precaution. In this respect it is necessary to recognize the following:

- Viable land such as areas with shallow slopes and areas where water accumulates readily is often land affected by landslides;
- Watering and leakage of water significantly influences landslide activation in the RA in those areas where precipitation is low.

Education on natural disasters in the RA commences in the lower classes of schools and continues through society. While social concern for landslide damage is strong, improved information dissemination will further deepen understanding, and an approach to ‘living with landslides’ may be developed.

Table 7.3 shows public relations exercises that were conducted within the Pilot Projects. TThe continuation of these exercises by MoUD will increase the success of these Pilot Projects.

Table 7.3 Public Relations by MOUD

Item	Content
Newsletters Technical bulletins（Publication and Web site）	-Successful cases of landslide management within the Pilot Projects
Landslide physical model	-Educational materials for schools（Reorganization of landslide activity and watering）
Brusher for landslide management	- Notes for co-existing with landslides

The consultative object from the community viewpoint is assumed to be the urban development department of regional government administrations (Marzpetarans in Marzes and Yerevan City Municipality) and for important problems, MoUD should respond to reports through regional government administrations.

7.3 Policy Ultimately Aiming at 'Landslide Mitigation'

7.3.1 Purpose of Researches for Landslide Management – Purpose-Oriented Program

Since 1970s, landslide engineering has been plasticized in RA. The engineers tended to perform activities mainly for planning and investigation/research, sometimes rather academic-oriented. Implementation of civil works for landslide control based on such research has rarely been heard of, except for the case in Ijevan where an underground drain tunnel was provided.

Recently, a program was proposed in MTEF from preliminary assessment and investigation through to implementation; however, the program appears to be general, with no clear target of investigations and/or monitoring activities. In short, "research for research sake" seems to have been the main activities in the landslide engineering field.

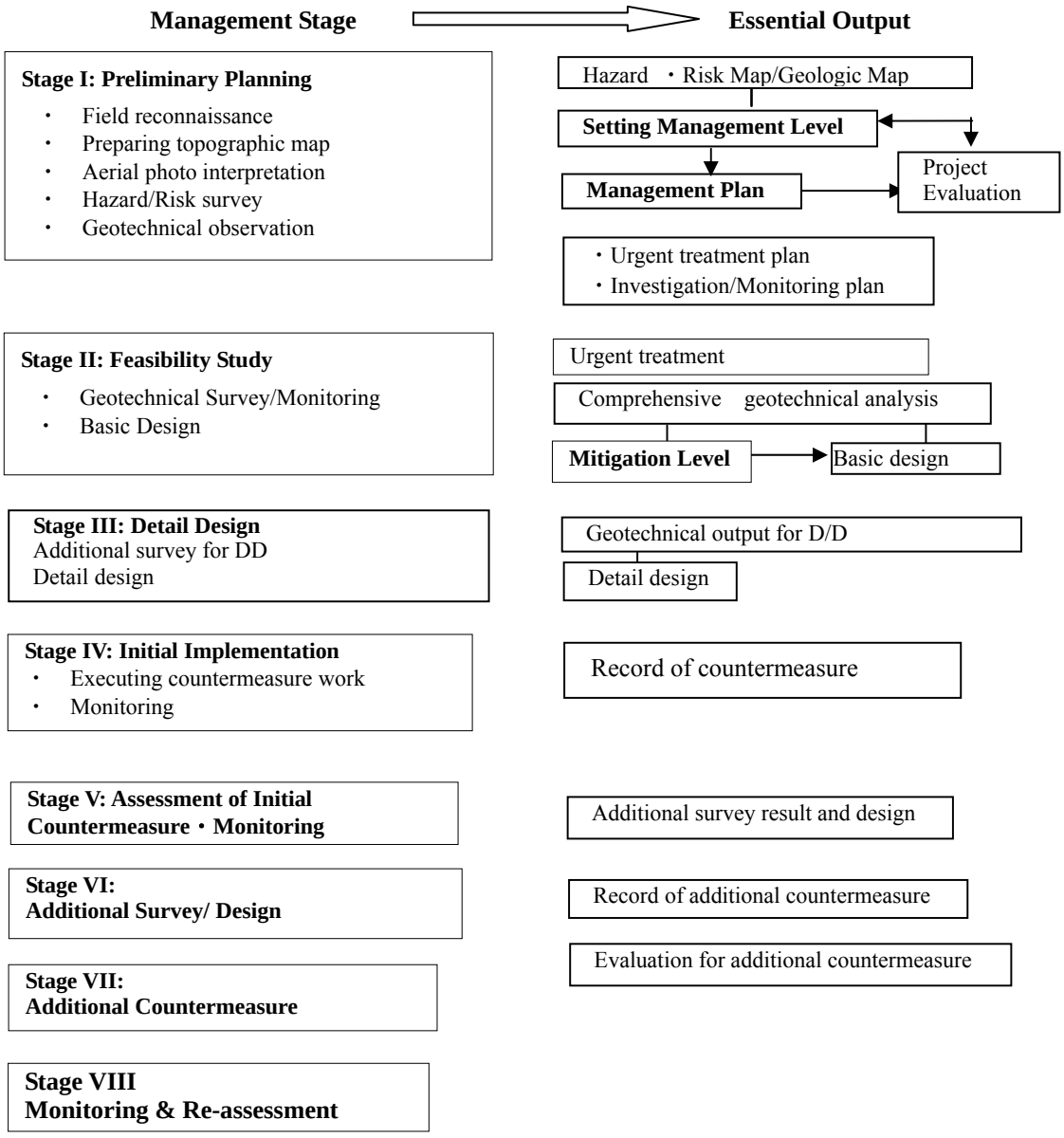
Recommendation: It has to be kept in mind that engineering research/investigations have to be purpose-oriented: landslide management. Activates in a program shall be worked-out for the realization of the pre-determined ultimate purposes for landslide mitigation.

7.3.2 Setting Clear Targets for Civil Works

As seen both in Harutyunyan Street landslide and the Railway 69 km landslide, civil works performed as recovery works from the landslide disasters, were not completed. This is partly because the final targets for the recovery works were not clearly defined from both socio-economic

and engineering points of view, though various factors were reportedly involved in those cases.

Table 7.4 Essential Output at Each Activity Stage



7.4 Framework for Practicing Landslide-Related Engineering

7.4.1 In-house Engineers or the Like – Consulting Engineers

It seems that the governmental organizations are over-privatized. Departments and/or sections in charge of engineering and civil works, in particular, have been separated from government as 'closed joint stock companies'; for example, MoUD's engineering section was privatized as a closed joint stock company 'Research Institute of Earthquake Engineering and Protection of Constructions'. As may be a result, in-house engineers are in a practical sense not available in MoUD. The over-privatization will not be preferable for:

accumulating knowledge and technology in a public organization in charge;

performing technical planning, technical review and supervision, technical evaluation for works being performed under the responsibility of the organization;

continuing engineering development.

On the other hand, privatization and decentralization is a world-wide trend that will continue for the time being. Under such conditions, an effective framework for engineering development for landslide mitigation shall have to be devised.

7.4.2 Introducing a Framework of Role Sharing

Presently, civil works appear to be conducted by 'total entrustment' where proper supervision– including quality control, progress control, and disbursement control– are not undertaken by the 'client – project owner', possibly due to lack of suitable personnel. A donor organization (WB) adopts a Project Implementation Unit (PIU) to handle the project, instead of the governmental organization in charge> Members of the PIU are selected by the donor.

For the case of a national project, a similar system has to be applied.

The proposed framework for project implementation shown below is being adopted world-wide. The key point is the participation of private firms of 'Consulting Engineers' who shall undertake all the necessary ToRs, on behalf of the project owner, for project implementation including primary field investigations and design, feasibility study; detail design including cost estimation, time scheduling, selecting contractors, and quality, progress, and disbursement control during the construction stage. A summarized Figure and Table are shown below.

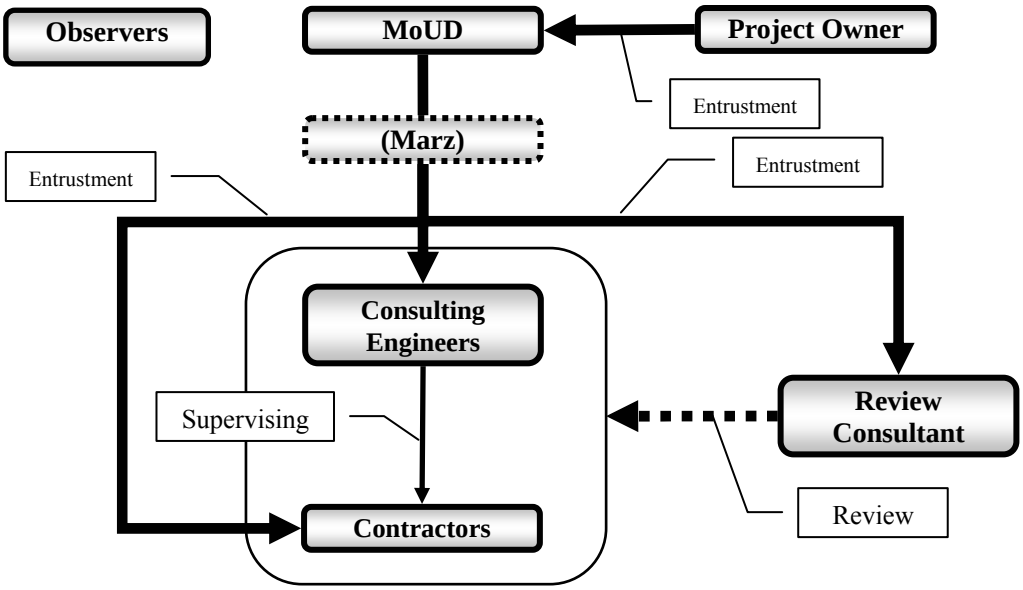


Figure 7.1 Framework of Project Implementation

Table 7.5 Allocations of Responsibilities for Landslide Civil Works

Actors	Obligation Recommended
Project Owners	- Project initiator for protecting of their risk objects under their responsibility
MoUD	- Engineering Policy Maker - Engineering Implementing Agency entrusted by each project owner
Marz	- Coordinating bodies between the central government and communities
Community	- Project owner for the community's territory
Consulting Engineers (Out-sourcing, Private sector)	- Alternative option for in-house engineers, - To be entrusted by MoUD, - In charge of practical planning of engineering aspects of, but not limited to: • Scientific researching , • Counter measure designing, • Time scheduling for construction • Cost estimating for construction • Civil works supervising for construction (Usually defined such three stages for a project as: feasibility study stage, detail design stage and construction supervision stage)
Review Engineer (Out-sourcing, Private sector)	- In charge of reviewing the performance of the consulting engineers
Contractors/Suppliers (Out-sourcing, Private sector)	- In charge of implementation of civil works or procurement materials
Relevant Organizations (Observers)	- Observers for transparency

7.5 Engineering Development

7.5.1 Introducing Essential, Practical and Manageable Engineering

There were numbers of capable engineers working together during the implementation of the Study. It was also experienced during the Study that engineers and governmental officers have great potential for absorbing knowledge and technology. The observations suggest that this potential has to be oriented towards the ultimate purposes of the landslide mitigation which is the development of the communities being affected by landslides. To do so, engineering shall be utilized as useful tools for the achievement of the ultimate purpose.

Engineers all over the world wish to apply advanced, state-of-the-art, and high-technology tools to their subjects. Although this is understandable, it has been observed that when such advanced high-tech tools have been installed, they have sometimes not been properly maintained, mostly due to lack of funds and/or 'maker-offered back-up services' available within the areas. Instead, in line with purpose-oriented engineering, essential but practical-and-manageable engineering tools backed up with professional knowledge have to be utilized first.

In the pilot projects performed during the Study, some simple but essential engineering devices were utilized. Those devices are relatively maintenance free and manageable even by people in the communities. Using such devices in Kapan city, a clear and persuasive picture of the current landslide conditions were presented to the working commission. Practical engineering solutions were then selected by the working commission. For Gosh and Martuni communities, monitoring activities of landslide movement are being performed by the people of the communities. These activities will be continued for landslide risk management.

As for other countermeasures, essential but practical-and-manageable measures shall be selected first. Proper water management -both surface water and groundwater- will be most essential as proved by the pilot project in Gosh.

Major devices for landslide investigations and monitoring are listed in the Table 8.3. Major types of countermeasures are listed in Table 7.6. Items recommended to be utilized at the initial stage are indicated in the tables.

Table 7.6 Landslide Observation Items and Monitoring Devices for Landslide

	Category	Sub-category	Means of Observation	Note
Landslide Movement Observation /Monitoring Equipment	Surface Movement of landslide mass	Inclinational movement	Inclinometer	-
		Lateral-ward movement	Extensometer	®
			Nuki-ita (movable beam)	®
			Movable post (Transit Survey)	-
			Movable post (Optical survey)	○
			Movable post (GPS survey)	○
	Sub-surface Movement of landslide mass	Inclinational Movement	In-Borehole Inclinometer (with built-in measuring device)	-
			In-borehole Inclinometer (without built-in measuring device)	-
		Lateral-wards Movement	Subsurface extensor-meter	-
			Multi-layer movement meter	-
			In-borehole strain-gauge	®
	Hydrology	Water pressure	Ground water level gauge	®
			Pore pressure gauge	-
		Climate	Rain gauge	®
			Snow gauge	-
	Movement of Structures	External forces	Soil pressure meter	-
			Load cell	-
		Internal forces	Strain gauge	-
			Rod stress gauge	-
		Displacement	Inclinometer	-
			Inner-structure Inclinometer	-
	Ground water drainage effect		Water flow meter	®

®: Recommended for the initial stage of landslide monitoring (manageable by COMMUNITY, once installed)
○: Recommended, but inputs of experts are needed.

Table 7.7 Countermeasures for Landslide Prevention/Mitigation

Category	Purposes	Countermeasures			Note
Mitigate Measures	**Reducing Rain (water)-origin influences**	Drainage	Surface water		®
			Groundwater	Under drainage	®
				Lateral Borehole	®
				Drainage well	
				Drainage Tunnel	
		Slope Surface Protection	Vegetation		®
			Motor-spray, Concrete-spray		
			Pitching (Masonry)		®
			Concrete-, Concrete block- Pitching		
			Concrete Frame-works		
Preventive Measures	**Controlling (Reducing) Moving Forces**	Earth moving			®
		Retaining Wall			®
		Anchor Works			
		Pile Works			
		Shaft Works			
		Tow Embankment			®
Preventive and Mitigation Measures		Gabion Works			®
®: Recommendable for Landslide control (manageable by community)					

7.5.2 Applying Advanced Engineering Tools and Design

There are attractive advanced engineering devices and tools which are sometimes very powerful and persuasive. On the other hand, they sometimes require “maker-offered technical services” and “special spare parts”. Due to lack of sufficient support systems available in regions, many are seen un-maintained and unused. This has to be taken into account when the organizations in charge consider the introduction of advanced engineering tools.

Similarly, there are many types of countermeasure works for landslide management, such as pile works, shaft works, anchor works, etc., which usually cost a huge investment and need expensive continuous maintenance works.. These points have to be again taken in to account when those countermeasures are to be introduced.

It was suggested in the explanation of DMC that “ the society should take only actions for which the techniques and financing are available in that society, and which can be performed within the capacity of the society at a given stage. Further actions for up-grading disaster management are left for the society to develop. A chain/cycle of actions shall form the desirable DMC to improve the disaster management step by step, time to time; corresponding to the development and the

requirement of the society". (If this is a direct quotation from the DMC, maybe you shouldn't change it)

7.5.3 Enhancing Capacity in Practical Engineering

Most specialists and engineers related to landslides in RA are currently middle-aged or older. Younger successors in landslide-related technological fields seem to have insufficient practical experience and knowledge. As mentioned previously, approaches to landslide problems have been rather academic and research oriented. Practical engineering that can be applied with essential but practical and manageable knowledge and tools shall be enhanced. This practical engineering shall definitely be required not only for public infrastructure-related landslide management but also for the development of communities affected by landslide movement.

The following plans are to be considered:

- Application for Technical Assistance from Overseas Donors
- Participation in International Landslide-related Projects

For example, the Armenian International Contractors Association (NGO) offers some seminars or instructions for Armenian contractors to assist them in their participation in international bids for construction projects in foreign countries.

7.6 Utilization of GIS based Landslide Location Maps

In RA, important basic data, e.g., topographic maps, monitoring-records and reports, all needed for landslide management, are scattered among various organizations, and have been kept individually and separately by each organization. Even, digitized information, though more interchangeable than paper-based data, are not available, not only to the public but also to relevant organizations. Worse, each responsible organization individually prepares a budget for its own GIS and creates GIS data. This is one of the fundamental issues to be improved immediately.

Information held by the relevant organizations shall be open to the public. Similarly, the GIS-based landslide distribution map the Study Team prepared shall be available for public use. The GIS data prepared by the JICA study team shall be utilized as follows:

Table 7.8 Utilization Plan of JICA-created Landslide GIS Data

Ministries	Plan of Utilization
MoUD	- Distribution of the GIS data to related organizations - Information/technical services to other organizations - Updating and maintenance of the GIS data - Planning policy for housing
MoEP	- planning of soil-erosion protection, foresting, etc.
MoTC	- Monitoring critical points along infrastructure - Planning policies
ARS	- Simulation of emergency relief or rescue, - Planning disaster preparedness

Due to privatization, MoUD does not have the capacity within the organization to update the GIS data. Updating and maintenance of the GIS shall be outsourced to private sectors that have sufficient capacity to do so. It is necessary to consider the establishment of an Armenian GIS consortium among GIS-related organizations, not only for landslide issues but also for other activities.

7.7 Information, Education and Communication to be undertaken by MoUD

7.7.1 Necessity of Services

The Government has rarely ever given information/technical services to the public even for communities that suffer from landslide hazards. EMA only instructs the public to let them (authorized organizations in central level) know when disasters emerge. This has hampered quick responses to impending disasters, and even rendered the public dependent and passive. As a result of both the lack of practical knowledge and information on the landslides, and the passivity and dependence of the people, the people are indifferent about improper water management in the lands they live on, which may trigger hazardous landslide events.

In line with the concept of community initiative landslide management, the public shall be given information and technical services for their own daily precautionary actions, and for responding actions when disasters emerge.

Information and technical services are essential for all the sectors dealing with public infrastructures that may be located on landslide areas.

7.7.2 Possible Measures

(1) Issuing of landslide-related newsletters

As a short-term measure, issuing of periodic (monthly) newsletters is recommended. MoUD shall be

the main actor in collecting manuscripts, editing and/or distributing them.

Copies of a newsletter will be delivered by Community Unions or sent directly to leaders in the communities by postal services. In the near future, the distribution shall be made through the Internet. The newsletter may primarily cover the following subjects for the communities or the people in landslide areas:

- To let the communities know the governments' plans/policies on landslide disasters and its current activities and topics;
- To provide scientific knowledge and technical advice on landslide mitigation efforts that can be made by the communities themselves;
- To exchange/share communities' experiences and/or knowledge for mitigation of landslide hazards among all the relevant organization; and
- To exchange opinions or ideas about landslide issues between the government and a community, or among the communities. Such opinion/information exchange shall be open to public.

For the time being, the government (MoUD) shall cooperate with other institutions such as NGOs that publish newsletters for communities or shall install communication boards in each village. The government (MoUD) shall also consider using a space of an existing nationwide or local newspaper such as the Agronews, or a newspapers issued periodically by a NGO in Dilijan to villagers participating in DCU.

(2) Building of a Landslide-related Internet Website

In the future, the contents of a newsletter shall be shown on the Internet. These will be helpful for the people and communities. The newsletters shall be delivered by e-mail, and the communities or the government in charge of landslide issues can exchange information using Internet technology such as a bulletin board function. Using the Internet, the cost and distribution time for the newsletters will be reduced.

To realize a digital/electric information exchange system instead of paper (analogue) media, it should be considered to link the community-landslide management with other Internet-related projects such as the "One Computer for One Village" project that is being planned by the Agropress. Agropress SCJSC issues a newspaper "Agronews" once per 10 days, and at least one free copy of it is delivered to each village in RA. This newspaper (project) is financially assisted by USDA.

(3) Publication of a Landslide Technical Bulletin

Publishing an annual landslide-technical bulletin (magazine) will contribute to the development of the scientific/engineering/technological fields in RA. The “Earth Science” being published three times per year by NAS is the only one scientific magazine, which is rather academic and scientific, that has been developed in RA. It is necessary to have engineering information that is practical and applicable for the landslide management fields.

To exchange and integrate experiences and practical technologies of landslide-related engineering, the landslide technical bulletin will be useful and valuable for specialists working in landslide scientific/engineering fields.

In addition, enhancement of capacity of the specialist via the technical bulletin is indispensable to strengthen a support system for community-initiative landslide management in terms of Mutual Assistance and Public Assistance

CHAPTER 8 INITIAL ENVIRONMENTAL EVALUATION (IEE)

8.1 Scoping and Action policy

The proposed master plan was evaluated using the JICA Guidelines for Environmental and Social Considerations (2004), and the relevant laws, regulations and guidelines in the RA.

Table 8.1 outlines the results of scoping of expected impacts and assumed mitigation measures.

Table 8.1 Summary of Impacts due to Master Plan Execution (Negative/Unknown Impacts)

Name of Cooperative Project		**Study of Landslide Disaster Management in the Republic of Armenia: Master Plan**		
Likely Impacts	Rating	Impact severity	Methods used for prediction	Assumed mitigation measures
Land use and utilization of local resources	C/-	Depends on the form of use, and whether landslide will be activated or settled down.	Landslide Investigation	Earthworks and drainage measures are necessary to increase landslide safety factor.
Local conflicts of interests	C/-	There is a possibility of violating the resources of the people concerned.	Confirmation at stockholder meeting (advisory committee)	Understanding, collecting opinions by notification and project conferences and correspondence.
Water Usage or Water Rights and Rights for Common	C/+-	There is a possible influence during earthworks, such as underground water level decrease and water quality pollution. Influence may remain after earthworks.	Hydraulics, water quality investigation	-Consensus among stockholders meeting -Application of alternative water resources -Purification facilities -Well installation
Sanitation	C/+-			
Groundwater	B/-			
Water Pollution	C/+-			
Noise and Vibration	B/-	There is a possibility of temporary noise and vibration during earthworks	-Household investigation in vicinity of construction. Generation of vibration and noise results in confirmation of work type and construction machinery.	-Limitation of time for construction -Movement of construction location
Note: Rating Criteria: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown. +: Positive impact is expected. - : Negative impact is expected.				

8.2 Procedure of Environmental Evaluation

Implementing bodies on landslide management (communities and management organizations for wide-area infrastructure) should evaluate the environmental impacts and undertake a study of the mitigating methods under the guidance of the Department of Environmental Protection of Marzpetaran.

In communities, the following methods are proposed for information dissemination for stakeholders:

- Newsletters and bulletin boards (community facilities, Marzpetaran)
- General assembly (meeting of heads of families) held as stakeholders meeting.

Marzpetaran calls for the regional stakeholders meeting to gather and consolidate opinions for revising the implementing body's ideas on environmental assessment, and proposed actions against the negative environmental impact of the landslide management measures. Participants in the stakeholders meetings are the implementing bodies on landslide management (communities, management organizations for wide-area infrastructure), Marzpetarans, ARS in the regions, heads of communities, and the Community Unions in the regions. MoEP and management authorities are called to participate when important environmental problems are considered.

Marzpetaran reports the results of the regional stakeholders meeting to the management authorities and to MoEP. They review the report and provide appropriate guidance to the implementing body for landslide management through Marzpetaran.