No.

MINISTRY OF BORDER AFFAIRS

JAPAN INTERNATIONAL COOPERATION AGENCY

PREPARATORY SURVEY FOR THE INTEGRATED REGIONAL DEVELOPMENT FOR ETHNIC MINORITIES IN THE SOUTH-EAST MYANMAR

FINAL REPORT

- MAIN REPORT -

OCTOBER 2013

RECS INTERNATIONAL INC.
NIPPON KOEI CO., LTD.
ORIENTAL CONSULTANTS CO., LTD.

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Abbreviations

AC	Asphalt Concrete
AD	Assistant Director
ADB	Asian Development Bank
ADB	Agricultural Development Bank
ADRA	Adventist Development & Relief Agency
AEC	ASEAN Economic Community
AFXB	Association François-Xavier Bagnoud
AIT	Asian Institute of Thailand
AMW	Auxiliary Mid-wife
ASEAN	Association of South East Asian Nation
AXM	Auxiliary Mid-wife
BAJ	Bridge Asia Japan
BC	British Council
BDS	Business Development Service
BGF	Border Guard Forces
BIM	Burnet Institute Myanmar
BMWEC	Burmese Migrant Workers Education Committee
BOT	Build, Operate and Transfer
BPHWT	Back Pack Health Workers Team
CARE	CARE International
CAD	Computer-Aided Design
CAM	Computer-Aided Manufacturing
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CCD	Convention to Combat Desertification
CDA	Community Development Association
CDC	Community Development Committee
CEO	Chief Executive Officer
CHEPP	Community Health Education and Prevention Program
CHW	Community Health Worker
CIDKP	Committee of Internally Displaced Karen People
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMP	Cutting, Making and Packing
CNC	Computer Numerical Control
CSO	Central Statistical Office
CWS	CWS-Asia/Pacific
D/A	Documents Against Acceptance
D/P	Documents against Payment
DDA	Department of Development Affairs
DEM	Digital Elevation Model
DEP	Department of Electric Power
DFID	Department for International Development
DHPDI	Department of Hydropower Development Implementation
DHPESE	Department of Hydropower Planning and Electric Supply Enterprise
DMH	Department of Meteorology and Hydrology
DKBA	Democratic Karen Benevolent Army
DOA	Department of Agriculture
DP	internally displaced person
DRD	Department of Rural Development
EGAT	Electricity Generation Authority of Thailand
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EL	Elevation
ER Bed	Emergency Room Bed
ERIA	East Asia ASEAN Center
ESE	Electric Supply Enterprise
ESZ	Environmentally Sensitive Zoning
EU	European Union
F/S	Feasibility Study
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FESR	Framework for Economic and Social Reform
FIRR	Financial Internal Rate of Return
FRP	Fiber Reinforced Plastics
FTZ	Free Trade Zone
GAD	General Administration Department
GAO	General Administration Office
GDP	Gross Domestic Product
GED	General Education Development
GED	General Educational Development
GIS	Geographic Information System
GMS	Greater Mekong Subregion
GOM	Government of Myanmar
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
HAI	HelpAge International
HDPP	Department of Hydropower Planning
HIV	Human Immunodeficiency Virus
HPGC	Hydro Power Generation Corporation
HPGE	Hydropower Generation Enterprise
ICD	Inland Container Depot
ID	Irrigation Department
IDP	Internally Displaced Person
IFRC	International Federation of Red Cross
IHA	International HIV/AIDS Alliance
IHLCS	Integrated Household Living Conditions Survey in Myanmar
INGO	International Non-Governmental Organization
IOM	International Organization for Migration
IP	Implementation Plan
IT	Information Technology
ITC	Industry Training Center
ITTA	International Tropical Timber Agreement
IWT	Inland Waterway Transport
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
JIFFA	Japan International Freight Forwarders Association
JIPS	Joint IDP Profiling Service
JIT	Just In Time System
JOGMEC	Japan Oil, Gas and Metals National Corporation
JPNA	Joint Peace-building Needs Assessment
JV	Joint Venture
KBC	Kayin Baptist Convention
KDHW	Kawtholei Department of Health and Welfare
KED	Karen Education Department
KESAN	Karen Environment and Social Action Network
KMHC	Karen Mobile Health Clinic
KNLA	Karen National Liberation Army
KNLA-PC	Karen National Liberation Army-Peace Council
KNU	Karen National Union
KORD	Karen Office of Relief and Development

KRC	Karen Refugee Committee
KWO	Karen Women's Organization
KYO	Karen Youth Organization
L/C	Letter of Credit
LTP	Long Term Plan
LUMC	Land Use Management Committee
MANA	Myanmar Anti‐Narcotics Association
MARPOL	International Convention for the Prevention of Pollution from Ships
MCHP	Maternal and Child Healthcare Program
MCP	Medical Care Program
MEB	Myanmar Economic Bank
MEPE	Myanmar Electric Power Enterprise
MHEP	Minmahaw Higher Education Program
MIMU	Myanmar Information Management Unit
MLF	Ministry of Livestock and Fisheries
MNP&ED	Ministry of National Planning and Economic Development
MOAI	Ministry of Agriculture and Irrigation
MOC	Ministry of Cooperative
MOC	Ministry of Construction
MOE	Ministry of Energy
MOECAF	Ministry of Environmental Conservation and Forestry
MOEP	Ministry of Electric Power
MOH	Ministry of Health
MPC	Myanmar Peace Center
MOI	Ministry of Industry
MoU	Memorandum of Understanding
MPA	Myanma Port Authority
MPSI	Myanmar Peace Support Initiative
MRCS	Myanmar Red Cross Society
MSI	Marie Stopes International
MSLE	Myanmar Small Loan Enterprise
MTSAT	Multifunctional Satellite Image
MTZ	Myawaddy Trade Zone
NATALA	Progress of Border Areas and National Races Department
NCEA	National Commission for Environment Affairs
NESDB	National Economic and Social Development Board of Thailand
NGO	Non-Governmental Organization
NMSP	New Mon State Party
NO	Nursing Officer
NPA	Norwegian People's Aid
NRC	Norwegian Refugee Council
NRF	Protected Public Forest
NSA	Non-State Actor
NSDS	National Sustainable Development Strategy
NTU	Nephelometric Turbidity Unit
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OVOP	One-Village-One-Product
P/O	Purchase Order
PA	Protected Area
PBANRD	Progress of Border Areas and National Races Department
PCCI	Philippine Chamber of Commerce and Industry
PDSG	Peace Donor Support Group
PES	Payment for Environmental Service System
PHS	Public Health Supervisor
PIC	Planning and Implementation Committee
PO	Parliament Office
POPs	Stockholm Convention on Persistent Organic Pollutants
PPF	Nature Reserved Forest
PPP	Polluter Pay Principle
pre-F/S	Preliminary Feasibility Study
pre-EIA	Preliminary Environmental Impact Assessment
PRI	plexus rectales inferiores
PSI	Population Services International
PTA	Parent-Teacher Association
PVC	Polyvinyl Chloride
PWD	Public Works Department
RC	Reinforced Concrete
REC	Returnees Empowerment Center
RF	Reserved Forest
RHC	Rural Health Center
RHSC	Rural Health Sub-Center
SC	Steering Committee
SC	Save the Children
SDC	State Development Committee
SDC	Swiss Agency for Development and Cooperation
SDF	Skills Development Fund
SE Myanmar	Southeast Myanmar
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SGO	State Government Office
SHC	Station Health Center
SIDA	Swedish International Development Cooperation Agency
SLRD	Settlement and Land Record Department
SME	Small and Medium-sized Enterprise
SMI	Small Medium Industry
SRTM	Shuttle Radar Topography Mission
SSB	Single Side Band
STD	Sexually Transmitted Diseases
STP	Five-Year Short Term Plan
STS	Sub-Township
SVA	Shanti Volunteer Association
TBA	Traditional Birth Attendant
TBC	The Border Consortium
TDAC	Township Development Assistant/ Support
TDC	Township Development Committee
TF	Total Factor
THA	Township Health Assistant
THO	Township Health Officer
TICA	Thailand International Cooperation Agency
TOT	Training-of-Trainers
TS	Township
TVET	Technical and Vocational Education and Training
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFC	United Nationalities Federal Council
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
UNICEFF	United Nations Children's Fund
VBDC	Vector Borne Disease Control
VT	Village Tract
WASH	Water And Sanitation for Health
WC	World Concern Myanmar

WFP	World Food Programme
WHO	World Health Organization
WRUD	Water Resources Utilization Department
WV	World Vision
YESB	Yangon Electricity Supply Board
YF	Yinthway Foundation

Unit of Measurement

Area	
m^2	square meter
km^2	square kilometer
acre	acre (= 4,047 m^2)
ha	hectare (= 10,000 m^2)
ft^2	square feet
Length	
mm	millimeter
cm	centimeter
m	meter
km	kilometer
in, “	Inch (=2.54 cm)
ft, ‘	feet (=12 inch or 30.48 cm)
yd	yard (= 3 feet or 0.9144 m)
mi	mile (= 1,760 yard or 1,609 m)
Weight	
kg	kilogram
t	ton (=1,000 kg)
Volume	
l	liter
m^3	cubic meter (= 1,000 liter)
MCM	million cubic meter

Time	
sec, s	second
min	minute
h, hr	hour
d	day
Energy	
V	volt
kV	kilovolt
kWh	kilowatt-hour
GWh	gigawatt-hour
MW	megawatt
VA	volt-ampere
MVA	mega volt-amper
Other	
%	percent
degree	degree Celsius
p.a.	per annum
knot	= 1,852/3,600 m/s
mph	mile per hour
Hpa	hectopascal
FEU	Forty-Foot Equivalent Unit
TEU	Twenty-Foot Equivalent Unit
DWT	Dead Weight Tonnage

Currency

JPY	Japanese Yen
Ky., MMK	Myanmar Kyat
US$	United States Dollar

CHAPTER 1 INTRODUCTION

1.1 Background

1.1.1 Study background

(1) Political background and JICA policy

The Union Government of Myanmar, under the new administration established in March 2011, has been pursuing policies for democratic governance and economic liberalization. Along these policies, the Government has been making further efforts to promote peaceful relationships with ethnic minorities constituting in fact substantive part of the Myanmar society, recognizing the conciliation with the ethnic minorities is an essential condition for the social stability and national integration.

Respecting these policies and associated measures taken by the new administration, the Japan International Cooperation Agency (JICA), the official agency for development assistance of the Japanese Government, has reviewed its cooperation policy with Myanmar, and started renewed efforts to support the people and the Government of Myanmar, focusing first on areas to meet the basic needs of the Myanmar people.

The JICA's support for ethnic minorities in Myanmar focused initially on the northern area of Shan State, but expansion of supports to other ethnic minority areas has been contemplated by JICA. This policy change reflects the recognition that the development of border areas where ethnic minorities live would be indispensable for the social stability and economic development of the Country as a whole. In fact, these border areas have high development potentials, taking advantage of relationships with neighboring countries.

The Union Government of Myanmar reached a cease fire agreement in January 2012 with the Kayin National Union (KNU) after the 63 year long conflicts. Following this, it is expected that large number of refugees in the border areas with Thailand and internally displaced persons (IDPs) will be coming back to settle in the Kayin State, where the KNU activities are based.

(2) Initial JICA study for Kayin and Mon States

To seek possibilities to support the return and settlement of the refugees and IDPs, JICA conducted a basic study to collect information and confirm development needs related to the supports of ethnic minorities in Kayin State and Mon State. The study has found out that (1) high development potentials may be realized in this border area, taking advantage of the east-west economic corridor with Thailand if the social stability is restored, and (2) complementary development between Kayin State and Mon State may be realized to contribute to the national integration of Myanmar.

In Kayin State, however, basic infrastructure including road network is very poor, and to facilitate the return and settlement of refugees and IDPs, access to settlement sites and basic infrastructure need to be much improved. Also, to secure livelihood opportunities for returnees, various economic activities need to be promoted by using rich local resources in both states. To meet these needs together, it is effective to support the integrated regional development for Kayin and Mon States together.

(3) Regional development policy and plans of Union Government

The Union Government of Myanmar prepared a long term national development plan for 2000/01~2030/31, called the Grand Plan. Under the new administration, the Ministry of National Planning and Economic Development (MNP&ED) has given directions to Ministries and State and Region governments to prepare five-year plans and annual plans in line with the Grand Plan. The Kayin and the Mon State governments have prepared their respective five-year plans. The Kayin State plan has been approved by the State government. Both plans may be modified through their integration into the National Plan and its approval at the Parliament.

The Union Government, under its localization policy, has given directions to State and Region governments to prepare reform plans complementary to the respective five-year plans as part of the economic structure reform in response to economic globalization. In preparing the reform plans, the State and Region governments are expected to effect a bottom-up approach for people-centered development. Specifically, a series of workshops should be conducted at different administrative levels with the participation of stakeholders including private businesses to examine existing conditions and needs and to reflect them in respective development plans.

According to the Sate of Union address by the President, such a participatory approach to development planning constitutes initial part of the revision of the long term national development plan also by the bottom-up approach. Eventually, the 20 year plan for national development will be prepared for the period up to 2030/31.

(4) Security conditions and measures

Following the cease fire agreement with KNU in January 2012, the President took the initiative for formal political dialogue with KNU starting in April 2012. In the process, the establishment of KNU liaison offices to support the returnees has been started in and around Kayin State.

By the Presidential Decree of October 2012, the Myanmar Peace Center (MPC) has been officially established to coordinate support activities for ethnic minority areas. The MPC activities are planned in two phases. Activities during Phase 1 from November 2012 to February 2013 include 1) cease fire negotiation and agreement, 2) peace negotiation and political dialogue, 3) coordination of support activities in conflict-affected areas, 4) promotion of understanding of peace process by people, and 5) counter-land mines measures. Phase 2 will follow for March 2013 through August 2014.

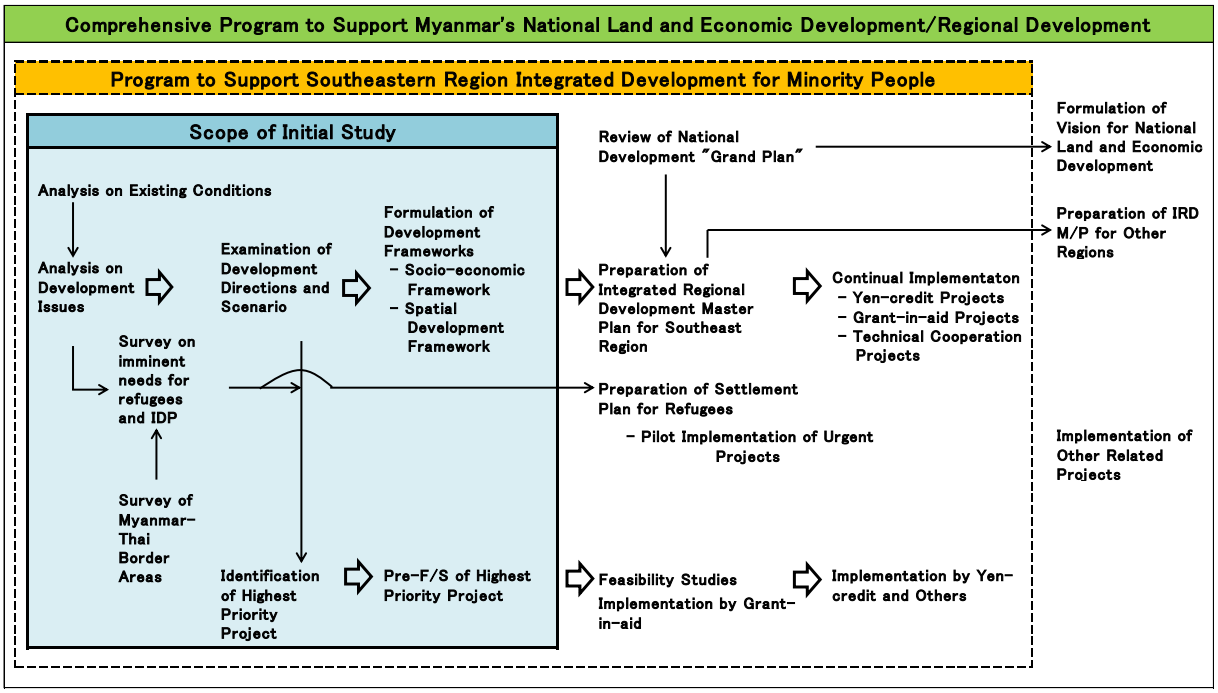
1.1.2 Study overview and Study objectives

(1) Overview of study scope

With the background outlined above, JICA has decided to extend further cooperation for supporting ethnic minority areas, focusing on Kayin and Mon States. As the first step, an initial study (the Study hereafter) was commenced to examine existing conditions and development issues related to return and settlement of refugees and IDPs, and to formulate specific measures to support the integrated

regional development of the two states and return and settlement of refugees and IDPs in line with the regional development.

The initial study constitutes the first step of a comprehensive program to support the regional development of Kayin and Mon States, which may be further extended to other ethnic minority areas. Possible scope of the comprehensive program and the scope of works of the initial study are illustrated in Figure 1.1.



Source: JICA Study Team

Figure 1.1 Overview of Comprehensive Program to Support Ethnic Minorities in South-east Region of Myanmar

(2) Study objectives

Objectives of this initial study are defined as follows:

(a) To clarify directions of regional development of the Southeastern region of Myanmar consisting of Kayin and Mon States to realize full potentials, and define the scope of works for subsequent integrated regional development master planning;
(b) To conduct a pre-feasibility study of highest priority infrastructure project to be identified for its early realization by JICA support; and
(c) To identify needs related to basic infrastructure facilities and livelihood activities to support return and settlement of refugees and IDPs.

1.1.3 Study area: Southeast Myanmar

(1) Definitions

The Study Area for this initial study is mainly the combined jurisdiction of Kayin and Mon States, which is called here as the Southeast Myanmar.

National policies and plans related to regional development, localization and other related aspects will be examined as prerequisites for conceiving development directions of the region. To examine

position of the Region in the national land and socio-economic development, the Study may examine relationships with neighboring countries and regions as well. In particular, relationships with Thailand will be examined as they relate more directly to the regional development of the two states. Limited field surveys in the border area of Thailand coterminous with Myanmar will be conducted as well as discussions with related agencies of the Thai Government.

(2) Characteristics

To examine characteristics of the Southeast Myanmar, Kayin and Mon States are compared with the neighboring Kayah State and Tanintharyi Region, and the larger Southeast Myanmar consisting of the three states and the region as well as Myanmar as a whole by selected socio-economic indices (Table 1.1). The Southeast Myanmar as a whole has the land area accounting for 14.4% of the national land, but the population corresponding only to about 10% of the national population.

Table 1.1 Comparison of Three States and Tanintharyi Region in Southeast Myanmar and Myanmar by Socioeconomic Indices

Index	Unit	Myanmar	Southeast Myanmar				
			Kayah	Kayin	Mon	Tanintharyi	SE Myanmar
Land area	km^2	676,578	11,670	30,383	12,155	43,328	97,536
Population (2009)	1,000	59,130	351	1,794	3,106	1,691	6,942
Population density (2009)	$/km^2$	87	30	59	256	39	71
Population growth rate (1990-2000)	%	2.08%	3.01%	2.13%	2.47%	2.46%	2.40%
Population growth rate (2000-2009)	%	1.85%	2.67%	1.92%	2.22%	2.22%	2.16%
Main ethnic groups (%)	%		Kayah (56) Burma (18) Shan (17)	Karen (60) Mon (13) Burma (12)	Mon (38) Burma (37) Karen (16)	Burma (84) Karen (6.5)	
Rice cultivation area (2005/2006)	1000 ha						
Rainy Season		6,236	39	199	336	152	726
Dry Season		1,046	2	46	41	7	95
Forest reserve/public forest ratio (2009-2010)	%	28.06%	54.12%	30.81%	19.11%	33.52%	
Household expenditure per person (2001)	Kyat	7,198 (Yangon)	4,130	6,966	5,340	6,999	
Poverty ratio	%	22.9%	35.4%	12.7%	19.9%	8.1%	
Diffusion rate of TV (1999)	%						
Town		35.8%	19.0%	42.7%	31.8%	29.0%	
Rural		12.9%	6.7%	23.0%	24.9%	14.0%	
Rate of head of household without education (1999)	%						
Town		16.5%	24.3%	20.0%	12.1%	11.0%	
Rural		12.0%	22.6%	18.2%	10.6%	14.4%	
Rate of access to clean water (1999)	%						
Town		31.2%	16.8%	27.2%	13.5%	27.5%	
Rural		67.9%	47.7%	54.1%	30.9%	76.8%	
Electrification rate	%						
Rural		17.7%	50.3%	20.1%	25.2%	11.6%	
Town		71.6%	64.3%	57.6%	28.8%	50.3%	
Total length of roads (2009/2010)	km	34,377	1,028	1,242	747	1,220	4,237
Road density	km/km^2	0.0051%	0.0088%	0.0041%	0.0061%	0.0028%	0.0043%
Rate of paved road	%	48%	46%	46%	86%	61%	57%
Main crops			rice, millet, maize, sesame, peanut, cotton, garlic, soybean, vegetables	rice, peanut, beans, sesame, tobacco, betel nut, sugar cane, rubber, coffee, tea	rice, peanut, beans, rubber, sugar cane, coconut, dhani, betel nut, cashew, rambutan, mangosteen	rice, betel nut, coconut, rubber, dhani, cassava, rambutan, durian, mangosteen, cashew, oil palm	
Main mineral resources			alabaster, tin, tungsten, antimony	iron, lead, copper, tin, antimony, tungsten	tin, antimony, white clay, yadana gas	various minerals	
Main industries			marble	cement	pulp, paper, sugar, rubber, textile, ceramic, marine products	pearl, rubber, teak products, marine products	
Other resources			teak, tourism (scenery, lake, cave)	teak, tourism (scenery, lake, cave)	Kyaikhtiyo Pagoda, traditional festival	marine resources, festival of Salon tribe, scuba diving,	
Main cities (population/unit: 10,000)			Loikaw (1.1)	Hpaan (5.0) Kawkareik Hpapun Hlaingbwe	Mawlamyine (26.0) Kyaikhtiyo Bilin, Thaton, Paung, Mottama, Mudon, Ye, Thanbyuzayat	Dawei (14.0) Myeik	

Source: 1) Wikipedia, 2) Gained by various materials, 3) "Real Image of Myanmar Economy", Toshihiro Kudo et.al. IDE-JETRO, 2008, 4) Central Statistical Organization, Statistical Yearbook 2010

The population shares of Kayin, Mon and Kayah States are smaller than their respective land area shares, but Tanintharyi Region has the population share larger than its land area share. This reflects the economically more advanced state of Tanintharyi due to large scale plantations of rubber and oil palm with their processing plants. Per capita household expenditure is largest also in Tanintharyi, but Kayin State has per capita household expenditure close to that of Tanintharyi. Poverty incidence is the lowest in Mon State, followed by Tanintharyi and Kayin State. Kayah State has the highest poverty incidence in the Southeast Myanmar.

In Table 1.1, use of durable consumables is represented by TV. As shown, use of TV in the Southeast Myanmar is comparable to the average in Myanmar in urban areas, but in rural areas, use of TV is more popular in the Southeast Myanmar than the national average except in Kayah State. The ratios of household heads without formal education in the Southeast Myanmar are also comparable to the national average except again in Kayah State.

The ratios of access to good quality water are generally lower in the Southeast Myanmar except in urban areas of Tanintharyi Region. Household electrification ratios are higher particularly in rural areas of Kayah State, and also in rural areas of Kayin and Mon States. This reflects geographic position of these states closer to the Baruchan hydroelectric power plants. Similar conditions are observed for road density as well, but in road pavement ratios, Mon State ranks first, followed by Tanintharyi. In Kayin State, the road length to be maintained and managed has increased rapidly following the cease fire agreement, and the total road length reached 1,800 km in 2012 with pavement ratio 56%.

To compare rice production and consumption, unit rice yield is assumed conservatively at 2.0 ton/ha to convert rice cultivated area to rice production, and rice consumption is calculated by assuming per capita rice consumption at 200 kg/year. Results are compared in Table 1.2 for three states and Tanintharyi as well as the Southeast Myanmar. As shown in the table, rice production exceeds rice consumption in the Southeast Myanmar as a whole, but the demand-supply balance is most stringent in Tanintharyi.

Table 1.2 Comparison of Rice Demand and Supply by State/Region

State/Region	Kayah	Kayin	Mon	Tanintharyi	SE Myanmar
Rice production (1,000 ton)	82	490	754	318	1,642
Rice consumption (1,000 ton)	70	359	621	338	1,388
Rice demand-supply balance (%)	117	136	121	97	118

Source: JICA Study Team based on SLRD data

1.2 Scope of the Study

1.2.1 Overall scope of the Study

The Study was carried out from the beginning of February to July 2013, mainly in Myanmar with limited fieldworks in Thailand and home works in Japan. A detailed work schedule is presented in Section 1.5. Study stages and main works involved in each stage are summarized in Table 1.3.

Table 1.3 Study Stages and Main Works Involved

Study Stage	Period	Main Works
1.	February 2013	- Planning for the Study - Preparation for fieldworks
2.	February ~ early April 2013	- Analysis on existing conditions - Clarification of development issues - Survey of border areas with Thailand - Selection of highest priority project for pre-F/S
3.	End of March ~ early May 2013	- Clarification of development directions, strategy and scenario - Pre-F/S of highest priority project - Profiling of settlement areas - Identification of needs for returned refugees and IDPs
4.	End of April ~ early July 2013	- Formulation of development frameworks - Pre-F/S of highest priority project (continued) to prepare draft IP - Formulation of projects to support returnees
5.	July 2013	- Preparation of Final Report

1.2.2 Study setup

(1) Study organization

A team of experts nominated by JICA took on the Study. The JICA Study Team attempted to work closely with staff members of counterpart agencies: i.e. the Kayin and the Mon State governments as well as the Ministry of Border Affairs, and particularly its Progress of Border Areas and National Races Department (PBANRD or NATALA). The JICA Study Team and the counterpart agencies had occasional meetings throughout the fieldwork period. The Myanmar counterpart agencies were requested to nominate a team of counterpart experts to work closely with the Study Team for collaborative works throughout the Study period, but the counterpart expert team was not formally organized in the Study period.

The JICA Study Team cooperated with related Myanmar organizations including MNP&ED, the Ministry of Social Welfare and Resettlement, the Myanmar Peace Center as well as ethnic minority organizations such as KNU, DKBA and NMSP. On the JICA side, an Advisory Committee has been organized with prominent experts to provide guidance for the Study.

(2) Study bases

The Study was carried out jointly by the JICA Study Team and its Myanmar counterpart organizations through collaborative efforts during the fieldworks. The Study was based mainly on readily available data and study reports as well as field observations and discussions with various stakeholders.

Limited field surveys were conducted to generate additional data useful for the Study, mobilizing Myanmar experts and assistants. They included a natural conditions survey, social survey and

surveys in the border areas between Myanmar and Thailand.

The Study has substantively effected an approach of the strategic environmental assessment (SEA). By this approach, stakeholders' meetings were convened at key stages of the Study to disseminate relevant information and discuss various issues involved in the regional development of the Southeast Myanmar. Instead of occasional meetings with all the stakeholders, small and frequent meetings have been convened separately for different stakeholders groups. The stakeholders include officials and experts of related government ministries/agencies, local governments, public organizations, ethnic minority organizations, education and research institutes, international aid organizations and NGOs.

1.2.3 Study output

(1) Tangible output

The Study will produce as tangible output the Final Report containing the following:

(a) Description of existing conditions in the Southeast Myanmar with all the relevant data collected and generated covering different sectors,
(b) Vision and objectives of the regional development of the Southeast Myanmar,
(c) Basic strategy and sector-wise strategies for the regional development,
(d) Long-term development scenario of the regional development,
(e) Profiles of prospective settlement sites of returned refugees and IDPs,
(f) Development needs of returning refugees and IDPs identified,
(g) Analysis on factors facilitating or obstructing returns of refugees and IDPs,
(h) A list of projects and related institutional measures to be undertaken subsequently, and
(i) Results of the pre-F/S of the highest priority infrastructure development project.

(2) Organizational development

The Study was expected to pave the way for implementation of subsequent technical cooperation and other projects. Therefore, the Study would contribute to establishing implementing arrangements for these subsequent projects. The JICA head office sent a mission during this inception work period to discuss with the Myanmar side on the implementing arrangements and other related matters for integrated regional development for ethnic minorities in the South-East Myanmar.

The JICA mission proposed the implementing arrangements consisting of the Joint Coordination Committee (JCC), the Project Implementation Committee (PIC), and Working Groups for Mon and Kayin State Development Plans, respectively. The Kayin and the Mon State Governments generally agreed on this proposal. The Kayin State Government nominated the Minster for Border Affairs and Security, and the Mon State Government nominated the Minister for Planning and Commerce as the Project Managers to chair the respective PICs.

1.3 Study Approach

1.3.1 Study requirements and main issues involved

The Study represents the initial part of comprehensive program for continual support to ethnic minority areas. As the first step, the Southeast Myanmar is defined combining Kayin and Mon States, and the Study encompasses both the preparation of medium and long term development plan for sustainable development of the Southeast Myanmar and the provision of urgent supports to facilitate return and settlement of refugees and IDPs. In view of the overall scope of works illustrated in Source: JICA Study Team

Figure 1.1, the Study requirements are presented in five points, and main issues involved are described below.

(1) Contribution to national land and economic development

The Study is expected to contribute to the national land and economic development of Myanmar. The Southeast Myanmar is located between the Yangon metropolitan region and the Tanintharyi region at the southern end of the Country. Large scale plantations area is developed in Tanintharyi, and large scale industrial development with a deep sea port is planned in the regional capital of Dawei in cooperation with Thailand. This region may become a segregated area developed with large and dominantly foreign capital. To integrate this region with the remaining part of the Country and the Yangon metropolitan area, the regional development of the Southeast Myanmar holds a key.

By combining Kayin and Mon States, the resource base will expand to support self-reliant regional development, and complementary development between the two states is conceived. Regional infrastructure and industrial clusters development can be planned encompassing the two states. Also, relationships with neighboring regions and countries should be reflected in the regional development in such a way to contribute to the national land and economic development of Myanmar as a whole.

(2) Complementary development with Thailand

Relationship with Thailand is very important for Myanmar in general, and this applies particularly to the Southeast Myanmar bordering on Thailand. Such relationship should be effectively utilized to benefits people of Myanmar and residents of the two states. At the same time, the regional development of the Southeast Myanmar should not cause conflicts with interests in Thailand. Such considerations are particularly important when economic corridors through Thailand and border towns are planned in the Southeast Myanmar.

In Tanintharyi Region, industrial development with a deep sea port at Dawei has been promoted in cooperation with Thailand. Similar development in the Southeast Myanmar may be seen to cause conflicts of interests in Thailand. Complementary development should be sought for both developments through close consultation with the Myanmar and Thai Governments. Development cooperation and private investments by Thailand will also support return and settlement of refugees and IDPs.

(3) Response to imminent needs

According to a recent survey by UNDP, the Southeast Myanmar is not classified as a poverty area, but nevertheless poverty alleviation is an important issue in the Southeast Myanmar as well to be

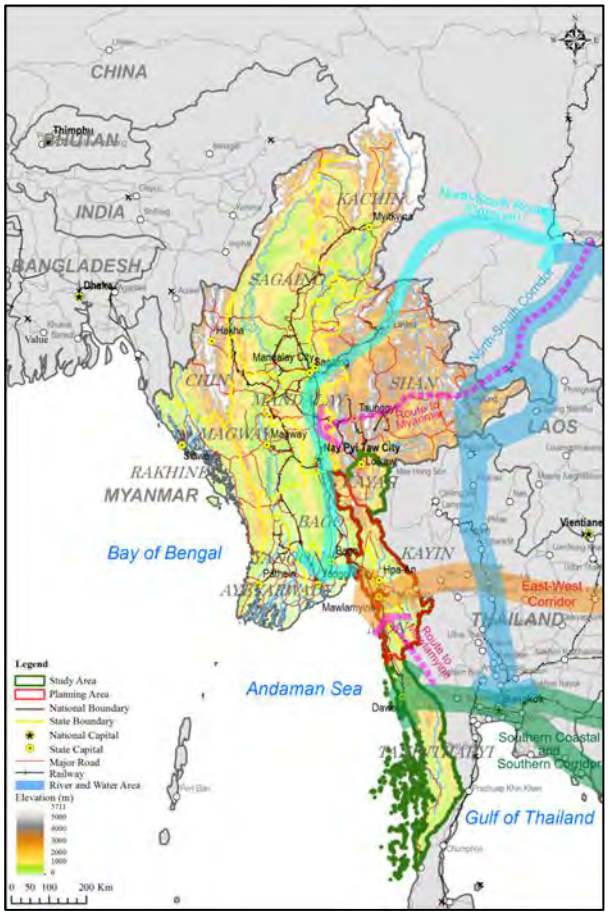
addressed immediately. Considerations on the national land and economic development and complementary development with Thailand as described above should not leave the poverty and related issues behind. Rather, the macroscopic development issues should be effectively utilized to resolve imminent issues including poverty alleviation.

Promotion of return and settlement of refugees and IDPs and support for their livelihood activities are most important imminent issues facing the Southeast Myanmar. The macroscopic development issues such as economic corridor development and industrial cluster development should be used to resolve the imminent issues related to refugees and IDPs. The Study should aim at simultaneous resolution of both the macroscopic and the imminent issues.

(4) Open development policy

The Union Government of Myanmar has established liberalization and democratization policies, and introduced a series of measures to effect the policies. Development directions dictated by these policies are particularly relevant to the Southeast Myanmar, which is bordering on Thailand and faces the Andaman Sea. The Southeast Myanmar has been affected also by China through development of some mineral resources, import of some daily commodities, and limited export industries. The Region should pursue an open development policy as a matter of course.

Planned economic development corridors have a particular importance in pursuing the open development policy. The Southeast Myanmar is located at the western end of an east-west corridor in the Southeast Asia defined by ADB. Another east-west economic development corridor has its western end at Dawei in Tanintharyi. Hpayarthonesu located on the Thai border links Bangkok and Mawlamyine, and an economic development corridor may be newly conceived along this link. These and other corridors to be examined in the Study are shown in Figure 1.2.



Source: JICA Study Team

Figure 1.2 Economic Development Corridors Centering around Myanmar

How to establish these corridors and use them to support the open development of the Southeast Myanmar is a main issue to be addressed by the Study. Regional infrastructure development related to these corridors should be effectively utilized to improve access to settlement areas, and industrial clusters should be developed linking livelihood activities by the poor and returned refugees and IDPs, indigenous industries and export industries by the regional infrastructure.

(5) First regional development plan in Myanmar

In line with the development policy and strategy at the Union level, both Kayin and Mon States are preparing respective development plans. In Mon State, urban development plans for towns over 100,000 populations are in preparation, covering 10 townships (TSs) and two sub-townships (STSs). Also, rural development plans are in preparation addressing poverty reduction, environmental protection and other issues. In Kayin State, eight principles for rural development have been established, and based on them an action plan has been prepared for poverty reduction and socio-economic development.

However, no integrated regional development plans have ever been prepared not only for Kayin and Mon States but in Myanmar as a whole. The integrated regional development planning for Kayin and Mon States should serve as a model for other regions in Myanmar as well with respect to both the planning procedure with participation of stakeholders and planned contents integrating different sectors and urban and rural plans.

1.3.2 Technical approach

Based on the recognition of the Study requirements and main issues as described above, the Study approach is established first in technical aspects with five elements as described below.

(1) Pursuit of alternative socio-economy

Myanmar had pursued economic growth under the economic sanction by some advanced countries in order to maintain political and social stability. In doing so, Myanmar has increased its dependence on the neighboring countries such as China and Thailand. Dependence on China has made the Myanmar economy relying on development and sale of hydro-electric and mineral resources supported by China. Recent development of natural gas and its sales to China and Thailand may further such dependence.

Along with the liberalization and democratization policies, increasing amount of development aid and private investments have been flowing into the Country, which may contribute to continuing and expanding resources development oriented economic growth, resulting in major environmental and social problems. This may, in turn, undermine political stability of the Country, which the Union Government would like to avoid.

Pursuing the footsteps of other developing and developed countries implies the reliance on cheap labor and resources development, which will not lead to sustainable development. Myanmar should pursue an alternative model for socio-economic development by taking advantage of the less developed status of the Country. Alternative socio-economic development would utilize unique social, economic and cultural conditions inherent to the Country and the region, and be supported by appropriate technologies based on them. Such technologies include “productive environmental technology” and “conventional technology upgraded by modern technology.”

Another important aspect of alternative socio-economy is related to development management or governance. The Union Government of Myanmar is promoting localization of development administration, but how to realize it is not necessarily clear yet. The idea of regional development is to utilize local resources by the local people for the benefit of local people. Concepts of local autonomy, equitable allocation of development benefits and self-reliant development are incorporated in the regional development idea. It means alternative socio-economic development based on

indigenous resources is a way to realize self-reliant development of ethnic minority regions.

(2) Regional development to contribute to balanced national development

The existing Grand Plan for long term development of Myanmar provides a basic reference in planning for the regional development of the Southeast Myanmar. Since it was prepared during the previous administration, however, some modifications may be necessary to reflect the liberalization and democratization policies of the new administration.

The Myanmar Government prepared the Framework for Economic and Social Reforms, and presented it to donor communities in January 2013. It represents a comprehensive conceptual framework to guide the national and regional development of Myanmar for years to come. Therefore, it is taken as a point of departure for the present study as well.

It is expected that within the framework of the national land and economic development, different regions of Myanmar will be characterized and their respective positions clarified in the subsequent stage of the JICA technical cooperation. For this purpose, the national land may be sub-divided into eight broad regions as shown in Figure 1.3.

Indices to be used to characterize the eight regions may include 1) population, particularly urban population and its distribution, 2) water resources endowments and water balance, 3) land suitability, 4) main economic activities, 5) relationships with neighboring countries, and 6) regional infrastructure.

These indices will be used to characterize the Southeast Myanmar first including Kayah State and Tanintharyi Region. Then, the characteristics and the position of the Southeast Myanmar will be clarified in relation to its neighbors. This will lead to proposals for development directions and establishment of development frameworks, strategy and scenario for the Southeast Myanmar.

Based on the examination of the national land and economic development at the macro level, and the regional development directions of the Southeast Myanmar at the meso level, township and community development related to return and settlement of refugees and IDPs can be planned at the micro level in a more appropriate and sustainable way.

Source: JICA Study Team

Figure 1.3 Proposed Division of Myanmar National Land for Integrated Regional Development Planning

(3) Self-reliant regional development with industrial clusters based on indigenous resources

The idea of regional development is to use indigenous resources by the local people for the benefit of the local people for self-reliant socio-economic development. The regional development provides an effective approach to realize self-reliant development, overcoming problems with the economic globalization. Specifically, industrial cluster development by using indigenous resources provides means to realize this idea though establishing “comparative advantage” of the industries in the global market.

Regional development also provides an ultimate approach to poverty alleviation. For this purpose, livelihood activities by the poor would have to be supported and integrated with indigenous industries, which should in turn be developed to link to the global market.

The rubber industry in the Southeast Myanmar offers an example of a potential industrial cluster. Collection of rubber sap may be a livelihood activity by the poor, and primary processing to produce latex and its derivatives may be indigenous industries. As the latex is processed into automobile tires, the products may be exported to the global market. At present, however, this chain of activities does not have sufficient width and depth as an industrial cluster. Products and export market need to be diversified.

Potential exists in the Southeast Myanmar to develop other industrial clusters based on indigenous resources. Cashew, produced in Kayin and Mon States for a long time, offers a range of resources to be processed into a variety of products. In addition to cashew nuts from kernel, its shells may be used to extract industrial oil that can be used for lacquer works, fake apple for wine and vinegar, tree sap for ink and paint, bark for tanning, and young leaves as forage for goats. Another industrial cluster may be developed capitalizing on the existing wood furniture and wood and bamboo handicrafts. Other industrial clusters may be developed based on sugarcane, mineral resources such as antimony and tungsten, and tourism.

In examining possible industrial clusters, consideration should be given to initial livelihood activities by returning refugees and IDPs. In other words, livelihood activities for returning refugees and IDPs should be planned in relation to industrial clusters with indigenous industries to make them sustainable. This is precisely what the regional development planning can accomplish.

It is reported that in the Southeast Myanmar, some of IDPs have settled informally to collect rubber sap for their livelihood. They should be integrated into a formal industrial cluster. In planned settlement areas, cultivation of tree crops on gently sloping land is considered promising in addition to traditional paddy and corn cultivation. Fruit trees and cashew are potential crops to be introduced or strengthened. They may supply to processing plants that may be established in industrial estates planned in Hpaan and Myawaddy. Related services may also constitute part of industrial clusters.

(4) Upgrading urban functions by city networking linked to Thailand

It is indispensable to strengthen urban functions for a country or region to realize self-reliant development in the globalizing economy. In particular, urban functions of larger cities, which may be called regional cities, should be much upgraded as the domestic/regional economies meet the global economy at regional cities. Reduction of economic transaction costs holds a key for domestic and regional economies to compete successfully in the global market.

In upgrading urban functions, city networking should be effectively utilized. By linking regional cities with transport and telecommunications infrastructure, higher order urban functions may be shared between the regional cities and their complementary development may be realized. Such a city network may be extended beyond

Source: JICA Study Team

Figure 1.4 Urban Hierarchical System Tentatively Proposed for the Southeast Myanmar

borders as inevitable in the globalizing world.

City networking to upgrade urban functions is particularly important for the regional development of the Southeast Myanmar, which is bordered on Thailand and located between the Yangon metropolitan area and the southern end of the Country. A hierarchical system of urban centers for the Southeast Myanmar is tentatively proposed in Figure 1.4.

The urban hierarchy for the Southeast Myanmar should incorporate the following:

(a) Revitalization of Mawlamyine as the regional city,
(b) Characterization of Hpaan and upgrading of its urban functions accordingly,
(c) Strengthening of selected secondary cities such as Hpapun, Kawkareik, Ye and Thanbyuzayat,
(d) Establishment of border cities in Myawaddy and Hpayarthonesu, and
(e) Complementary development with the Yangon metropolitan area and the Dawei area in Tanintharyi.

The city network for the Southeast Myanmar should be utilized to improve service provision to smaller towns and rural settlements in the Region. The urban hierarchy in the Southeast Myanmar, as shown in Figure 1.4, encompasses secondary urban centers, which should be linked effectively to rural service centers to ensure sufficient service provision to settlements for returned refugees and IDPs as well. To support livelihood activities of returned refugees and IDPs and integrate them with indigenous industries to make them develop into viable industrial clusters, the city network will play an important role.

(5) Community development with returned refugees and IDPs

In order to settle returned refugees and IDPs, it is essential to integrate them into existing communities of settlement sites. Conversely, return and settlement of refugees and IDPs should be utilized for re-vitalization of existing communities. It is proposed that a Community Development Committee (CDC) should be established at each planned settlement site by participation of residents there. CDC would be established first with existing residents, and expanded by incorporating returned refugees and IDPs.

According to the Chief Minister, Kayin State already has an idea to form a team to assist refugees upon their returns and to coordinate existing communities in any settlement site with returnees. Possible frictions on land use, for instance, may be resolved, facilitated by such a team or committee. This institution may be established also for urban areas first with government officials and local residents.

To re-vitalize existing communities with CDCs as media, it is effective for each CDC to plan for public facilities to be shared by both original residents and returnees by participatory approach. Such participatory planning should be undertaken first by the administrative initiative. Such an institution with CDC should be used to encourage communications between residents and between the administration and residents for joint works with information sharing. It is expected that through this process, reconciliation between original residents and the returnees and the administration would be promoted. Participatory approach is in fact a method to augment development resources, complementing limited public sector resources.

To guide returning refugees and IDPs and facilitate their settlement, some institutional mechanism is necessary. A possible idea may be to establish such an institutional mechanism, called here the Returnees Empowerment Center (REC) with donor support. The REC is firstly an information center. Information on activities and other conditions at each settlement site is made available to returnees,

and information on intentions, needs and other characteristics of returnees is conveyed to settlements. Such information exchanges at the REC should be supported by the administration.

The REC may be utilized also to prepare returnees for livelihood activities after settlement. First, opportunities for livelihood activities at different settlement sites are made available, and returnees may make their judgment on whether they may utilize skills and experiences obtained in refugee camps or displaced areas. Second, returnees may receive training for livelihood activities before they actually return and settle. In case where returnees are employed by factories in an industrial estate, private enterprises may offer training programs together with necessary facilities. Some returnees may serve as trainees for skills that they have obtained while being away.

According to the Chief Minister, Kayin State plans to establish "check points" along the borders with Thailand to provide initial supports to refugees returning from Thailand. Functions of any check point are not to investigate refugees but to provide basic health care, food, transport services to settlement sites and other supports to returnees and to guide them on where to settle and find employment opportunities.

Following the Study, another project will be implemented with JICA support to prepare a return and settlement plan. The plan consists of land use plan and community development plan for each settlement site. The plan would provide a basis for JICA to support livelihood activities, develop indigenous industries, and establish industrial clusters that may compete in the global market for both returnees and original residents.

1.3.3 Operational approach

To carry out the Study by the technical approach described above, operational approach is proposed with the following five elements.

(1) Utmost concerns on security

The Southeast Myanmar is inhabited by one of most influential ethnic minorities, and a cease fire agreement was reached with the Union Government only recently. Some disturbances may occur in any time, which may affect the Study. Therefore, utmost concerns will be paid to security conditions in and around the Southeast Myanmar.

Officials and other staff members of the Union Government are expected to accompany the Study Team for any field surveys. Especially, visits to remote settlement sites are strictly subject to official approval by the Myanmar authority. The Study Team, however, will make efforts to explain the needs for any survey, and discuss with the Myanmar personnel in charge of security on how to conduct surveys without causing disturbances in areas to visit.

(2) Contribution to coordination between the Union and the local governments

The Study cannot be successfully carried out without coordinated efforts between the Union Government and the local governments of Kayin and Mon States. The Study will be conducted by joint efforts of the Union Government, the local governments and the JICA Study Team as much as possible. Through this process, the Study would contribute to better coordination between the Union Government and the local governments for regional development of the Southeast Myanmar. Such a relationship will be an essential condition for subsequent cooperation by JICA for ethnic minority areas.

Experts of the JICA Study Team would like to serve as facilitators to convey specific needs of ethnic minorities to the Union Government. Establishment of better relationships between the Union Government and the local governments and ethnic minority organizations to be realized through the Study would contribute to stability of border areas and the national integration.

(3) Expansion of private cooperation between Myanmar and Japan

Regional development will not be realized simply by the official development assistance alone. Private investment should be promoted at the same time. In view of importance of Japan-Myanmar relationships and needs for mutual development of Myanmar and Japanese economies, the Study should contribute to promotion of private investments by Japanese enterprises. Specific plans and projects promoted by Japanese firms will be reviewed in the light of regional development of the Southeast Myanmar, and incorporated in proposals with modifications if necessary. Interim outcomes of the Study will be shared widely with stakeholders both in Myanmar and in Japan including Japanese investors so that related projects will be implemented earlier based on judgments by private firms.

The Study will coordinate with on-going and planned activities by other Japanese organizations as well as international organizations. They include a planning study by East Asia ASEAN Center (ERIA) to examine deep sea port development with associated industrial development covering Tirawa, Dawei and other areas, and another survey on petroleum, natural gas and mineral resources jointly undertaken by JOGMEC.

(4) Proposals for continual JICA cooperation

The Study constitutes the first step for JICA to provide continual support for ethnic minority areas. The Study is expected to be followed by the integrated regional development master planning and planning for return and settlement of refugees and IDPs with pilot implementation of urgent projects, both in the Southeast Myanmar. Feasibility studies of priority infrastructure development projects to be followed by implementation by yen loans, and implementation of urgent projects by grant-in-aid may also follow.

The Study Team will work closely with the JICA head office and its Myanmar office to formulate proposals that will fit to JICA policy, coordinating with other JICA cooperation projects as well. The integrated regional development master planning is a unique technical cooperation facilities of JICA, which may be instrumental to guide planning, promotion and implementation of many other projects both in the Southeast Myanmar and in other areas.

(5) High quality outcomes by Japan association

The JICA Study Team is a joint venture (JV) of three consulting firms led by RECS International Inc. In addition, a few other firms are cooperating in their respective fields of expertise so that the Study Team is effectively a seven firms JV, which may be called a Japan association. This deliberate formation will first ensure highest quality outcomes with respect to proposals for subsequent cooperation by JICA. Second, it will also allow generation of cadre of experts for other projects. Third, it will strengthen implementing arrangements on the Myanmar side.

The JICA Study Team will cooperate widely with other donors, international organizations and NGOs, and coordinate with their activities. To facilitate this, experts of these organizations will be invited to regular meetings of the Study Team and the Myanmar counterpart team to share information on their

activities and related matters. Representation of major Japanese consulting firms will allow communications with these organizations and experts at high levels.

1.4 Study Procedure and Methods

1.4.1 Overall study flow

(1) Study stages and tasks

The Study was planned to proceed through five stages, partly overlapping one another, with 21 tasks as listed below. The work flow is shown in Figure 1.5.

1) Stage 1: Preparatory works in Japan and initial discussion with Myanmar side

Task 1-1 Preparation of draft Inception Report
1-2 Discussion with JICA head office and Advisory Team
1-3 Finalization of Inception Report through discussion with Myanmar side
1-4 Establishment of implementing arrangements

2) Stage 2: Fieldworks

- Component 1

Task 2-1 Analysis on existing conditions of the Southeast Myanmar
2-2 Survey of border areas with Thailand
2-3 Clarification of development issues for the Southeast Myanmar
2-4 Selection of highest priority project for pre-F/S

- Component 2

Task 2-5 Analysis on existing conditions and issues in settlement areas

3) Stage 3 and Stage 4: Field works

- Component 1

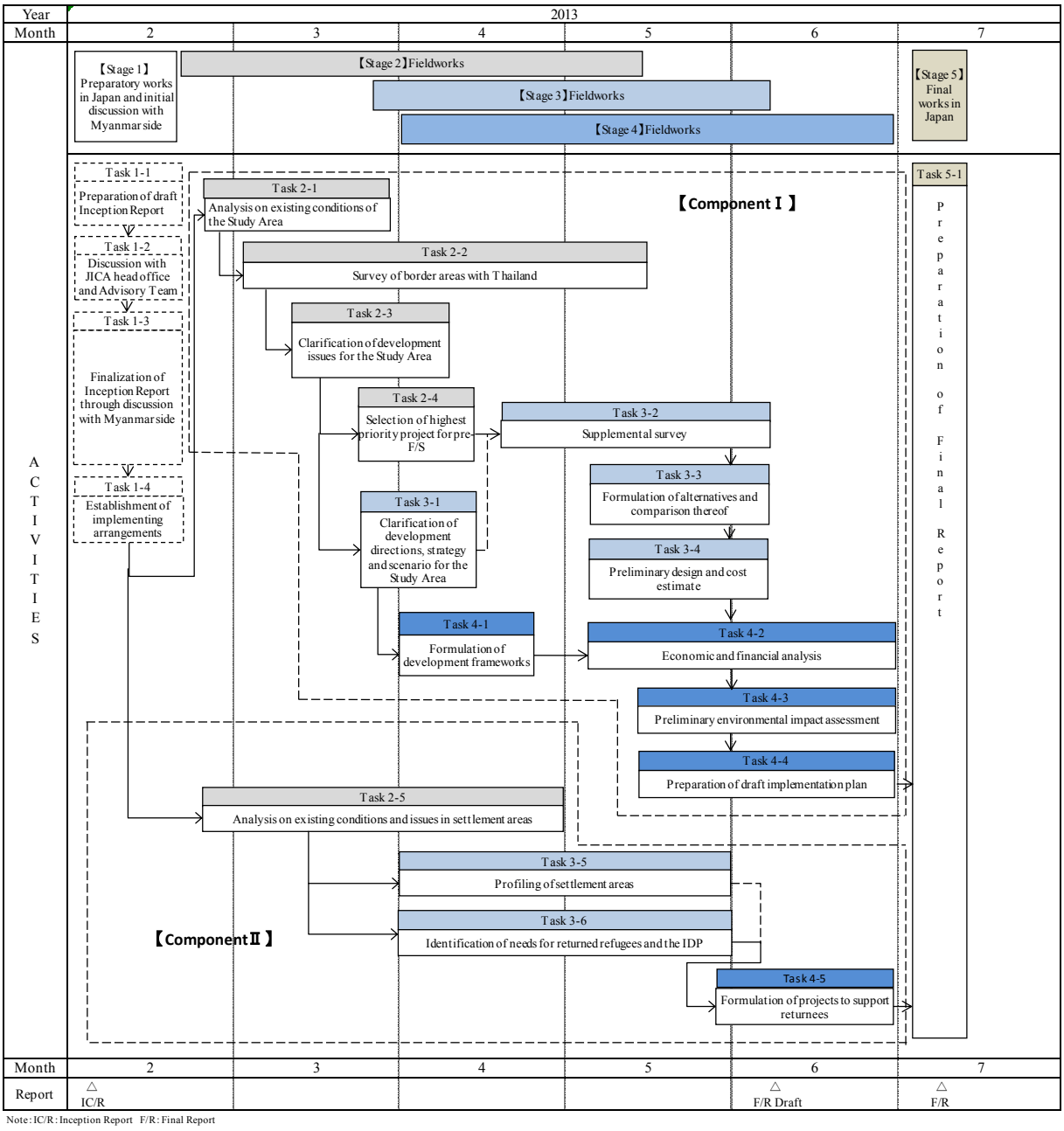
Task 3-1 Clarification of development directions, strategy and scenario for the Southeast Myanmar
Task 4-1 Formulation of development frameworks (Pre-F/S)
Task 3-2 Supplemental survey
3-3 Formulation of alternatives and comparison thereof
3-4 Preliminary design and cost estimate
4-2 Economic and financial analysis
4-3 Preliminary environmental impact assessment
4-4 Preparation of draft implementation plan

- Component 2

Task 3-5 Profiling of settlement areas
3-6 Identification of needs for returned refugees and IDPs
Task 4-5 Formulation of projects to support returnees

4) Stage 5: Final works in Japan

Task 5-1 Preparation of Final Report



Source: JICA Study Team

Figure 1.5 Work Flow of the Study

(2) Surveys

As described in Section 1.2, the Study was planned to be based mainly on readily available data and study reports as well as field observations and discussions with various stakeholders, but limited field surveys has been conducted to generate additional data useful for the Study. A survey on the border area with Thailand on the Myanmar side was planned to be entrusted to a Myanmar consultant, NGO or research institute, and carried out under the supervision of the Study Team in cooperation with the Myanmar counterpart team. The Myanmar counterpart team was expected to help the Study Team to find out a capable Myanmar team to carry out the survey.

A few surveys have been undertaken in Thailand. A survey on economic corridors was conducted by hearings and collection of relevant data and information related to the economic corridors. A survey

of existing conditions in refugee camps on the Thai borders was carried out by field observations, without interviews with related organizations and refugees. A survey on the border area on the Thai side was conducted mostly by existing data and statistics and limited interviews. A survey on conditions affecting returns of refugees was carried out to understand policies, institutions and procedure related to returns of refugees by hearings, and to understand intentions and characteristics of refugees by interviews and observations.

As part of analysis on existing conditions in the Southeast Myanmar, a natural conditions survey and a social survey have also been carried out. These surveys were initiated by the Study Team in cooperation with the Myanmar counterpart team, but collection of data and information were supported by Myanmar experts and assistants.

1.4.2 Study procedure and methods

(1) Stage 1: Preparatory works in Japan and initial discussion with Myanmar side

- Task 1-1 Preparation of draft Inception Report

The objectives, scope, procedure, methods, schedule and implementing arrangements of the Study are examined, and a draft Inception Report is compiled. Subjects to be discussed with the Myanmar side at the beginning of the fieldworks will also be clarified. Data, information and study reports already available are reviewed, and needs for additional data collection are clarified. Preparatory works necessary for the surveys to be conducted in the field are undertaken.

- Task 1-2 Discussion with JICA and Advisory Team

Based on the draft Inception Report, the Study Team discusses with JICA and the Advisory Team formed by JICA for the Study. Subjects to be discussed and resolved with the Myanmar side are further clarified, and other specifics of the Study described in the Report may be modified.

- Task 1-3 Finalization of Inception Report through discussions with Myanmar side

The draft Inception Report has been discussed with the Myanmar side upon the arrival of the Study Team in Myanmar. Discussions were made with the Kayin and the Mon State governments, the Ministry of Border Affairs and its offices in the Southeast Myanmar, particularly the NATALA offices, MNP&ED and other national and local organizations. The Inception Report is now finalized reflecting the discussions with the Myanmar side, and submitted at the end of February 2013.

- Task 1-4 Establishment of implementing arrangements

Implementing arrangements of the Study are established through the discussions with JICA and the Myanmar side, particularly the Kayin and the Mon State governments and NATALA of the Ministry of Border Affairs. Coordination with ethnic minority organizations is also discussed, and how to ensure their cooperation for the Study is clarified. Public consultation and stakeholders' meetings with these and other organizations will be convened at later stage of the Study.

The Study Team has established its office in Hpaan for continuous works during the fieldworks. They Myanmar side is expected to work closely with the Study Team on a daily base. In particular, counterpart experts are expected to be nominated by the Myanmar side to work with the Study Team. Occasional meetings are conducted by the Study Team, the Myanmar counterpart team and other related organizations and experts as relevant.

(2) Stage 2: Fieldworks

1) Component 1

➢ Task 2-1 Analysis on existing conditions of the Southeast Myanmar

To examine the existing conditions of the Southeast Myanmar, related plans, study reports and other data are collected, discussions with government officials, experts and residents are conducted, and field surveys are carried out. The results of the basic study carried out by JICA during May through July 2012 are fully utilized, and complementary surveys and analyses are carried out in limited periods.

The following aspects are examined at this stage.

i) Existing development plans including national development plans, policies and plans related to ethnic minorities, localization, regional development and development of Thai border areas,
ii) Administrative structure at central, state/regional and local levels, division of responsibilities, staff distribution, procedure for development planning and budgeting, and development and ordinary budgets,
iii) Related organizations including ethnic minority organizations, their organizational structure, staff distribution, roles and duties, financial conditions and others,
iv) Socio-economy: population distribution and dynamics, returns of refugees and IDPs, economic activities, employment, main agro products and manufactured goods, resources endowments and development, education and training, health and medical care and others,
v) Political, welfare and security conditions,
vi) Natural and environmental conditions: climatic conditions, hydro-geological conditions, topography, fauna and flora including endemic and endangered species, soil and others,
vii) Land use: macroscopic land use distribution of the Southeast Myanmar as a whole, more detailed land use in and around settlement areas of returning refugees and IDPs.

➢ Task 2-2 Survey of border areas with Thailand

Surveys on existing conditions of the border areas with Thailand are carried out to clarify flows of commodities and moves of people across the borders. A survey on the Myanmar side is carried out by a Myanmar team of experts and assistants under the supervision of the Study Team as described in the previous sub-section.

A survey on the Thai side is carried out by the Study Team based in principle on official statistics and existing study reports as described in the previous sub-section. Existing conditions of refugees on the Thai borders are examined based on refugees profiling conducted by UNHCR and the Thai Government. Limited sample interviews are is also conducted at refugee camps on the borders.

It is reported that some 140,000 refugees exist at refugee camps in Thailand, of which only less than about 60% are registered. Refugees not registered are not formally eligible to settlement in the third countries, and also some of them are worried if they are receiving support packages upon return and may subject to penalties due to lack of possession of Myanmar ID cards. These are reported to be factors to obstruct returns of refugees. These and other conditions are clarified to facilitate analysis on conditions to encourage the returns.

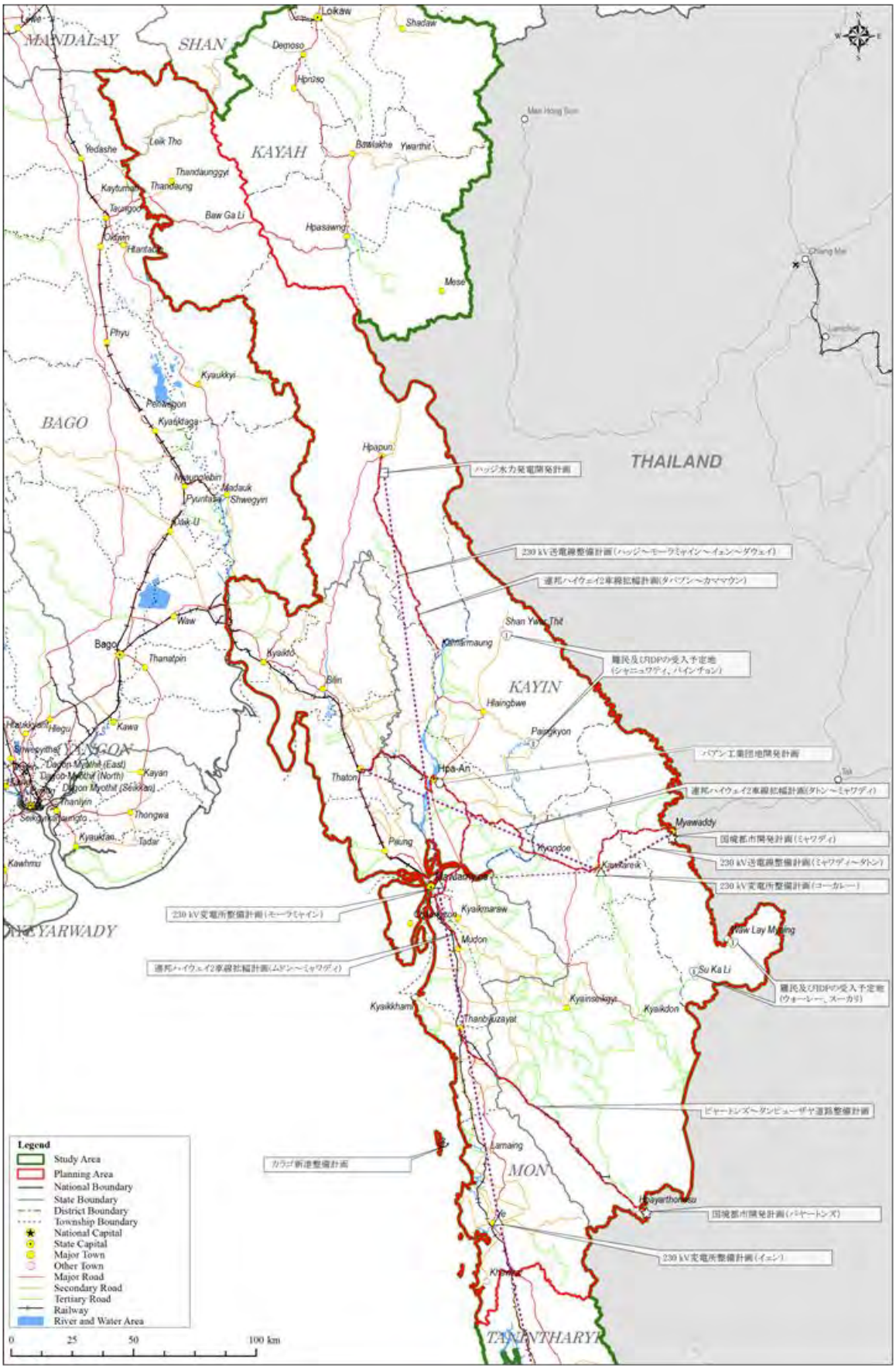
➢ Task 2-3 Clarification of development issues for Southeast Myanmar

Based on the results of Task 2-1, development issues for the regional development of the Southeast Myanmar are examined through stakeholders' meetings. The issues may cover regional infrastructure development, industrial clusters promotion, land use for agriculture, resources development, social development, and return and settlement planning. Ideas by the Study Team on these issues are explained and discussed with stakeholders. In addition to a stakeholders' meeting to discuss on all the development issues listed above, separate meetings may be organized to discuss each issue in more detailed. Implementing arrangements and roles of different stakeholders may be clarified through discussions as the first step to prepare for implementation of proposed ideas.

As part of examining prospects to realize economic corridors, a survey in Thailand is conducted to clarify Thai Government policies on industrial promotion and related institutions and to collect trade data as described in the previous sub-section.

➢ Task 2-4 Selection of highest priority project for pre-F/S

Based on the results of Task 2-3, priority infrastructure development projects are examined, and the highest priority project is selected for a pre-feasibility study (pre-F/S). Candidate infrastructure development projects are illustrated in Figure 1.6. It is proposed that a complex development project should be formulated combining several projects along the proposed economic corridors, and a key facilities to constitute the corridors will be selected for the pre-F/S. Possible economic corridors are 1) the east-west corridor passing through Hpaan, Kawkareik and Myawaddy, and 2) the alternative southern corridor passing through Hpayarthonesu, Thanbyuzayat and Mawlamyine.



Source: JICA Study Team

Figure 1.6 Priority Infrastructure Development Projects in the Southeast Myanmar

2) Component 2

➢ Task 2-5 Analysis on existing conditions and issues in settlement areas

Possible settlement areas have been selected in urban areas of Myawaddy and Hpaan, and rural areas of the Myawaddy and the Hlaingbwe districts. Industrial estates are planned in these urban areas, where foreign and domestic investments are expected. The existing plans for these industrial areas need to be examined to see whether they may be used to accommodate returned refugees and IDPs, covering infrastructure and utilities, types of industries to be located, site plan, operating organization and others. Living conditions in these areas should also be examined.

Possible livelihood activities by returned refugees and IDPs include not only employment at planned industrial estates but also agriculture, handicraft making and various services. To plan for agricultural activities, land use and land capability need to be analyzed. To re-activate communities in settlement areas, social conditions need to be reflected in the planning such as ethnic composition of population, and indigenous system for decision making and resources management. The aspects and methods to cover by this task are summarized in Table 1.4.

Table 1.4 Aspects and Methods to Cover to Examine Existing Conditions of Settlement Areas

Aspects	Methods
Land use	Adoption of existing maps and GIS data and use of satellite imageries to examine land use distribution and land capability
Social infrastructure	Use of existing study reports and data in combination with field observations and interviews to examine water supply and sanitation, power supply, education and training, and health and medical care
Economy	Use of existing study reports and statistics in combination with field observations and interviews to examine production, consumption, and marketing of main agro products, manufactured goods and handicrafts, related employment, education and skill levels, training opportunities etc.
Social system	Use of existing study reports and statistics in combination with field observations and interviews to understand ethnic composition, migration, indigenous organizations and institutions, decision making mechanism etc.
Administrative system	Use of existing reports and interviews to understand administrative system at national, state/regional and local levels, organizational structure, functional division, staff distribution, budgets, development plans etc.
Household economies	Use of existing study reports in combination with field observations and interviews to understand household income by source, expenditure by purpose, food self-sufficiency and other household conditions
Political, welfare and security	Use of existing study reports in combination with field observations and interviews to examine conditions related to peace building

(3) Stage 3: Fieldworks

1) Component 1

➢ Task 3-1 Clarification of development directions, strategy and scenario for the Southeast Myanmar

Based on the results of Task 2-1, Task 2-2 and Task 2-3, development directions for regional development of the Southeast Myanmar are analyzed. The development issues examined by Task 2-3 are analyzed in a systematic way by a problem structure analysis. The problem structure is constructed in such a way to clarify those problem factors at the bottom of many interrelated problems, and problem phenomena to be resolved through planned development efforts.

Development objectives are established and basic development strategy is formulated based on the problem structure analysis.

Through the discussions on development issues in Task 2-3, an overall vision of the regional development of the Southeast Myanmar will emerge and shared by stakeholders. The vision is further clarified and made more specific by a development scenario, which is a descriptive presentation of future course of regional development. The development scenario is described in socio-economic, spatial development and institutional aspects.

Pre-F/S of highest priority infrastructure development project

A pre-feasibility study of highest priority infrastructure development project selected by Task 2-4 is initiated during Stage 3. Tasks to be carried out during this stage are described below.

- Task 3-2 Supplemental surveys

As proposed by Task 2-4, the two possible economic corridors may be examined for their priority in view of the regional development vision of the Southeast Myanmar examined by Task 3-1. To examine these alternatives, related infrastructure may also be examined concomitantly such as establishment of border towns and industrial estates in Myawaddy and Hpaan, and possibly a new regional sea port conceived in the Kyaikkhami area near Thanbyuzayat along the alternative southern corridor.

Supplemental surveys necessary to examine the feasibility of the selected project at a preliminary level are planned and conducted. They may include a traffic survey, detailed natural conditions survey, environmental survey and assessment, and social survey. Limited topographic survey and a sea depth survey may also be necessary. Scope of works and other specifics of any survey are subject to discussion with, and approval by JICA.

- Task 3-3 Formulation of alternatives and comparison thereof

Alternative alignments of roads and alternatives for other facilities involved in the selected priority project are formulated and compared. As the priority project is likely to be a mega project of complex nature, a stage wise development plan is examined, and level of development, implementation procedure and construction methods may be examined by stage.

- Task 3-4 Preliminary design and cost estimate

Facilities involved in the selected priority project are designed at a preliminary level, and initial investment costs, and operation and maintenance costs are estimated. In case where re-settlement of people are involved in implementing the project, land acquisition costs and compensation and re-settlement costs are also estimated reflecting conditions in Myanmar as well as international standards/

2) Component 2

- Task 3-5 Profiling of settlement areas

Of the nine sub-townships (STs) in Kayin State where the Government has been preparing for returns of refugees and IDPs, Paingkyon and Shanywarthit STs in Hlaingbwe township and Wawlay and Sukali STs in Myawaddy township are selected for detailed study of existing conditions. For each ST, the following are examined as much as possible.

i) Latest population with gender and age distribution, population before conflicts, and planned population to be accommodated,

ii) Basic public facilities for education and training, health and medical care, water supply and sanitation and others,
iii) Procedure of return and settlement after immigration, existing conditions of return and settlement,
iv) Planning and implementation of facilities to receive returnees, and
v) Land mines related information including accidents, victims and education to avoid accidents.

Based on these surveys, and referring also to the results of Task 2-5, profiles of each settlement area is prepared, covering its urban area, rural area, and broad environment. Profiles should be used as essential information for returnees, and provide useful input for the Government to plan for development and settlement.

➢ Task 3-6 Identification of needs for returned refugees and IDPs

Based on the results of Task 2-5 and Task 3-5, needs for returned refugees and IDPs are identified. For this purpose, factors that will promote the returns and those to obstruct the returns are analyzed. The results of surveys in border areas with Thailand by Task 2-2 are also referred to in this analysis. Conditions to accept the returnees in settlement areas, issues related to promotion of settlement of the returnees are examined, including community development at each settlement area. Factors affecting returns of refugees and IDPs include security conditions, livelihood opportunities, support measures and institutions, and availability of related information.

(4) Stage 4: Fieldworks

1) Component 1

➢ Task 4-1 Formulation of development frameworks

The vision of regional development of the Southeast Myanmar is substantiated by development frameworks consisting of socio-economic framework and spatial development framework. The socio-economic framework is specified by population, and broad economic and employment structure in the future. The spatial development framework is specified by population distribution in urban and rural areas, artery transport network, and land use distribution in the future.

Pre-F/S of highest priority infrastructure development project

➢ Task 4-2 Economic and financial analyses

Benefits of implementing the selected priority project are estimated in view of the development frameworks formulated by Task 4-1. Future traffic volume and its composition are forecasted based on the future population, and the economic and employment structure, and contribution by the project is identified as the benefit. Combined with cost estimates by Task 3-4, cash flow is constructed for project evaluation. Both economic evaluation from the viewpoint of the Myanmar national economy or the regional economy of the Southeast Myanmar and financial evaluation from the viewpoint of implementing agencies are conducted.

➢ Task 4-3 Preliminary environmental impact assessment

The idea of strategic environmental assessment (SEA) is applied to the Study as a whole. For this purpose, information related to the regional development of the Southeast Myanmar is made open and shared by stakeholders, and stakeholders' meetings are organized during the fieldworks. Within the framework of SEA, preliminary environmental impact assessment is conducted for the

selected priority project. By using the results of surveys by Task 3-2, possible effects of the project on natural and social environment are assessed, and mitigation measures for possible adverse effects are built into the project planning in line with the SEA. Additional surveys and other measures necessary for more detailed evaluation and design of the project are recommended.

- Task 4-4 Preparation of draft implementation plan

A draft implementation plan (IP) for the selected priority project is prepared by compiling the outcomes of Task 3-4, Task 4-2 and Task 4-3. The draft IP contains presentation of facilities constituting the project, their location and related local conditions, staged development plan, implementation procedure and schedule, maintenance and management organization, associated institutional measures and other related aspects. Socio-economic effects and financial viability and environmental effects are compiled based on Task 4-2 and Task 4-3.

2) Component 2

- Task 4-5 Formulation of projects to support returnees

Specific projects and measures to meet the needs of returnees identified by Task 3-6 are formulated. These are projects to promote the returns of refugees and IDPs by utilizing those factors analyzed by Task 3-6 that promote or obstruct the returns. A few proposed projects or measures may be pilot implemented as part of a subsequent JICA project to support the returnees.

(5) Study finalization: Fieldworks followed by home works in Japan

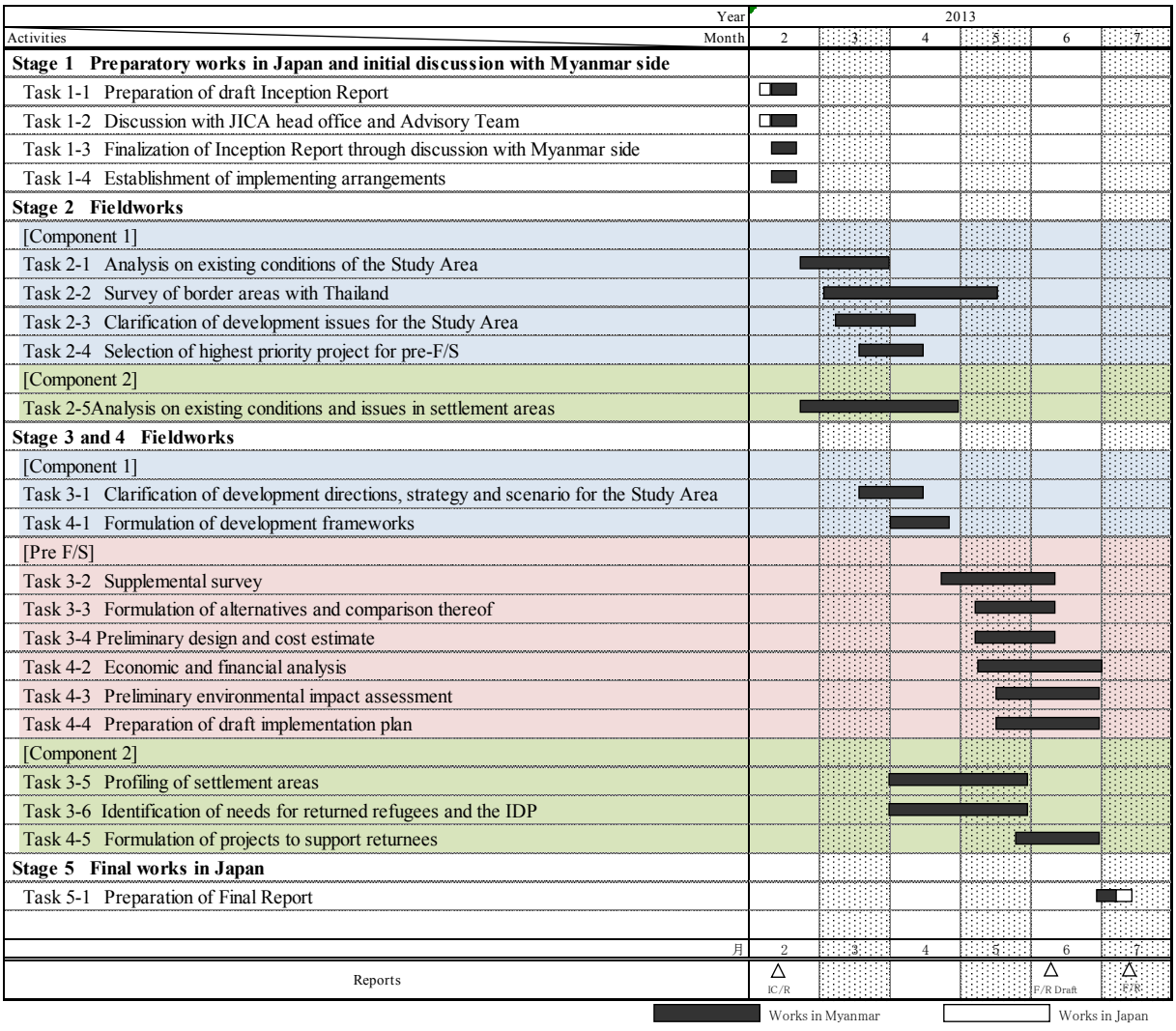
- Task 5-1 Preparation of Final Report

Results of all the tasks described above are first compiled into an outline Final Report for discussion. The outline Final Report is prepared in early June for discussion with JICA first to clarify remaining issues to be resolved with the Myanmar side. It is discussed extensively with the Myanmar side during the final stage of the fieldworks. Through the discussion, how to make effective use of the Study results for subsequent phase and projects of JICA cooperation is clarified as well.

1.5 Work Plan

1.5.1 Work schedule

The Study was initiated in early February 2013, and conducted mainly with fieldworks in Myanmar and limited works in Thailand, and completed in the middle of July 2013 with the submission of the Final Report. To make effective use of the limited fieldwork period, it was proposed that an outline Final Report would be prepared first for discussions with JICA and the Myanmar side, and the Final Report would be substantively completed during the final stage of the fieldworks in Myanmar. The Study schedule was tentatively shown in Figure 1.7.



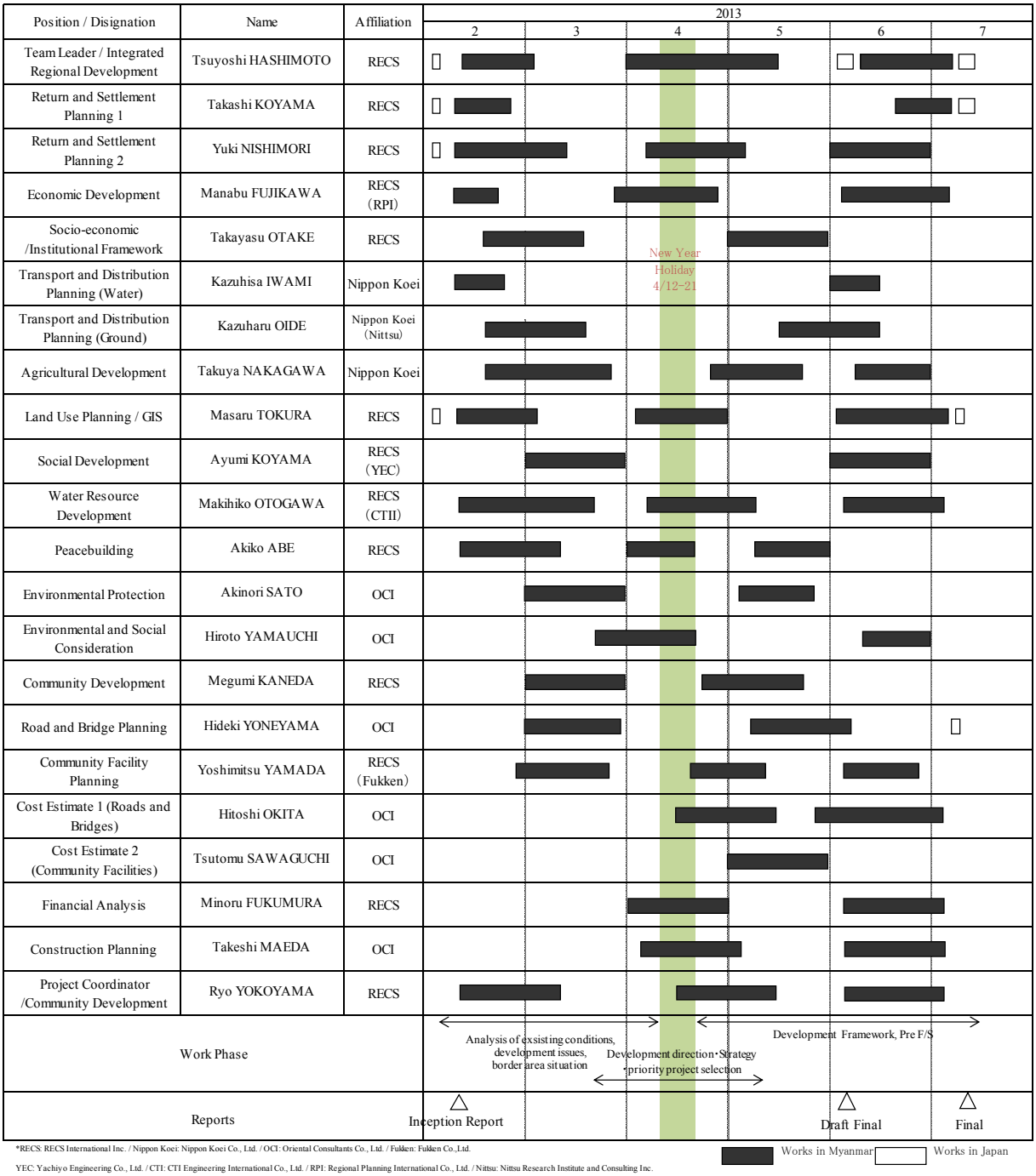
Source: JICA Study Team

Figure 1.7 Tentative Work Schedule of the Study

1.5.2 Staffing schedule

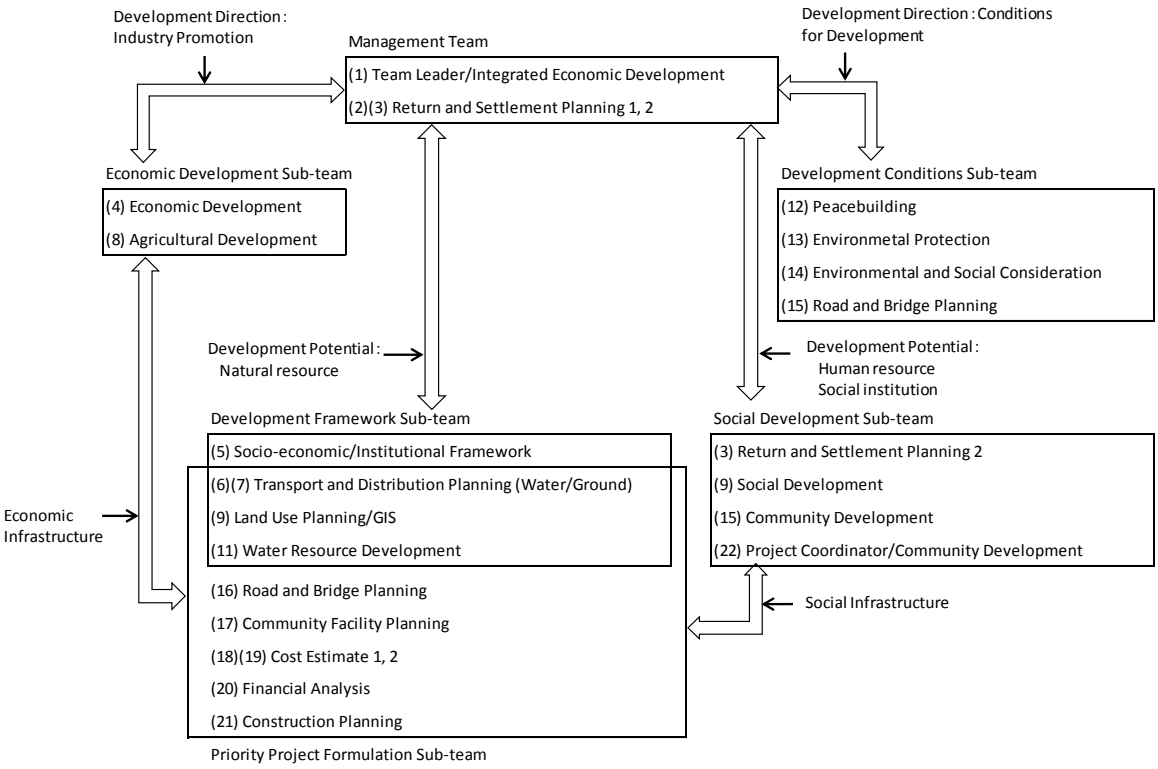
To undertake the Study as planned, a total of 22 experts have been nominated to cover many fields. A staffing schedule is shown in Figure 1.8. The schedule was expected to changes as the Study proceeds. Additional input has been made for the pre-F/S of the highest priority project. The Study Team is composed into sub-teams that are mutually inter-related in a flexible way for efficient Study

execution as shown in Figure 1.9.



Source: JICA Study Team

Figure 1.8 Staffing Schedule for the Study



Source: JICA Study Team

Figure 1.9 Structure of the Study Team with Sub-teams

1.6 Work Procedure

(1) Inception works

The Study started in early February 2013 by a team of experts led by RECS International Inc. selected through a competitive bidding and nominated by JICA to carry out the Study. The JICA Study Team prepared a draft Inception Report and discussed on it with the JICA head office and Mr. T. Kudo, the advisor for the Study, on February 12.

The field works of the Study started on February 12 by a dispatch of a team of a few experts, while the inception discussion was conducted at the JICA head office. The Leader of the JICA Study Team joined the field works on February 13. The Study Team presented the draft Inception Report to the Kayin State Government on February 14, and to the Mon State Government on February 15. Discussion took place at each State office with the presence of the respective Chief Ministers.

The JICA Study Team modified the draft Inception Report reflecting the discussion at the two State offices. To ensure that the Study would be carried out on the common understanding of scope, procedure, outcome, schedule, implementing arrangements and other specifics, a follow up session was organized with each State Government, on February 21 with Kayin State and on February 28 with Mon State. Inception Report was finalized and submitted at the end of February 2013.

The JICA head office mission visited Myanmar during this inception work period to have initial discussion with the Myanmar side. Objectives of the mission were to clarify the overall scope of the new initiative for integrated regional development to ethnic peoples in Kayin and Mon States, and to agree with the Myanmar Government in principle on the scope of works and implementing arrangements. The mission had discussion with the Ministry of National Planning and Economic Development in Naypyitaw; the Myanmar Peace Center in Yangon and other related government agencies as well as the Kayin and the Mon State Governments. The mission also visited a few sites where JICA may extend cooperation in the Southeast Myanmar.

(2) Analysis on existing conditions and prospects

The Study proceeded for the analysis on existing conditions by sector in Myanmar and the Southeast Myanmar. Each expert of the JICA Study Team collected basic data and information from related government and non-government organizations, exchange views with their staff on development issues and prospects by sector, and made field visits to selected sites. For field visits, experts of the Study Team were accompanied by officers of the respective State Governments, NATALA and other government organizations as well as security staff.

The Study Team visited most parts of the Southeast Myanmar and had many sessions with various stakeholders including peace groups. The Study Team visited the eastern part of the Southeast Myanmar during February 15 through 18, the northern part during April 2 through 6, and the southern part during April 22 through 25 accompanied by officers and experts on the Myanmar side.

The Study Team had briefing and discussion sessions at many townships (TSs) and sub-townships (STSs) during the respective trips as follows.

(a) Eastern part: Myawaddy TS, Wawlay STS and Sukali STS
(b) Northern part: Leiktho STS, Yardo village, Thandaunggyi STS, Bawgali STS, Kyaikto TS, Bilin TS, Kamamaung STS and Hpapun TS
(c) Southern part: Kyainseikgyi TS, Hpayarthonesu STS and Ye TS

Other TSs and STSs were also visited on separate occasions for briefing and discussion sessions. They include Shanywarthit STS, Paingkyon STS, Thanbyuzayat TS and Kyaikmaraw TS. At each TS and STS visited, the JICA Study Team had a briefing on existing conditions from respective TS/STS officers, and discussed with them on development issues and prospects.

The Study Team exchanged views on the existing situations related to return and settlement of refugees and IDPS and on the peace building with many stakeholders including peace groups, donors and NGOs. As part of such efforts, some members of the Study Team visited Thailand a few times to observe the situations at refugee camps and discuss with peace groups donors and NGOs supporting them. These organizations include NRC, UNHCR, WFP, UNICEFF, OCHA, NPA, IOM, MIMU, BAJ, TBC, SVA, CIDKP, Japan Foundation, Mae Fah Luag Foundation, Burma Labor Solidarity Organization and Karen Youth Organization as well as KNU, DKBA, BGF, KRC and NMSP.

(3) Meetings with State Governments

During the field works period, the Study Team had frequent discussions with officers and experts of the Kayin and the Mon State Governments, often under the presence of the respective Chief Ministers, on various issues related to regional development and return and settlement of refugees and IDPs.

In Mon State, the first meeting of stakeholders for peace and development was convened on April 24, participated by representatives of KNU and NMSP as well as State government officers with the presence of the Chief Minister. Major development issues were discussed and priority needs were clarified and shared by participants. A similar meeting was planned for Kayin State as well, but it has not been materialized due to pending issues between the State Government and various peace groups to be resolved before such meetings may be convened.

(4) Compilation of Final Report

The Final Report of the initial study started to be compiled in May after the second visit to Myanmar by the Team Leader. A draft Final Report was first compiled in Japan, and discussed with the JICA head office on June 18. Contents of the draft Final Report were substantively shared with the Myanmar side including both the State Governments and related organizations of the Union Government as well as peace groups during the third visit by the Team Leader. Reflecting comments on the draft Report, the Final Report has been prepared in Japan, and submitted to the JICA head office in late July.

CHAPTER 2 EXISTING CONDITIONS OF ENVIRONMENT IN SOUTHEAST MYANMAR

In this and four following chapters, existing conditions of the Southeast Myanmar are described by broad sector. The existing conditions are described based on related data compiled by sector, and based on it, prospects for development are suggested by sector. These chapters, will clarify characteristics of the Southeast Myanmar, and provide the basis to discuss the regional development potentials as presented in Chapter 7

This chapter presents existing environmental conditions of the Southeast Myanmar. Existing conditions of environment in various aspects and environmental protection are described in a comprehensive way, existing policies and institutions related to environment are summarized, and a framework is presented for future environmental protection. Finally, a provisional list of projects and programs related to environment is proposed.

2.1 Overview of Environment in Myanmar and Southeast Myanmar

2.1.1 Existing environmental conditions

(1) Geography

The Southeast Myanmar is defined here as the combined jurisdiction of Kayin and Mon States in the southeastern part of Myanmar. Kayin State is facing the border to Thailand in the eastern side and in the western side of Mon State are the Gulf of Mottama and the Andaman Sea.

The Southeast Myanmar stretches over approximately 510 km the north to the south, and 125 km from the east to the west. The Region has a total land area of 42,538 km^2 or 6.3% of the whole Country (Statistical Yearbook 2011, Central Statistical Office, Ministry of national Planning and Economic).

The low land areas having less than 3% slope extend from Mawlamyine to the center of the Southeast Myanmar. Geographically, the northern part of Kayin to Hpapun is characterized as mountainous areas higher than 1,000 m elevation. In the southern part of Hpapun is the Thanlwin River and below it is the Mawlamyine area. The lowland area in the eastern part of the Region is separated by the Dawna mountain range and the Teanghyo range is connected to the southeast mountains and shorelines.

(2) Climate

Myanmar is classified climatically as tropical monsoon area. The climate of Myanmar is affected by monsoon winds. Generally, Myanmar has three seasons: namely monsoon season, winter season and summer season. In Kayin State, the following seasons are observed:

(a) Monsoon season : from May to October
(b) Winter season : from November to January
(c) Summer season : from February to April

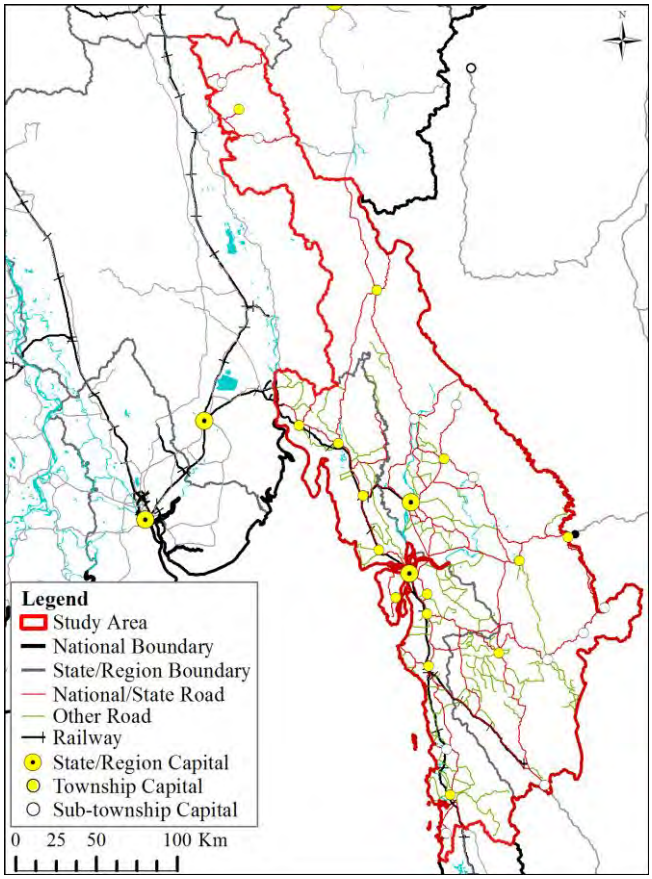


Figure 2.1 Southeast Myanmar

The climatic conditions in Kayin and Mon States are summarized in Table 2.1. According to the record of the Hpaan weather station, the average annual rainfall is recorded to be 4,556 mm in 2001 - 10. The monsoon winds bring highly humid air to this area with more than 90% of the annual rainfall concentrated during this season. The meteorological stations in Mawlamyine and Yay in Mon State recorded an approximate 5000 mm annual rainfall. During this season flooding in the Southeast Myanmar is a common problem. The mean maximum temperature in the Region is recorded to be at 33 to 45 degrees Celsius, and mean minimum temperature is 21 to 23 degrees Celsius.

Table 2.1 Climate in Kayin and Mon States

Weather Stations	2001-2010 Average				2010 Actual			
	Annual Rainfall (mm)	Temperature		Mean Relative Humidity (%)	Annual Rainfall (mm)	Temperature		Mean Relative Humidity (%)
		Mean Max. (C)	Mean Min. (C)			Mean Max. (C)	Mean Min. (C)	
Kayin State								
Hpaan	4,556	33.7	21.4	77.7	3747	34.5	21.0	73.6
								Mon State
Mawlamyine	5,161	32.2	22.6	77.2	3084	33.3	23.2	76.8
Ye	5,564	32.6	22.6	81.6	3228	33.5	23.5	80.8

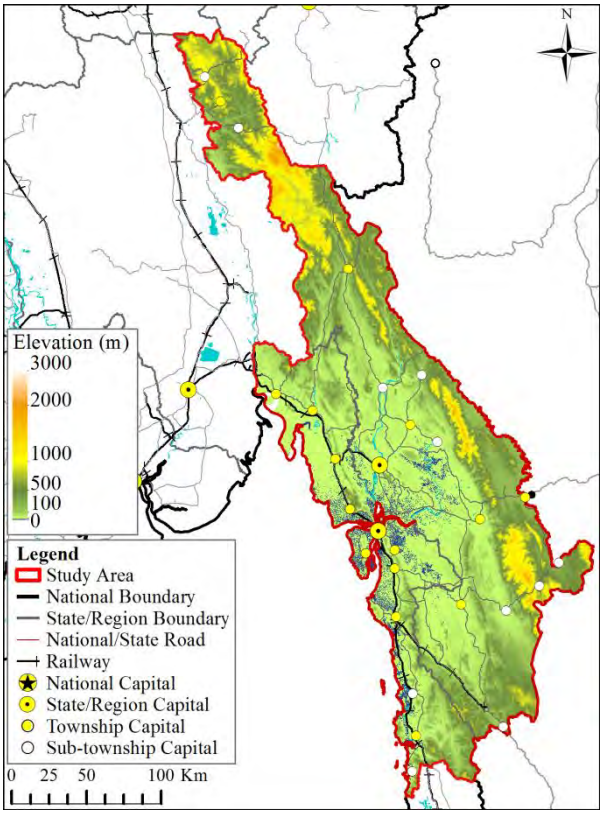
Source: Statistical Yearbook 2011, Central Statistical Office, 2012

(3) Topography and vegetation

Figure 2.2, Figure 2.3 and Figure 2.4 show the elevation, slope and land use/land cover maps in the Southeast Myanmar, respectively. As mentioned in the previous section, the low land areas having less than 3% slope are extending to the center of the Region from Mawlamyine. The distribution

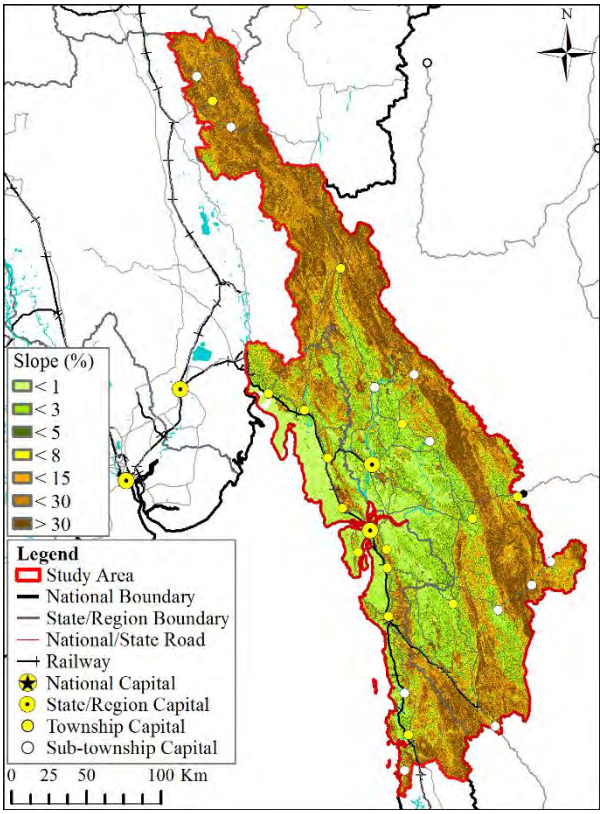
pattern of these low land areas is largely the same as distribution of agriculture land.

The high elevation areas with more than 500 m are distributed in the northern part of the Southeast Myanmar from Hpapun, and the mountains stretched to the south in the eastern Kayin State near the Thai border. This mountain range also stretches to the south in the eastern Kayin State near the Thai border. In the southern part of the Southeast Myanmar, the mountain area has about 500-1000 m elevation which is distributed from the north to the south. The distribution patterns of these high elevation areas determine largely distribution patterns of the evergreen forests and deciduous forests.



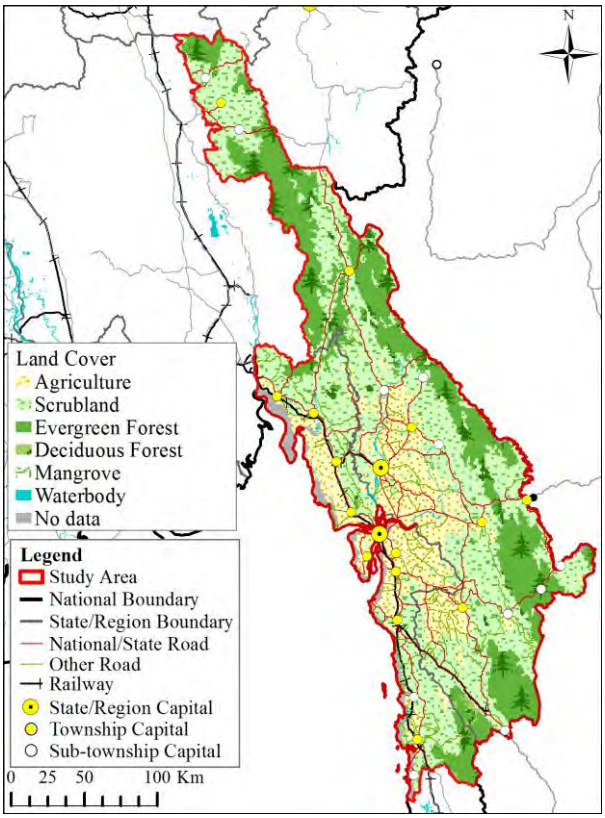
Source: Digital elevation model of SRTM

Figure 2.2 Elevation Map



Source: Digital elevation model of SRTM

Figure 2.3 Slope Map



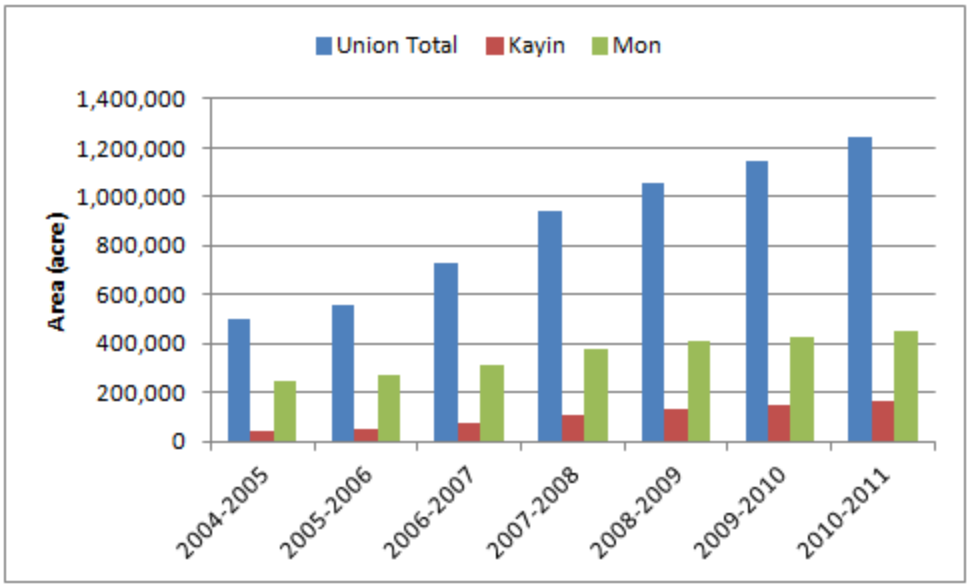
Source: Land cover map by UNEP, 2001

Figure 2.4 Distribution of Vegetation

(4) Land conversion for rubber plantations

In Mon State, hardwoods including teak, iron wood and others were exported to India and Europe for over 100 years ago. At the time, rubber plantations have just started to develop in Mon State. In the Seingyi village of Ye township (TS), for example, rubber plantations were developed over 80 years ago. Over 20 years ago, the price of rubber materials and products were high so that areas of rubber plantations also increased rapidly. Figure 2.5 shows the areas of the rubber plantations, which increased by about 3.9 times in Kayin State and 1.8 times in Mon State from 2004-05 to 2010-11. The total rubber plantation area in Kayin and Mon States accounts for about 36% of the total rubber plantation areas of Myanmar. In Kayin and Mon States, the rubber plantations account for approximately 2.2% and 14.9% of the total land area respectively. Mon State has the largest rubber plantation area as compared with the Union level (0.7%).

The number of development permits for land conversion from forest land to rubber plantations. As shown, Kayin State has a total area of 20,194 acre while Mon State has 59,504 acre of approved land conversion from forest land to rubber plantation as of December 2012. Permitted areas per case were 98 acre/case in Kayin State and 8.1 acre/case in Mon State. In Mon State, although rubber plantation areas are larger than Kayin State, there are many small rubber plantation establishments.



Source: Statistical Yearbook 2011, Central Statistical Office, Ministry of national Planning and Economic

Figure 2.5 Changes in Area of Rubber Plantation

Table 2.2 Development Permits for Land Conversion from Forest Land to Rubber Plantation as of December 31, 2012

Township/District	Name of Forest Land	No. of Permitted Persons/Company	Permitted Area (acre)	Established Area (acre)
Kayin State		**205**	**20,194.47**	**18,897.47**
Hpaan Tsp. Hpaan Dist.	Myainggalay RF Mithayaung RF, Kyeikhtiyo NRF	50	6,441.35	6,391.35
Hlaingbwe Tsp. Hpaan Dist.	Kyonepako RF, Melong RF, Hti Lon PPF, Htl Lon RF, Hlaingbwe PPF	109	8,438.42	7191.42
Kawkareik Tsp. Kawkareik Dist.	Dar Li RF	7	797.00	797.00
Myawaddy Tsp. Myawaddy Dist.	Mepalethaung Yin RF Myawaddy PPF	39	4,517.70	4,517.70
Mon State		**7,337**	**59,504.14**	**57,469.14**
Kyaikto Tsp. Thaton Dist.	Wetwontaung RF Kyuntaung RF, Kyeikhtiyo NRF	63	3,484.75	1,984.75
Bilin Tsp. Thaton Dist.	Kaylartha PA Bilin RF The Phyuchaung PPF	139	583.82	583.82
Paung Tsp. Thaton Dist.	Kalamataung RF Mottama RF	656	6,653.40	6,653.40
Thaton Tsp. Thaton Dist.	Danu RF Kalamataung RF Phapein RF	665	4,914.64	4,379.64
Mawlamyine Tsp. Mawlamyine Dist.	Mawlamyine Fuel-Wood RF, Kyeikkamok RF	5	114.90	114.90
Mudon Tsp. Mawlamyine Dist.	Mawlamyine Fuel-Wood RF, Kyeikkamok RF	3,012	21,769.15	21,769.15
Thanbyuzayat Tsp. Mawlamyine Dist.	Htinshu RF	126	322.25	322.25
Ye Tsp. Mawlamyine Dist.	Manaung RF Yechaung RF	410	2,198.00	2,198.00
Kyaikmaraw Tsp. Mawlamyine Dist.	Darli RF Kyeikkamok RF Mawlamyine Fuel Wood RF	2,261	19,463.23	19,463.23

Note: RF: Reserved Forest, PPF: Protected Public Forest, NRF: Nature Reserved Forest, PA: Protected Area

Source: Letter from Planning and Statistics Department, Ministry of Environmental Conservation and Forestry dated on April 23, 2013

The areas of permitted and illegal rubber plantations are shown in Table 2.3. It is necessary to obtain development permissions from the State Forest Department for rubber plantation development in forest land. In Kayin State, a total of 2,064 acre of illegal rubber plantations exists or about 9.2% of the total rubber plantation area, while Mon state also registered almost the same size of illegal rubber plantations.

Table 2.3 Rubber Plantation Area in Forest Land, Kayin and Mon States

(Unit: acre)

State	Legal Rubber Plantation	Illegal Rubber Plantation	Total of Rubber Plantation	% of Rubber Plantation
Kayin[1)]	20,324.47 acre 90.8%	2,064.61 acre 9.2%	22,389.08 acre 100.0% In only forest Land	
Mon[2)]	508,535.54 acre 99.6%	1,875.21 acre 0.4%	510,410.75 acre 100.0% In forest land and disposable land	16.8%

Source: Interview to State Forest Department based on "Fact about Forestry Sector and Completion of Activities

1) January 2013 data, rubber plantations in forest land

2) February 2013 data, rubber plantations in forest land and disposable land

As seen from Table 2.3, the area of rubber plantations in the Southeast Myanmar is expanding rapidly, especially in Mon State. It is sprawled not only in flat areas but also into steep slope areas. According to the Forest Department of Kayin and Mon States environmental problems were observed such as decreasing water source cultivation, decreasing water level at water sources, water pollution cause by the use of fertilizer and pesticide in the plantations, although there is no scientific research about the effects of rubber plantations.

In February 2013, the Chief Minister of Mon State proclaimed that rubber plantations should not exceed 500,000 acre in the State, while rubber plantation area already reached 510,000 acre according to the Forest Department Report as of February 2013. At present, the Forest Department of Mon State is no longer issuing development permits for rubber plantation development. On the other hand, the Planning and Statistics Development, MOECAF explained that there is no regulation that controls rubber plantation development.

Table 2.4 Recognition of Environmental Problems Caused by Rubber Plantation Development in Kayin State and Mon State.

Kayin State	Mon State
Illegal rubber plantation	- Decreasing of water level at water sources caused by land conversion to rubber plantation from forest - Decreasing of agriculture land - Decreasing of biodiversity - Water pollution caused by use of fertilizer and agricultural chemicals (no data)

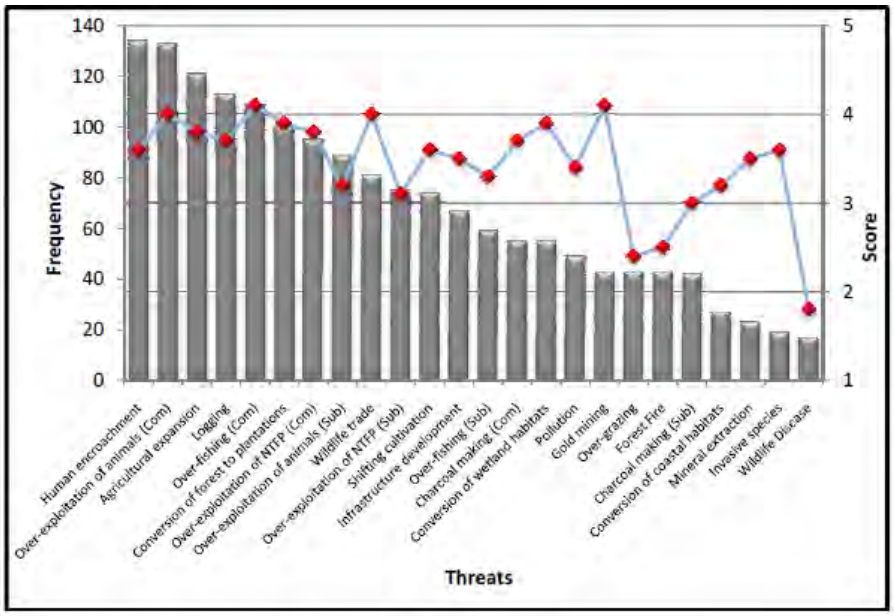
Source: Interview with Forest Departments, Kayin and Mon States in March 2013

(5) Expansion of cultivated area into steep slope land and deforestation

The Myanmar's Biodiversity Conservation Investment Vision (Wildlife Conservation Society, 2013) ranked the threats to key biodiversity areas based on frequency and intensity of threats in order to determine conservation priority species in the Country. Based on this study, the most frequent and intense threats are human encroachment (1st.), agriculture expansion (3rd), logging (4th) and conversion of forest to plantation (6th). This ranking shows that concern on biodiversity is high on threats caused by agriculture and people's activities.

Furthermore, the shifting cultivation and rubber plantations are encroaching into high elevation areas as well as steep slope areas. According to the Forest Department of Myawaddy TS, closed forests cover a large area, but currently some of them is becoming an open forest. The inappropriate

agricultural practices including cultivation in steep slope land, shifting cultivation on laterite soil, and the increasing of population have contributed to the condition. In Kayin and Mon States, where high rainfall areas exceeding 4000 mm annual rainfall are easily eroded during heavy rains.



Source: Myanmar Biodiversity Conservation Investment Vision, Wildlife Conservation Society, 2013

Figure 2.6 Score and Intensity of Threat to Key Biodiversity Areas and Conservation Priority Species

(6) Protected area management

In Myanmar, the protected areas are established by two laws: Forest Law, No. 8, 1992 and Protection of Wildlife and Conservation of Natural Areas Law, No. 6, 1994. These laws regulate the types of protected area as shown in Table 2.5. The protected areas under the Forest Law encompass not only areas for protection of natural environment and ecosystem but also for commercial logging purpose. Both areas categorized as protected areas by these laws are managed by MOECAF. Based on Myanmar's Agenda 21, the protected area management is the first pillar out of the nine important pillars.

Table 2.5 Categories of Protected Area in Myanmar

Forest Law, No. 8, 1992[1)]	The Protection of Wildlife and Conservation of Natural Areas Law, No. 6, 1994[2)]
Reserved Forest includes: (a) Commercial Reserved Forest (b) Local Supply reserved Forest (c) Watershed or Catchment Protection Served Forest (d) Environment and Bio-diversity conservation reserved Forest (e) Other Categories of Reserved Forest	(a) Scientific Reserve; (b) National Park; (c) Marine National Park; (d) Nature Reserve; (e) Wildlife Sanctuary; (f) Geo-physically Significant Reserve; (g) Other Nature Reserve determined by the Minister.

Note: 1) The Forest Law, No. 8, 1992
2) The Protection of Wildlife and Conservation of Natural Areas Law, No. 6, 1994

In the Southeast Myanmar, there are 88 and 18 protected areas under the Forest Law, No. 8, 1992 and the Protection of Wildlife and Conservation of Natural Areas Law, No. 6, 1994, respectively (Table 2.6). The total protected areas in Myanmar are 49,523,277 acre or 30% of total land in Myanmar

(167,185,920 acre). The total protected areas account only for 19% of land area of Kayin and Mon States. Although the total area of protected areas under the Protection of Wildlife and Conservation of Natural Areas Law, No. 6 increased in Myanmar to 42% around 2010, the protected area in the Region has not changed (Table 2.7).

Table 2.6 Number of Protected Area in Kayin and Mon States

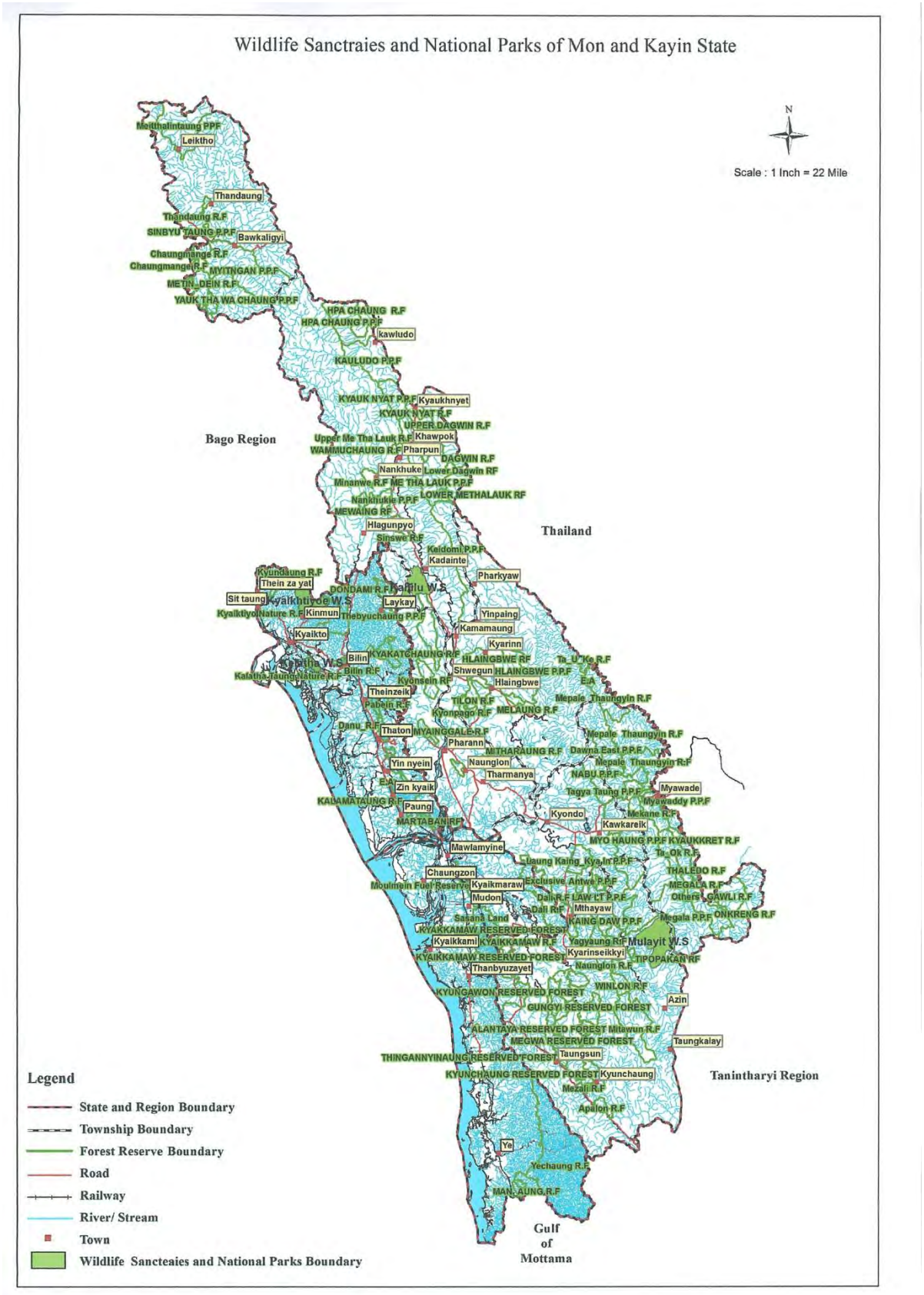
State	Item	Reserved Forest	Protected Area	Wildlife Sanctuary	Total
Kayin	No. of sites	55	31	2	88
	Area (acre)	1,118,475	1,116,644	73,920	2,309,039
Mon	No. of sites	15	1	2	18
	Area (acre)	454,625	39,467	44,514	538,606
Total	No. of sites	70	32	4	106
	Area (acre)	1,573,100	1,156,111	118,434	2,847,645

Table 2.7 Area of Protected Area in Kayin and Mon States

(Unit: mile^2)

Area	Year	Total Land Area	Permanent Forest		
			Reserved Forest& Protected Public Forest Area	Protected Area System	Total
Union	2006-2007	261,228	61,354.52	10,275.52	71,630.04
	2007-2008	261,228	62,489.38	10,275.52	72,764.90
	2008-2009	261,228	62,801.89	10,275.52	73,077.41
	2009-2010	261,228	63,048.86	10,275.53	73,324.39
	2010-2011	261,228	62,748.95	14,631.17	77,380.12
	%	100	24.0	5.6	29.6
Kayin	2006-2007	11,731	3,442.00	115.48	3,557.48
	2007-2008	11,731	3,442.00	115.48	3,557.48
	2008-2009	11,731	3,485.78	115.48	3,601.26
	2009-2010	11,731	3,499.66	115.48	3,615.14
	2010-2011	11,731	3,492.37	115.48	3,607.85
	%	100	29.8	1.1	30.8
Mon	2006-2007	4,748	838.23	69.56	907.79
	2007-2008	4,748	838.23	69.56	907.79
	2008-2009	4,748	837.85	69.56	907.41
	2009-2010	4,748	837.84	69.56	907.40
	2010-2011	4,748	832.32	69.56	901.88
	%	100	17.5	1.5	19.0

Source: Statistical Yearbook 2011, Central Statistical Office, Ministry of national Planning and Economic Development, 2012



Source: Ministry of Environmental Conservation and Forestry

Figure 2.7 Locations of Wildlife Sanctuaries and National Parks in Kayin and Mon States

Table 2.8 Outlines of Wildlife Sanctuary in Kayin and Mon States

State	Name of Wildlife Sanctuary	Outlines
Kayin	Kahilu Wildlife Sanctuary	a Established year: 1928 (Protected Area; Notification No.188/1928 (2-9-1928)) b Area: 160.55 km^2 (60.99 sq. mile) c Major forest types: Evergreen forest, Hill forest d Key Fauna: Serow, Mouse deer, Hog deer e Objectives: To conserve rare wildlife and associated habitats f Protected status: Managed by Kyainseikgyi Township Forest Department
	Mulayit Wildlife Sanctuary	a Established year: 1935 (Protected Area; Notification No. 232/1935 (5-11-1935)) b Area: 138.54 km^2 (53.49 sq. mile) c Major forest types: Evergreen forest, Hill forest d Key Fauna: Barking deer, Wild boar, Macaque, Avifauna e Objectives: To conserve rare wildlife and associated habitats f Protected status: Managed by Harpoon Township Forest Department
Mon	Kelatha Wildlife Sanctuary	a Established year 1942 (Re-notified in 2002 Notification No. 23/2002 (15-3-2002) b Area: 23.93 km^2 (9.24 sq. mile) c Major forest types: Evergreen forest, Hill forest d Key Fauna: Samber, Barking deer, Wildboar, Avifauna e Objectives: To conserve rare wildlife and associated habitats f Protected status: Managed by Bilin Township Forest Department
	Kyaikhtiyoe Wildlife Sanctuary	a Established year: 2001 (Protected Area; Notification No. 37/2001 (6-7-2001)) b Area: 156.23 km^2 (60.32sq. mile) c Major forest types: Evergreen forest, Hill forest d Key Fauna: Goral, Gaur, Sambar, Barking deer, Macque e Objectives: - To maintain green environment of the Kyaikhtiyoe pagoda, a legendary and national heritage of Myanmar - To conserve rare wildlife and associated habitats. F Protected status: Managed by Park Warden Office, Nature and Wildlife Conservation Division, Forest Department

Source: Letter from Planning and Statistics Department, Ministry of Environmental Conservation and Forestry dated on April 23, 2013

The Wawlay STS and Myawaddy TS are located within the Kawli protected area. Wawlay used to be a small village, but its population has increased thus it has now been elevated to the township level. As a result, the Kawli protected area is not suitable as a protected area. The Myawaddy TS requested MOECAF to cancel the protected area designation. As observed, there are cases of inappropriate designation of protected areas based on conservation level for natural environment and ecosystem. It is necessary to review the existing conditions of the current protected areas and re-delineate new boundaries.

(7) Inadequate solid waste management

In the Southeast Myanmar, a common problem in built-up areas is inappropriate solid waste management. Throwing garbage into road sides, channels and rivers give rise to negative environmental impact not only in the aspect of water pollution of water sources for water supply and agriculture, and good hygiene but also in decreasing the capacity of water flow.

Solid waste disposal practiced in the Region is categorized as open dumping method so that it is expected that the river water, groundwater and agriculture land are polluted by leachate with high

concentration of organic matters and heavy metals. In Myawaddy, it is observed that garbage from open dumping sites on river sides of the Thanlwin River are scattered in the river. The Thanlwin River is an international river bordering on Thailand. It is feared that this situation will cause international problem in the near future.

Scattering garbage on the road side between Bilin and Thaton

Throwing garbage into rivers in Thaton

Scattering hospital waste in Hpaan

Hospital waste in Hpaan

Scattering garbage in Hpaan

Scattering garbage in international river with Thailand, Thanlwin river in Myawaddy

Open dumping site in Myawaddy

Disposed garbage is scattered into international river, Thanlwin river

Open dumping site in Hpaan

Mim Ywar open dumping site at the former rubber plantation in Mawlamyine

Photo 2.1 Illegal Throwing Garbage and Scattering Garbage

(8) Natural disasters

According to the UN Risk Model, Myanmar ranks first and categorized as most flood risk country in Asia and Pacific (source: OCHA: United Nations Office for the Coordination of Humanitarian Affairs). The Country is vulnerable to a wide range of hazards including floods, cyclones, earthquakes, landslides and tsunamis.

Major natural disasters from 2008 to 2012 are summarized in Table 2.9 and Figure 2.8. The cyclone Nargis hit the Ayeyarwady delta on May 2, 2008 of which the UN estimated 2.4 million people were affected. For the Southeast Myanmar, flooding has affected a large area including Kayin and Mon States. In the whole Country, flooding has affected a total of 267,000 people, over 136, 000 acre of farmland aside from the totally and partially damaged houses, roads and bridges. The flood inundated area from August 18 to 22, 20012 is shown in Figure 2.9.

Table 2.9 Major Natural Disaster 2008 - 2012

Year	Event
May 2008	May 2008 (Cyclone Nargis): Cyclone Nargis left some 140,000 people dead and missing in the Ayeyarwady Delta region. An estimated 2.4 million people lost their homes and livelihoods.
June 2010	June 2010 (Floods in northern Rakhine State): The floods killed 68 people and affected 29,000 families. Over 800 houses were completely destroyed
October 2010	October 2010 (Cyclone Giri): At least 45 people were killed, 100,000 people became homeless and some 260,000 people were affected. Over 20,300 houses, 17,500 acres of agricultural land and nearly 50,000 acres of aquaculture ponds were damaged by the Cyclone Giri.
March 2011	March 2011 (6.8 Earthquake in Shan State): Over 18,000 people were affected. At least 74 people were killed and 125 injured. Over 3,000 people became homeless.
October 2011	October 2011 (Floods in Magway Region): Nearly 30,000 people were affected to varying degree. Over 3,500 houses and some 5,400 acres of croplands were destroyed.
August 2012	August 2012 (Floods across Myanmar): The floods in different states and regions displaced some 86,000 people and affected over 287,000 people. Ayeyarwady Region was the worst affected with some 48,000 people displaced. Over 136,000 acres of farmland, houses, roads and bridges were damaged.
November 2012	November 2012 (6.8 Earthquake in northern Myanmar): At least 16 people were killed and 52 injured, with over 400 houses, 65 schools and some 100 religious building damaged.

Source: Myanmar Natural Disaster 2012-2012, OCHA

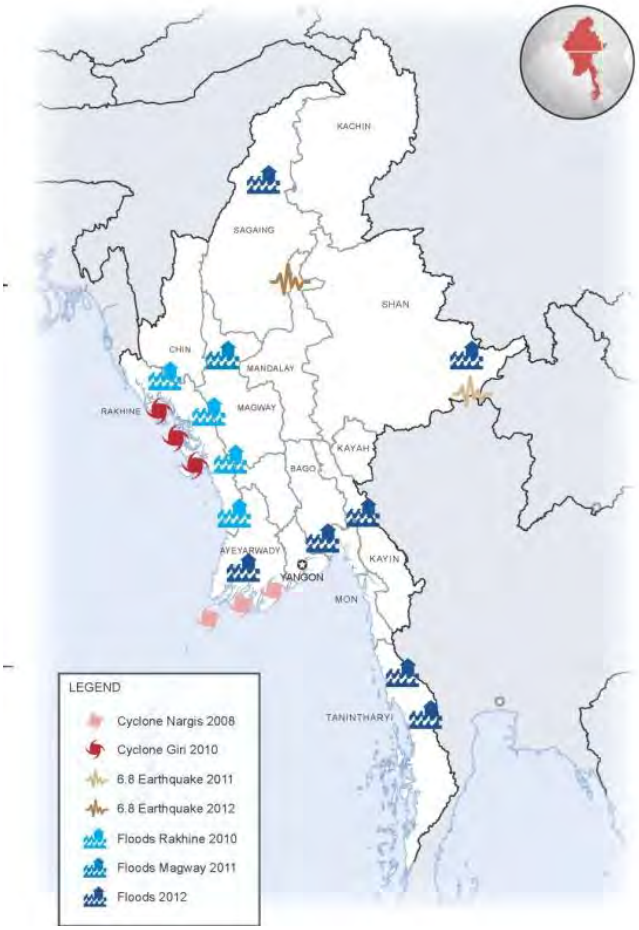


Figure 2.8 Major Natural Disaster 2008 – 2012

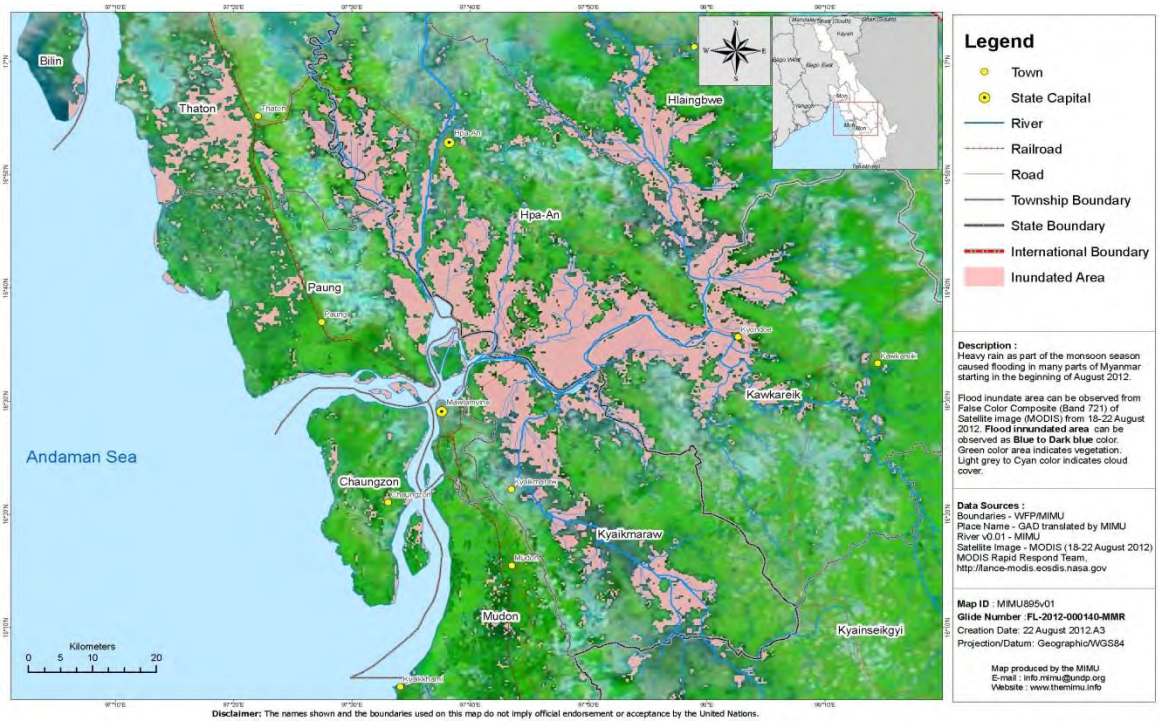
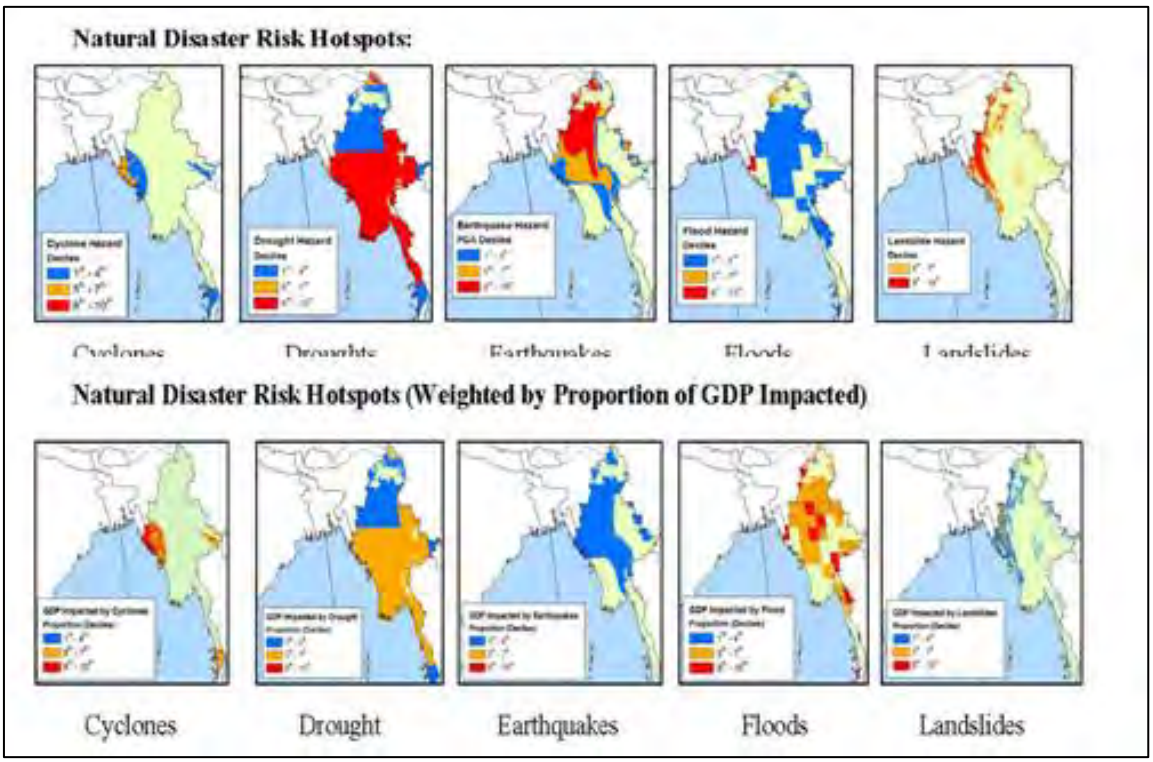


Figure 2.9 Flood Inundated Area in Kayin and Mon States from August 18 - 22, 2012

Other data also point out that in the northern part of the Southeast Myanmar, risk hotspots by draught

and flood are also very common (Figure 2.10). The risk hotspots weighted by the GDP affect most of the Southeast Myanmar with middle level draughts and the northern part of Kayin State with high risk of flooding.



Source: The Earth Institute, Columbia University

Figure 2.10 Natural Disaster Risk Hotspots

2.1.2 Structure of environmental problems in Southeast Myanmar

The environmental problems structure in the Southeast Myanmar is shown in Figure 2.11. As seen from Figure 2.11, the Southeast Myanmar can be divided into low land, hilly area and mountainous area. People use these areas for habitation, socio-economic activities and production. The cultivated land is sprawled to hilly and mountainous areas. In the Dawna mountain range, the cultivated lands are observed in high lands with 1000 m elevation.

Rubber plantations are expanding in the Southeast Myanmar and have extended from low lands to hilly areas. In Mon State, the area for rubber plantations covers about 14.9% to its total land area. Encroachment of agriculture lands and rubber plantations into hilly and mountainous areas give rise to the deterioration of forest ecosystem and also in decreasing water resource potentiality due to decreasing water level at water sources and water pollution by chemical use.

The built-up areas of the Southeast Myanmar also have different environmental problems such as scattering garbage and inappropriate garbage disposal sites which are common issues in Myanmar. People throw garbage in road sides, channels and rivers. The scattering garbage causes deterioration of landscape, environmental quality and hygiene.

During the interview survey conducted by the JICA Study Team, people's awareness about the implications of throwing garbage is seen to be a major problem. The second problem of solid waste management is at disposal sites, especially open dumping sites in Myawaddy. The Myawaddy's open dumping site is located on the river side of the Thanlwin River facing the international border with

Thailand. The disposed garbage scatted into the river by rainfalls. Leachate from the dumping site also gives rise to river water pollution in the area.

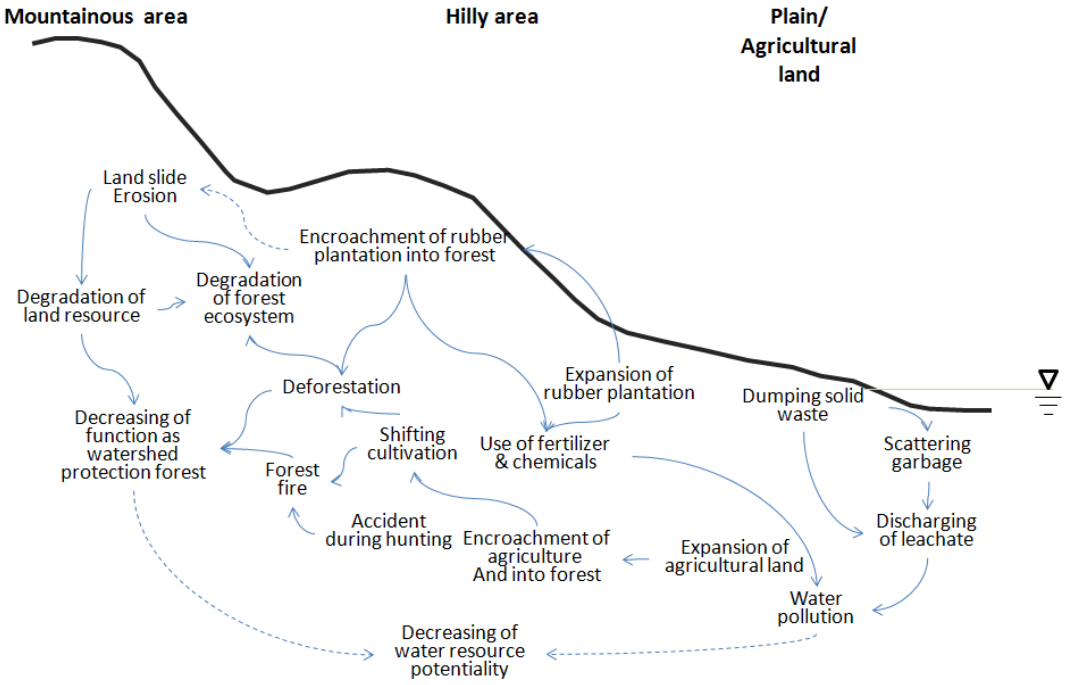


Figure 2.11 Environmental Problem Structure in the Southeast Myanmar

2.2 Current Environmental Management

2.2.1 Environmental conservation policy in Myanmar

(1) Constitution

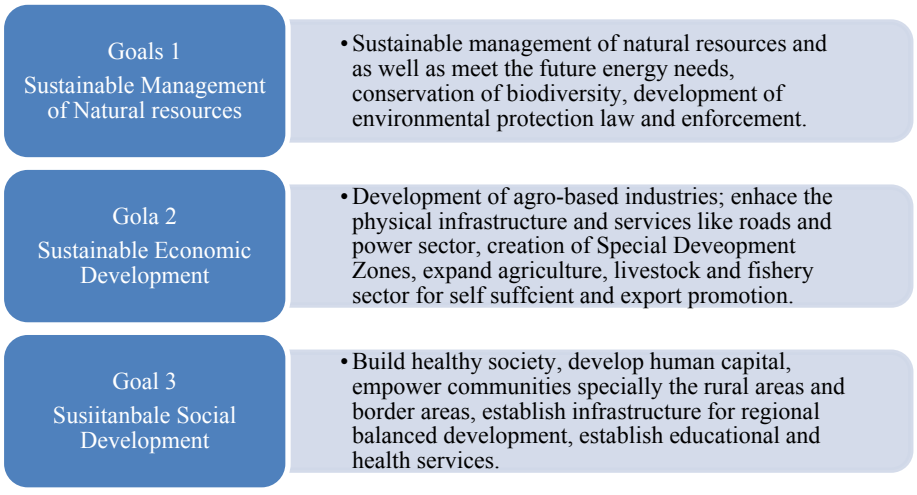
The Constitution of the Republic Union of Myanmar was adopted in May 2008. Section 45 of the Constitution provides the provision regarding environmental conservation of the Country that mandates the protection and conservation of the natural environment.

The Constitution also prescribes duties of Myanmar's citizen under Section 390 which include: a) preservation and safeguarding of cultural heritage, b) environmental conservation, c) striving for development of human resources, and d) protection and preservation of public property. Environmental conservation is known to be one of important duties of the people in Myanmar.

(2) Myanmar Agenda 21

Myanmar Agenda 21 was formulated and published in 1997, which provides the national environmental policy for sustainable development in the Country in the international society context. It provides the blueprint for the Country's approach to sustainable development.

Based on Myanmar Agenda 21, the National Sustainable Development Strategy (NSDS) was launched in 2009. The NSDS envisions the achievement of a "well-being and happiness for all people of Myanmar within 15 year time-frame." The NSDS covers the three pillars: namely environment, economic and social aspects as a basis for the improvement of quality of life and the provision for competitiveness of the Country in the long run. The Myanmar NSDS strategy aims to achieve that vision through the three integrated goals as shown in Figure 2.12.



Source: UNEP

Figure 2.12 Three Goals of National Sustainable Development Strategy of Myanmar

(3) Environmental Conservation Law No. 9, 2012

The Environmental Conservation Law was promulgated in March 2012. The objectives of this law are as follows:

(a) to implement the Myanmar National Environmental Policy;
(b) to lay down the basic principles and give guidance for systematic integration of the matters of environmental conservation in the sustainable development process;

(c) to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;
(d) to reclaim ecosystems as may be possible which are starting to degenerate and disappear;
(e) to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;
(f) to implement for promoting public awareness and cooperation in educational programmers for dissemination of environmental perception;
(g) to promote international, regional and bilateral cooperation in the matters of environmental conservation;
(h) to cooperate with Government departments, Government; and
(i) to cooperate with organizations, international organizations, non-government organizations and individuals in matters of environmental conservation.

The Environmental Conservation Law highlights the following issues:
(a) to control and manage the pollution and waste,
(b) to set environmental quality standards,
(c) to maintain a comprehensive monitoring system and implement,
(d) to set environmental impact assessment systems,
(e) to advise as may be necessary to the relevant organizations individuals for the management of urban environment,
(f) to conserve, manage, beneficial use and sustainable use of the natural resources the Natural Resources and Cultural Heritages,
(g) to submit proposals for economic incentive mechanisms and terms and conditions which may not affect the environment or cause least environmental affect for sustainable development in addition to legal affairs and guidelines relating to environment,
(h) to set and manage the polluter Pay Principle (PPP), Payment for environmental service system (PES) and to contribute a part of the benefit from the businesses which explore, trade and use the natural resources in environmental conservation works, and
(i) to promote international cooperation on environmental matters.

2.2.2 Legislation related to environment

According to the Planning and Statistics Department of the Ministry of Environmental Conservation and Forestry (MOECF), in order to implement the Environmental Conservation Law, environmental conservation rules needs to be drafted with the participation of all stakeholders including NGOs and to be submitted to the Cabinet.

The rules highlight promotion of environmental education and awareness campaign, monitoring system for environmental protection and enhancement, resolution of environmental disputes, establishment of environmental management fund, setting of environmental standards, undertaking of urban environmental management, waste management, conservation of natural resources and culture heritage, and establishment of the EIS system.

2.2.3 Roles of related agencies for environmental conservation

(1) National level

The National Commission for Environment Affairs (NCEA) was established in February 1990. The first chairperson was the Minister of Foreign Affairs, followed by the Ministry of Forest appointed as

chairperson of the NCEA. The NCEA has the following functions:

(a) to coordinate environmental problems with related government agencies as responsible agency for environmental policy,
(b) to enlighten environmental issues in the Country,
(c) to research water quality survey and soil survey,
(d) to control pollution, and
(e) to advise and recommend international environmental conventions and treaties.

The Ministry of Environmental Conservation and Forestry was established in 2012. The Ministry has the overall responsibility for environmental management in the Country. The Ministry consists of five departments as shown in Figure 2.13.

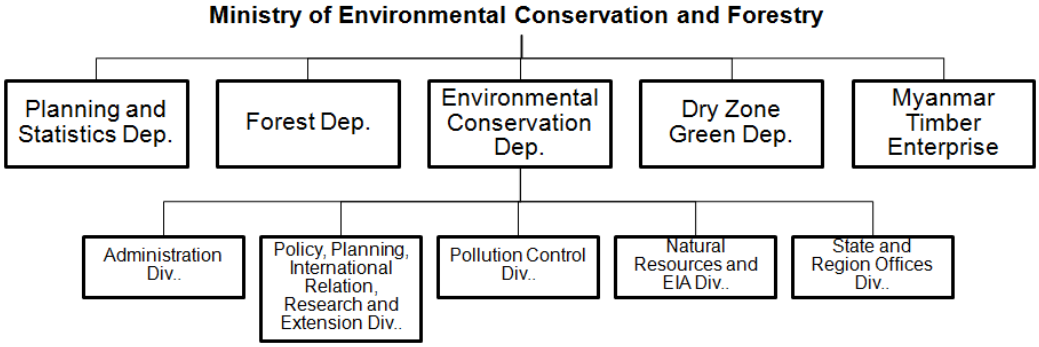


Figure 2.13 Organization Chart of Ministry of Environmental Conservation and Forestry

(2) State level

The Forest Department of the State Ministry of Forest and Mine under the State Minster are a major environmental management bodies at the state level Figure 2.14 shows the organizational chart of Ministry of Forest and Mine. Its roles consist of the following:

(a) Protection of forests,
(b) Sustainable timber production,
(c) Ensuring of forest products for people, and
(d) Raising environmental awareness of people.

There is no responsible body concerned about the comprehensive environmental management at the state level such as state level of Environmental Conservation Department.

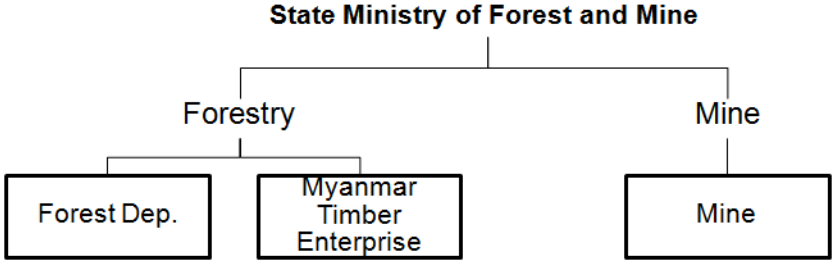


Figure 2.14 Organization Chart of State Ministry of Forestry and Mine

(3) Township level

At the township level, only the Forest Department is the responsible organization for the environmental management. This is the same situation as observed at the state level.

2.2.4 International and bilateral treaties, conventions and agreements related to environment

The Government of Myanmar signed the international and regional agreements and conventions as shown in Box 2.1.

Box 2.1 List of Ratified International Treaties and Conventions by the Union of Myanmar

- United Nations Framework Convention on Climate Change (UNFCCC), 1992
- Convention on Biological Diversity (CBD), 1992
- Vienna Convention for the Protection of the Ozone Layer, 1985
- Montreal Protocol for the Protection of the Ozone Layer (Montreal Protocol), 1987
- London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, 1990
- International Convention for the Prevention of Pollution from Ships (MARPOL), 1973
- Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1987
- Convention concerning the Protection of the World Culture and Natural Heritage, 1972
- Convention to Combat Desertification (CCD), 1994
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1979
- International Tropical Timber Agreement (ITTA), 1994
- Agreement on the Networks of Aquaculture Centers in Asia and Pacific Region, 1988
- Stockholm Convention on Persistent Organic Pollutants (POPs).

2.3 Environmental Conservation Policy Framework

2.3.1 Objectives of environmental conservation

The objectives of incorporating environmental conservation into the regional development in the Southeast Myanmar may be defined as follows:

(a) To strengthen environmental sustainability of the Southeast Myanmar by ensuring the balanced between environmental conservation and socio-economic development demand, and.
(b) To maintain and optimize environmental quality in the Southeast Myanmar.

2.3.2 Environmental conservation issues in Southeast Myanmar

The new Government administration in Myanmar was established in March 2011. Since then, steady progress has been made towards democratization and economic liberalization as known. As a result, it is expected that the Myanmar's economy will be experiencing a rapid growth. With the expected rapid and progressing development, the environmental quality of Myanmar will be endangered.

Under the assumption of future environmental stresses, the current environmental conditions will further deteriorate if the Government does not improve its environmental management system. This poses a challenge for the Southeast Myanmar regional development in its pursuit of a model of sustainable regional development in Myanmar.

In order to strengthen the position of the Southeast Myanmar, as well as to sustain and maintain its development efforts, the Region should promote sustainable area development along with the essential elements that will balance economic growth and environmental conservation. In order to achieve this goal, the environmental policy issues listed in Figure 2.15 should be addressed in integral way with the economic development. Furthermore, these environmental issues also need to be tackled in environmental conservation.

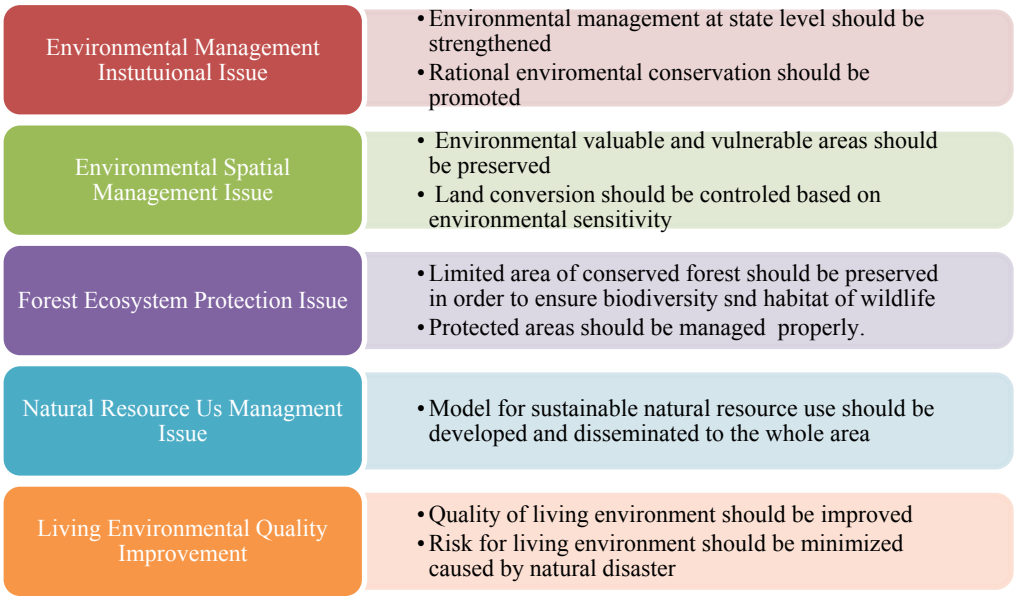


Figure 2.15 Environmental Conservation Issues

2.3.3 Environmental conservation strategy and measures

A structure of environmental conservation is schematically shown in Figure 2.16 in relation to the environmental conservation issues raised in the previous section. In order to achieve and solve management issues, the following strategy should be taken and incorporated in the environmental conservation plan. Environmental conservation measures are also listed in the environmental conservation plan (Figure 2.16).

- State Environmental Conservation Department is to be established.
- Capacity for environmental conservation at state level is to be developed.
- Scientific data base for environmental conservation should be established.
- Environmentally Sensitive Zoning is to be introduced in Environmental Conservation.
- Preservation and conservation of forest areas should be realized based on environmentally sensitive zoning maps.
- Existing protected areas should be review and re-established.
- Plant resources are to be made use of as alternative materials for environmental conservation and income generation.
- Mechanism for biological resource utilization and sharing benefit should be developed
- Sustainable natural resource use by highland ethnic peoples and environmental conservation are to be enhanced
- Solid waste disposal sites should be located in appropriate areas.
- Land use is to be controlled in flood-prone areas especially housing, industries and commercial purposes.

(1) Establishment of State Environmental Conservation Department

Although MOECAF covers the comprehensive environmental management at the Union level, only the Forest Department has responsibility for environmental management at the state level. Moreover, the State Forest Department covers only forest management aspect. Therefore, it is necessary to establish an Environmental Conservation Department at the state level that covers the following domains so that detailed planning and plan implementation for environmental conservation can be prioritized:

(a) policy and planning formulation for environmental management,
(b) implementation of Environmental Conservation Law, No. 9, 2012 at state level,
(c) monitoring for environmental conditions, and
(d) environmental impact assessment.

Moreover, in order to establish the State Environmental Conservation Department, it is necessary to have a legal basis to effect revision of related environmental regulations. From the view point of technical aspect, capacity development for environmental conservation at the state level is also required through human resources development.

(2) Capacity development for environmental management at state level

The State Government has responsibility for the sustainable development of their jurisdiction. However, capacity development for environmental conservation at the state level is weak. Hence, there is a need to strengthen its capacity for environmental conservation including human resources development program of staff and personnel. The district and township officers will need to be involved in environmental conservation in cooperation with the State Government so that any training

programs should cover not only the state level but also district and township levels.

(3) Scientific data based environmental conservation

During the interview and survey by the JICA Study Team, government officers and people in communities pointed out their environmental problems and provide their opinions, but most problems mentioned are not supported by any data, facts and evidences. Providing only anecdotes cannot be a sound basis for rational planning; hence, in order to realize both the sustainable utilization of natural resources and the environmental conservation, it is indispensable to introduce environmental conservation system based on scientific data.

Scientific data provide a base for effective management, minimizing futile activities and wasteful budget uses. As Kayin and Mon States have many environmental assets that are to be preserved and conserved from the viewpoints of ecosystem protection, sustainable resource use etc., it is necessary to conduct a precise assessment research in order to deepen understanding of the characteristics of the areas. Such data and information are important and valuable for appropriate environmental conservation interventions. Only scientific evidences can realize planning and implementation of environmental conservation.

(4) Environmentally sensitive zoning

The economy of Myanmar is rapidly growing, and the lack or absence of a comprehensive environmental conservation plan may result in an adverse environmental impact of the growth. A case in point is agricultural activities that have vastly encroached in hilly and forested areas. This disorderly development will cause environmental damage and disrupt the natural balance of valuable and vulnerable environments. It is necessary to identify environmentally valuable and vulnerable areas, and take actions for measures before these areas disappear.

The land potentiality and vulnerability analysis should be conducted in order to determine the different resource uses that have become intertwined and overlapping, resulting in conflicts of uses. Besides user conflicts, this situation can cause a geographical, ecological, and social conflicts in the future if not manage properly. Coordination is necessary between and among spatial users in order to minimize the potential conflicts which will arise from resource utilization.

It is also important to note that the use of any areas should be reasonable and integrated within the use of neighboring areas taking into account geographical and ecological conditions. Due to development pressure and the associated loss and fragmentation of natural areas throughout the Southeast Myanmar, it has become increasingly important to preserve the remaining natural assets. Also important is the designation of areas for preservation and conservation to ensure ecological balance for sustainable production. It is also critical that a precise assessment and research by zone of natural environment and ecosystem be undertaken.

An environmentally sensitive zoning map should indicate the areas that should be preserved, conserved, and restored. This information is important and valuable for effective and appropriate environmental conservation in the Southeast Myanmar. It is recommended that environmentally sensitive zoning is introduced in order to effect and implement environmental conservation. The environmentally sensitive zoning management is a strategic approach to sustainable area development in the Southeast Myanmar as describe below.

1) What is environmentally sensitive zoning?

Environmentally sensitive zoning (ESZ) is a system of designation for an area which needs special protection due to its value and/or vulnerable landscape and/or ecosystem from the viewpoint of environmental conservation. An ESZ map is one of the most effective tools in environmental spatial management. It is practiced by designating permitted uses of land on mapped zones, separating one set of land uses from another. It also shows the areas which should be preserved, conserved, and restored from the viewpoint of natural environmental conservation and ecosystem protection.

2) Key environment and ecosystem in environmentally sensitive zoning in Southeast Myanmar

Key environments and ecosystems refer to environmentally important and critical areas and other unique features as well as critical habitats, ecosystems, and ecological processes. Based on preliminary analysis of the existing environmental conditions, the key environments and ecosystems of the Southeast Myanmar have been identified as: natural landscape, land suitability, forest ecosystem, and watershed conservation (Figure 2.16).

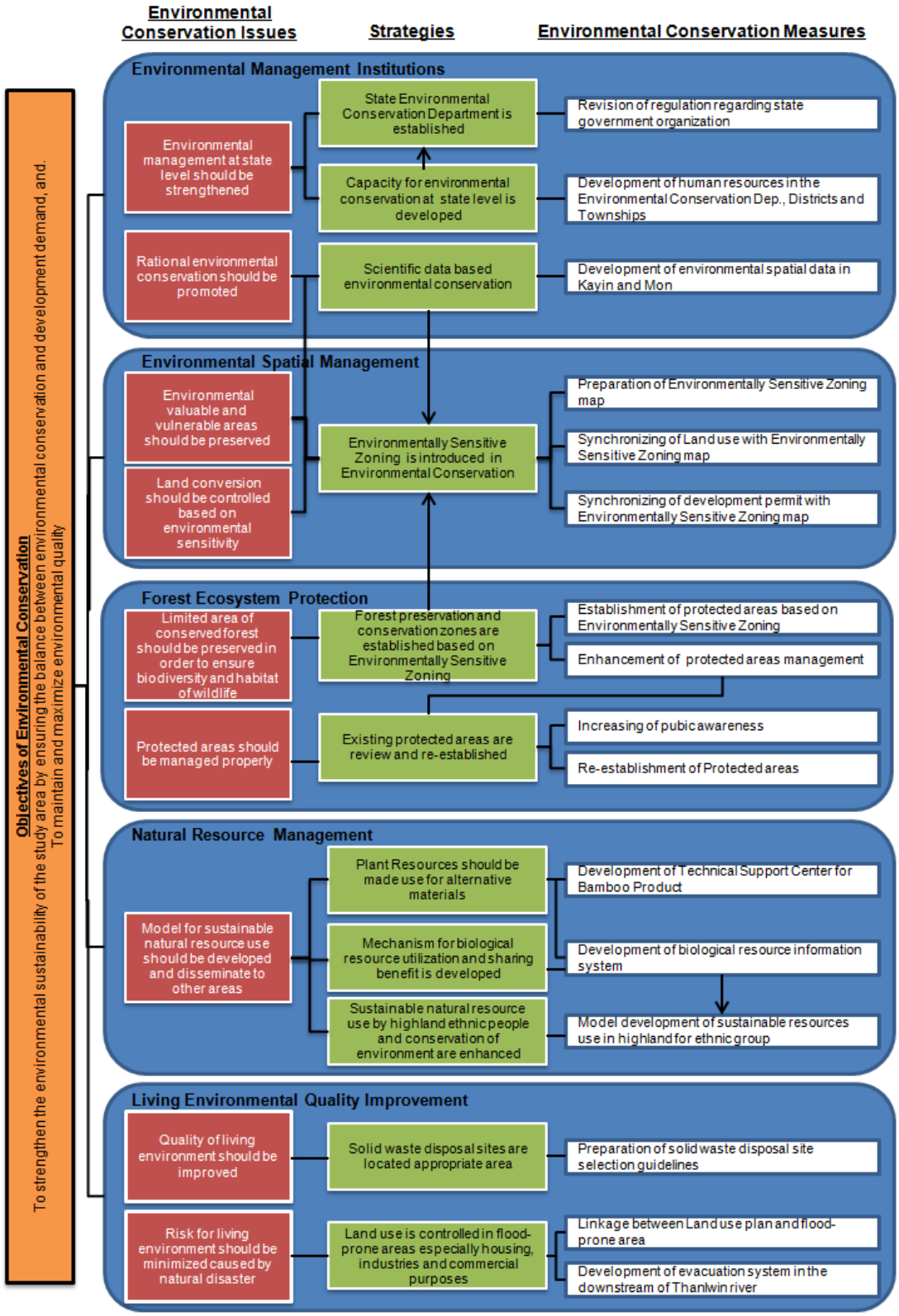


Figure 2.16 Schematic Diagram for Environmental Conservation in Southeast Myanmar

The objectives, targets and parameters of environmentally sensitive zoning are shown in Table 2.10.

Table 2.10 Objectives, Targets and Parameters of Environmentally Sensitive Zones

Components	Objectives of Zoning	Zoning Targets	Zoning Parameters
Natural Landscape	- To protect the unique landscape at national and state levels	- Unique Limestone Landform	- Size of the area and height of cliff - Wider area - Difference in elevation - No damage by human activities
Land Stability	- To protect unique landscape	- Land prone to landslides and soil erosion	- Slope and elevation - Landslide and erosion potentiality (Universal Soil Loss Quotation - Land cover
Forest Ecosystem	- To protect forest ecosystem	- Primary Forest (Closed forest, Reserved forest) - Wild life habitats	- Primary forest area - Elevation
Watershed Conservation	- To conserve water resource	- Closed forest - Preserved forest	- Watershed areas for water resource - Forest and other land cover

(5) Preservation and conservation of forest areas by environmentally sensitive zoning map

Rubber plantation development is a booming industry in the Southeast Myanmar for a long time because of its high value compared to the other crops and trees. For this reason, rubber plantations are extended into forest areas. Rubber plantations in Mon State have already reached 14.9% of its total land area. Furthermore, cultivated land is also encroached into forest areas. Forest ecosystem is now experiencing development pressures, which may reach a critical level, if not managed and responded to properly.

Although primary forest areas are limited in the Southeast Myanmar, they are ecologically important areas. Primary forest areas should be strictly maintained to ensure ecosystem and biodiversity, while production forests may be absorbed into conservation areas, where some socioeconomic activities are allowed to some extent. There are limited data on distribution of primary forests so that primary forests should be identified first.

Environmentally sensitive zones for forest ecosystem will be identified and preserved, conserved and restored in order to protect limited forest areas. From the viewpoint of simplified analysis for satellite images, forest areas which require preservation and conservation can be found as shown in Figure 2.17. In these areas, high density evergreen forests and deciduous forests are distributed, and their areas are steep slope areas with more than 15% (Figure 2.3 and Figure 2.4).

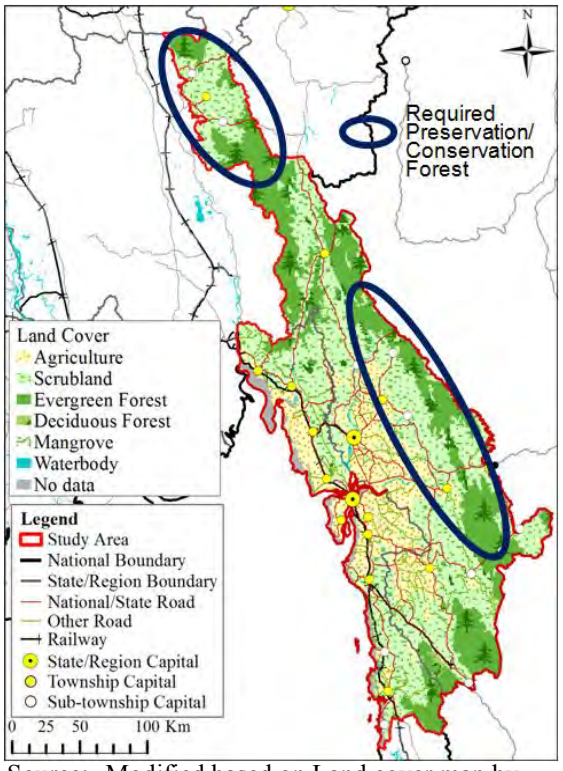
It is also necessary to take actions in the aspects of preserving the forest ecosystem through the establishment of new protected areas in order to preserve biodiversity and habitat of wildlife, conserve watershed, and protect land against soil erosion and land slides. Moreover, detailed spatial data are required in the formulation of a rational and effective conservation plan and at the same time field surveys need to be conducted in order to prepare environmentally sensitive zoning maps to determine effective measures to be undertaken.

(6) Review and revision of protected areas

Designation of protected areas is a very effective environmental management tool. In the Southeast Myanmar、however, some protected areas have not been appropriately delineated on the basis of its existing environmental conditions. Some of the protected areas have been already developed within

and/or surrounding areas of protected areas. For example, at the Kawli protected area in Wawlay STS is a remote area from Myawaddy, and it was only a village. Because of many small development activities, this village has become a town, hence, with this development, it become reasonable to review its protected area status and assess development conditions from the viewpoint of natural environmental conditions.

The review of the existing protected areas, and the need to re-delineate the new boundaries to be protected from viewpoint of the present environmentally importance and conservation level is an urgent concern that needs to be taken into consideration by the Union Government of Myanmar. As it is expected that there will be more environmentally valuable and vulnerable areas in the Southeast Myanmar, it imperative that the new protected areas will be established based on environmentally sensitive zoning maps.



Source: Modified based on Land cover map by UNEP, 2001

Figure 2.17 Preliminary Identification of Required Preservation and Conservation Forest Areas in Southeast Myanmar

(7) Utilization of plant resources as alternative materials for socio-economic development

As already noted in the previous section, rubber plantation development is a booming industry in Mon and Kayin States. This development has also contributed to the concern about illegal logging, and encroachment of cultivated land by illegal loggers. The people from remote areas and the highland ethnic peoples have limited income sources which can be one of the causes of illegal logging. It is recommended, therefore, that a variety of plant resources will be used as alternative materials to minimize environmental impact including logging of trees, and maximize income for remote and highland ethnic peoples.

Medicinal plants for development of medicine are one of alternatives (as discussed in next section). Bamboo is another alternative income source. Bamboo can be grown in widely different habitats, and its growth rate is much faster than other trees such as rubber and iron wood. Hence, it can be an alternate income source. Bamboo can be used for various purposes as shown in Table 2.11. It is recommended that utilization of bamboo should be promoted and enhanced.

There are bamboo works in Kayin and Mon States. However, it is necessary to improve quality of end- products in order to encourage people to engage in bamboo business.

Table 2.11 Utilization of Bamboo

Purposes	Utilization
Individual Use	chair, bed, mat, bamboo acetic acid for insect repellent, anti-fungal and deodorant effect
Local Use	building materials such as wall, fence, bamboo work, bamboo charcoal
Industrial Use	material for paper mill

There used to be a paper mill in Sittaung. This factory was constructed in 1965, and started to operate mill paper by using bamboo since 1975. Paper made by bamboo was produced at 40 tons/day at the begging of operation, and 15 tons/day in 2011. Then operation was stopped in September 2011, because equipment was installed 41 years ago and cost has increased especially for natural gas as fuel. Provided that energy saving equipment will be installed, it can be expected to reduce cost for paper production, and generate more value.

Making bamboo works

Sittaung Paper Mill
Equipment was installed 41 years ago

Photo 2.2 Utilization of Bamboo

(8) Development of mechanism for biological resource utilization and benefit sharing

Scientists believe that plants and animals have very high potentiality for commercial value for medicines and cosmetics. However, some conflicts are experienced in Brazil and other countries as bio-prospectors collect medicinal plants for development of medicines. It is said that only mega-pharmaceutical companies obtain huge benefits leaving the local people with almost nothing.

In order to control bio-prospectors, the Convention on Biodiversity and Agreement on Trade-Related Aspect of Intellectual Property Right should be established and strengthened. In order to protect the rights of the people and shared the benefit from biological resources and make use economical valuable biological resources for local societies, mechanism for benefit sharing with local people should be established. It is recommended that a Biological Resource Information Center will be established with the following functions:

(a) To collect and store samples,
(b) To develop biological resource database and sample bank,
(c) To manage patents regarding own biological resources, and
(d) To coordinate issue of permission for gathering biological resources to users.

(9) Enhancement of sustainable natural resources use by highland ethnic peoples

According to Myanmar Biodiversity Conservation Investment Vision (Wildlife Conservation Society, 2013), 11th frequent and intense threat is shifting cultivation (Figure 2.6). The shifting cultivated areas are encroached into highland with steep slope areas. It can be seen from satellite images that patches of damaged forests are distributed widely. The shifting cultivation gives rise to deteriorate forest areas through generation of physical and ecological gaps in forest areas, decreasing habitats for wildlife, increasing risk for extension of forest fire, and generation of soil erosion and others.

While information on highland ethnic peoples is limited, it is said that highland ethnic peoples live in small groups, and they are comfortable in living in highland rather than lowland. It is necessary to protect their culture and life for ensuring their identity and heritage. In this sense, both protection for their culture and life and environmental conservation should be achieved at the same time. A

mechanism for sustainable natural resources use by highland ethnic peoples should be developed through pilot projects in order to develop a workable model for dissemination to other areas.

(10) Guidance for suitable locations of solid waste disposal sites

With the rapid economic growth in Myanmar, economic activities and population will increase rapidly. The rapid economic development and population increase can generate increasing amount of solid wastes. In general, the existing solid waste disposal sites have risk for influence on the environment through the following problems:

(a) to scatter garbage around disposal sites,
(b) to generate odor,
(c) to pollute surface water, groundwater and soil through leak of leachate, and
(d) to increase risk of infectious disease.

In order to conserve the environment and promote a clean green environment, guidelines for solid waste disposal sites should be formulated. These guidelines will include:

(a) site selection criteria,
(b) construction guidance,
(c) operational manual for waste disposal, and
(d) monitoring manual for water and soil quality.

(11) Control of land use in flood-prone areas

Myanmar is a country vulnerable to natural disasters, especially floods and cyclones. In order to minimize damages caused by floods, land use should be controlled based on avoidance of risky area for development by floods or other known disasters especially on development for commercial, industrial and residential areas. These can be realized by a system for issuance of development permits.

2.4 Tentative List of Proposed Programs and Projects

The programs and projects for environmental conservation in the Southeast Myanmar are tentatively proposed as listed in Table 2.12. The list is still not comprehensive, and the inclusion in the list does not imply priority at this stage.

Table 2.12 Tentative List of Proposed Programs and Projects for Environmental Conservation

Project & Program Title	Location	Time Frame	Implementing Agency
Revision of regulation regarding state government organization	-	Short-term	MOECAF
Development of human resources in the Environmental Conservation Dep., Districts and Townships	Kayin state Mon state	Short - Long term	MOECAF/State Environmental Conservation Dep.
Development of environmental spatial data in Kayin and Mon	Kayin state Mon state	Short-term	MOECAF
Preparation of Environmentally Sensitive Zoning map	Kayin state Mon state	Short-term	MOECAF/State Environmental Conservation Dep. Or State Forest Dep.
Synchronizing of Land use with Environmentally Sensitive Zoning map	Kayin state Mon state	Middle term	State Environmental Conservation Dep. Or State Forest Dep.
Synchronizing of development permit with Environmentally Sensitive Zoning map	Kayin state Mon state	Short-Middle term	State Government
Establishment of protected areas based on Environmentally Sensitive Zoning	Kayin state Mon state	Short-term	MOECAF/State Environmental Conservation Dep. Or State Forest Dep.
Enhancement of protected areas management	Kayin state Mon state	Short - Long term	MOECAF/State Environmental Conservation Dep. Or State Forest Dep.
Increasing of public awareness	Kayin state Mon state	Short - Long term	State Government
Re-establishment of Protected areas	Kayin state Mon state	Short-term	MOECAF/State Environmental Conservation Dep. Or State Forest Dep.
Development of Technical Support Center for Bamboo Product	Kayin state Mon state	Middle term	Ministry of Industry
Development of biological resource information system	Mawlamyine	Middle - Long term	MOECA Ministry of Industry
Model development of sustainable resources use in highland for ethnic group	Mountainous area	Middle term	NATALA
Preparation of solid waste disposal site selection guidelines	Kayin state Mon state	Short-term	State Government
Linkage between Land use plan and flood-prone area	Kayin state Mon state	Middle term	State Government
Development of evacuation system in the downstream of Thanlwin river	Watershed of Thanlwin river	Short-term	State Government

Note: Time Frame: Short-term: 2014-2018 Meddle-term: 2019-2023
Long-term: 2024-2030

CHAPTER 3 EXISTING CONDITIONS OF SOCIO-ECONOMY OF SOUTHEAST MYANMAR

This chapter presents an overview of the existing socio-economy in the Southeast Myanmar. Demographic conditions are outlined based on the population statistics, and existing conditions of agriculture and industry are described based on basic data and information compiled.

For agriculture, production, land use and land ownership, agricultural policies and related institutions, agro-economy, labor force and other aspects are covered comprehensively. Livestock and fishery are also outlined. Based on these, prospects for agricultural development in the Southeast Myanmar are clarified, and agricultural development strategy is suggested. Finally, a provisional list of possible projects and programs for agricultural development is proposed.

For industry, existing industrial policies and related institutions in Myanmar are reviewed, and the existing conditions of industry in the Southeast Myanmar are described with respect to sub-sector structure, numbers industries by sub-sector and by side and their distribution and other aspects with basic data. Based on these, issues for industrial development in the Southeast Myanmar are clarified, and prospects for development are suggested. Finally, as specific proposals for industrial development, industrial clusters promotion, industrial estates development, development of border areas with Thailand, and promotion of small and medium industries are discussed.

3.1 Demography

3.1.1 Population data

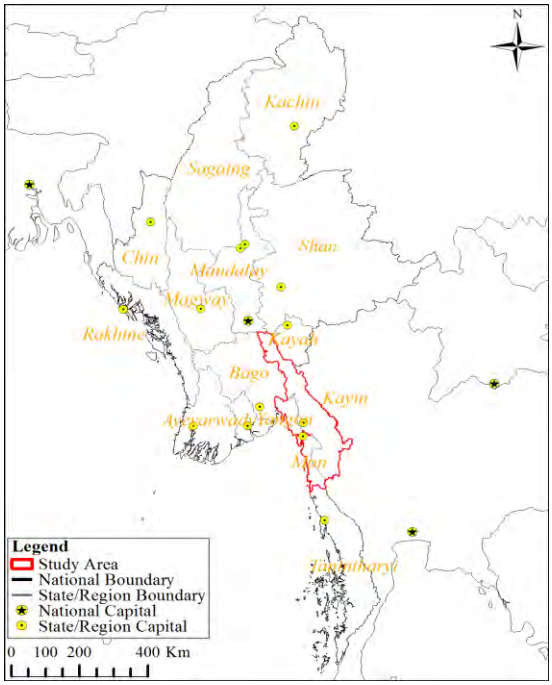
(1) Population by state/region

Population data by state/region from two sources are summarized in Table 3.1. As shown, there is a wide discrepancy in the population data from the two sources, and in the present study, the official statistics from the Statistical Yearbook are used. Population in Kayin State is 3.03% of the national population as of 2009, and this share is much smaller than its land area share of 4.49%. Population in Mon State is 5.25% of the national population, and this share is much larger than its land area share of 1.82%. The Southeast Myanmar, combining Kayin and Mon States, has population share of 8.28% and land area share of 6.31% of the respective national total.

Table 3.1 Land Area and Population by State/Region in Myanmar

State and Region	Area[1] (km^2)	Population in 2009 (1000)	
		Yearbook[2]	Health Profile[3]
Ayeyarwady	35,032	7,952	6,538
Bago	39,402	5,944	4,873
Chin	36,019	545	489
Kachin	89,042	1,560	1,383
Kayah	11,732	351	270
Kayin	30,383	1,794	1,388
Magway	44,821	5,564	4,020
Mandalay	37,946	8,333	6,356
Mon	12,297	3,106	2,080
Rakhine	36,778	3,271	3,356
Sagaing	93,705	6,480	5,013
Shan	155,801	5,595	4,458
Tanintharyi	43,345	1,691	1,586
Yangon	10,277	6,944	5,924
Total	676,578	59,130	47,735

Sources: 1) Agriculture Atlas, FAO; 2) Statistical Yearbook 2010, Central Statics Office; 3) Health Profile 2009, WHO

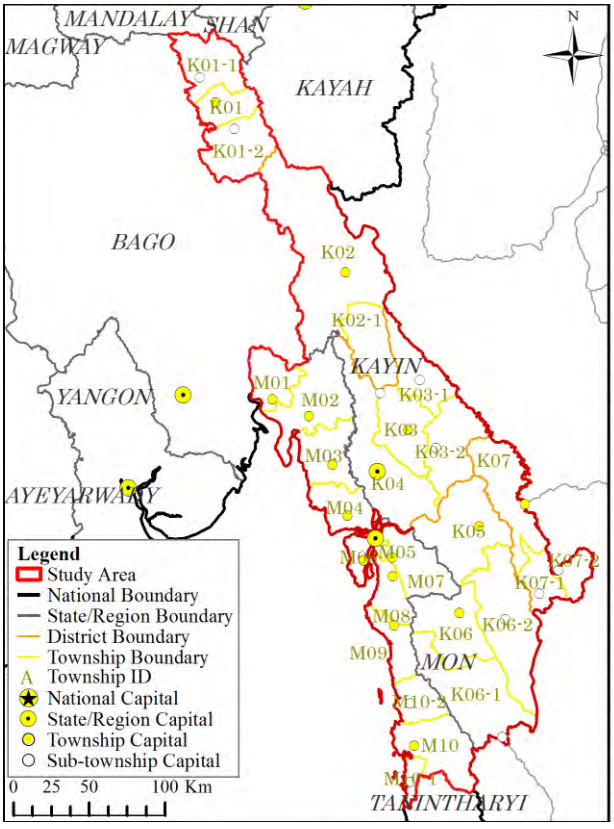


Source: Myanmar Information Management Unit

Figure 3.1 State and Region in Myanmar

(2) Population of Southeast Myanmar

Administrative setting by township (TS)/sub-township (STS) is shown in Figure 3.2. Recent population data by TS/STS in Kayin and Mon States are summarized in Table 3.2 and Table 3.3. Growth rates of population between 2009 and 2013 are shown only as a reference. Comparison is not meaningful since the population data from two sources are not consistent as shown above.



STATE	DISTRICT	ID	TOWNSHIP
Kayin	Hpa-An	K01	Thandaunggyi TS
Kayin	Hpa-An	K01-1	Leik Tho STS
Kayin	Hpa-An	K01-2	Baw Ga Li STS
Kayin	Hpa-An	K03	Hlaingbwe TS
Kayin	Hpa-An	K03-1	Shan Ywar Thit STS
Kayin	Hpa-An	K03-2	Paingkyon STS
Kayin	Hpa-An	K04	Hpa-An TS
Kayin	Hpapun	K02	Hpapun TS
Kayin	Hpapun	K02-1	Kamamaung STS
Kayin	Kawkareik	K05	Kawkareik TS
Kayin	Kawkareik	K06	Kyainseikgyi TS
Kayin	Kawkareik	K06-1	Hpayarthonesu STS
Kayin	Kawkareik	K06-2	Kyaikdon STS
Kayin	Myawaddy	K07	Myawaddy TS
Kayin	Myawaddy	K07-1	Su Ka Li STS
Kayin	Myawaddy	K07-2	Waw Lay
Mon	Mawlamyine	M05	Mawlamyine TS
Mon	Mawlamyine	M06	Chaungzon TS
Mon	Mawlamyine	M07	Kyaikmaraw TS
Mon	Mawlamyine	M08	Mudon TS
Mon	Mawlamyine	M09	Thanbyuzayat TS
Mon	Mawlamyine	M10	Ye TS
Mon	Mawlamyine	M10-1	Khawzar STS
Mon	Mawlamyine	M10-2	Lamaing STS
Mon	Thaton	M01	Kyaikto TS
Mon	Thaton	M02	Bilin TS
Mon	Thaton	M03	Thaton TS
Mon	Thaton	M04	Paung TS

Source: Myanmar Information Management Unit

Figure 3.2 Administrative Setting by Township/Sub-township in Southeast Myanmar

Table 3.2 Administrative Area and Population by Township/Sub-township in Kayin and Mon States in 2009 and 2013

State	District	Township	Sub-township	Area	Population in STS		Density in 2013	Growth Rate
				(km^2)	2009	2013	(person/km^2)	(%/yr)
Kayin	Hpaan	Hpaan	Hpaan	2,903	424,195	365,229	125.8	-3.7
		Hlaingbwe	Hlaingbwe	1,448	149,882	151,251	104.5	0.2
			Paingkyon STS	1,647	75,154	75,841	46.1	0.2
			Shanywarthit STS	1,233	29,777	30,049	24.4	0.2
		Thandaunggyi	Thandaunggyi	760	30,316	25,789	33.9	-4.0
			Bawgali STS	1,494	15,535	13,215	8.8	-4.0
			Leiktho STS	1,387	47,542	40,442	29.1	-4.0
	Hpapun	Hpapun	Hpapun	5,396	28,677	68,960	12.8	24.5
			Kamamaung STS	1,345	18,203	43,774	32.6	24.5
	Kawkareik	Kawkareik	Kawkareik	2,420	293,397	234,475	96.9	-5.5
		Kyainseikgyi	Kyainseikgyi	1,791	70,000	80,789	45.1	3.6
			Hpayarthonesu STS	2,673	45,162	52,123	19.5	3.6
			Kyaikdon STS	2,751	71,276	82,261	29.9	3.6
	Myawaddy	Myawaddy	Myawaddy	1,881	81,075	62,920	33.4	-6.1
			Sukali STS	753	3,417	2,652	3.5	-6.1
			Wawlay STS	502	4,538	3,522	7.0	-6.1
Total				30,383	1,388,146	1,333,292	43.9	-1.0
Mon	Mawlamyine	Mawlamyine	Mawlamyine	152	277,250	239,504	1,574.3	-3.6
		Chaungzon	Chaungzon	443	152,757	156,789	354.2	0.7
		Kyaikmaraw	Kyaikmaraw	1,447	211,601	213,107	147.3	0.2
		Mudon	Mudon	799	210,224	176,222	220.5	-4.3
		Thanbyuzayat	Thanbyuzayat	844	166,217	150,246	178.0	-2.5
		Ye	Ye	1,800	148,722	141,616	78.7	-1.2
			Khawzar STS	321	26,543	25,275	78.7	-1.2
			Lamaing STS	856	70,761	67,380	78.7	-1.2
	Thaton	Bilin	Bilin	2,179	172,398	150,935	69.3	-3.3
		Kyaikto	Kyaikto	1,041	154,119	139,113	133.6	-2.5
		Paung	Paung	1,064	244,771	235,050	220.8	-1.0
		Thaton	Thaton	1,350	244,501	220,628	163.4	-2.5
Total				12,297	2,079,864	1,915,865	155.8	-2.0

Sources: District area specified in Agriculture Atlas of the Union of Myanmar, FAO; Health Profile 2009, WHO for population in 2009; Statistics provided by state governments for population in 2013

Table 3.3 Urban and Rural Population by Township/Sub-township in Kayin and Mon States in 2013

State	District	Township	Sub-township	Population in 2013		%		
				Urban	Rural	Urban	Rural	Total
Kayin	Hpaan	Hpaan	Hpaan	51,424	313,805	14.1	85.9	100.0
		Hlaingbwe	Hlaingbwe	12,201	139,050	8.1	91.9	100.0
			Paingkyon STS	4,451	71,390	5.9	94.1	100.0
			Shanywarthit STS	331	29,718	1.1	98.9	100.0
		Thandaunggyi	Thandaunggyi	13,356	12,433	51.8	48.2	100.0
			Bawgali STS	1,778	11,437	13.5	86.5	100.0
			Leiktho STS	2,373	38,069	5.9	94.1	100.0
	Hpapun	Hpapun	Hpapun	2,024	66,936	2.9	97.1	100.0
			Kamamaung STS	12,672	31,102	28.9	71.1	100.0
	Kawkareik	Kawkareik	Kawkareik	44,490	189,985	19.0	81.0	100.0
		Kyainseikgyi	Kyainseikgyi	9,211	71,578	11.4	88.6	100.0
			Hpayarthonesu STS	10,155	41,968	19.5	80.5	100.0
			Kyaikdon STS	4,304	77,957	5.2	94.8	100.0
	Myawaddy	Myawaddy	Myawaddy	33,020	29,900	52.5	47.5	100.0
			Sukali STS	323	2,329	12.2	87.8	100.0
			Wawlay STS	1,701	1,821	48.3	51.7	100.0
	Total			203,814	1,129,478	15.3	84.7	100.0
Mon	Mawlamyine	Mawlamyine	Mawlamyine	180,488	59,016	75.4	24.6	100.0
		Chaungzon	Chaungzon	3,667	153,122	2.3	97.7	100.0
		Kyaikmaraw	Kyaikmaraw	14,437	198,670	6.8	93.2	100.0
		Mudon	Mudon	44,646	131,576	25.3	74.7	100.0
		Thanbyuzayat	Thanbyuzayat	27,214	123,032	18.1	81.9	100.0
		Ye	Ye	20,256	121,360	14.3	85.7	100.0
			Khawzar STS	3,615	21,660	14.3	85.7	100.0
			Lamaing STS	9,638	57,742	14.3	85.7	100.0
	Thaton	Bilin	Bilin	16,093	134,842	10.7	89.3	100.0
		Kyaikto	Kyaikto	29,288	109,825	21.1	78.9	100.0
		Paung	Paung	32,502	202,548	13.8	86.2	100.0
		Thaton	Thaton	49,216	171,412	22.3	77.7	100.0
	Total			431,060	1,484,805	22.5	77.5	100.0

Source: Statistics provided by state governments

3.1.2 Population growth and urban/rural population in Southeast Myanmar

(1) Population by gender and population growth

Population by gender in the Southeast Myanmar is summarized in Table 3.4. Sex ratio or the ratio of male population to female population is consistently smaller than 100% in Kayin State but larger than 100% in Mon State. This implies that Mon State is a receiving area of employment seeking population from other areas, although out-migration from the State mainly to Thailand is also significant. There exists practically no difference in growth rates between male and female population.

Table 3.4 Population by Gender and Population Growth

State	Sex	1990	Growth 1990-95 % p.a.	1995	Growth 1995-00 % p.a.	2000	Growth 2000-05 % p.a.	2005	Growth 2005-10 % p.a.	2009	2010
Kayin	Total	1,225	1.95	1,349	2.31	1,512	2.06	1,674	1.64	1,794	1,816
	Male	606	1.97	668	2.29	748	2.08	829	1.63	888	899
	Female	619	1.93	681	2.33	764	2.04	845	1.65	906	917
Mon	Total	1,996	2.27	2,233	2.67	2,548	2.39	2,868	1.81	3,106	3,137
	Male	1,000	2.29	1,120	2.69	1,279	2.40	1,440	1.81	1,560	1,575
	Female	996	2.25	1,113	2.66	1,269	2.39	1,428	1.81	1,546	1,562
Myanmar	Total	40,786	1.87	44,744	2.30	50,125	2.02	55,396	1.53	59,130	59,780
	Male	20,215	1.92	22,227	2.30	24,907	2.03	27,540	1.54	29,400	29,723
	Female	20,571	1.82	22,517	2.29	25,218	2.01	27,856	1.53	29,730	30,057

Source: Statistical Yearbook 2011, Central Statistics Office

(2) Birth and death rates

Crude birth and death rates in Myanmar in recent years are summarized in Table 3.5. Both birth and death rates have been decreasing steadily in both urban and rural areas. No data specific to the Southeast Myanmar are readily available. Implied natural population growth is already very low in Myanmar: 1.02% in urban area and 1.05% in rural area in 2010. Total fertility rate in Myanmar has declined fast in recent years to reach 2.03 in 2010. This is extremely low as compared to developing countries of similar economic development levels.

Table 3.5 Crude Birth and Death Rates in Myanmar

Item	Unit	Area	1990	1995	2000	2005	2009	2010
Crude birth rate	Per 1,000	Urban	28.4	28.0	24.2	19.0	15.3	15.4
		Rural	30.2	30.1	26.4	21.9	16.6	16.6
Crude death rate		Urban	8.8	8.6	6.3	5.5	5.1	5.2
		Rural	9.7	9.9	7.3	6.4	5.8	6.1
Implied natural population growth	% p.a.	Urban	1.96	1.94	1.79	1.35	1.02	1.02
		Rural	2.01	2.02	1.91	1.55	1.08	1.05
Total fertility rate	Persons		3.56	3.49	2.96	2.11	2.04	2.03

Source: Statistical Yearbook 2011, Central Statistics Office

(3) Urban and rural population

Urban and rural population in the Southeast Myanmar and Myanmar are summarized in Table 3.6. Urbanization ratio is already quite high in Myanmar as close to a half of the national population live in

urban areas. Urbanization ratio is high also in Mon State at 50.2% in 2010. In Kayin State, urbanization ratio is only 15.5% in 2010. Growth of urban population is still high in Kayin State recording 4.05% annually over 2000-10. Urban population growth is already low in Mon State at 2.10% on average in 2000-10 and even lower in Myanmar as a whole at 1.78% per annum in 2000-10.

Table 3.6 Urban and Rural Population in Southeast Myanmar and Myanmar

State	Area	1990		1995		2000		2005		2009	2010		Growth rate (% p.a.)	
			(%)		(%)		(%)		(%)			(%)	1990-2000	2000-2010
Kayin	Total	1,225	100.0	1,349	100.0	1,512	100.0	1,674	100.0	1,794	1,816	100.0	2.13	1.85
	Urban	123	10.0	165	12.2	189	12.5	239	14.3	276	281	15.5	4.39	4.05
	Rural	1,102	90.0	1,184	87.8	1,323	87.5	1,435	85.7	1,518	1,535	84.5	1.84	1.50
Mon	Total	1,996	100.0	2,233	100.0	2,548	100.0	2,868	100.0	3,106	3,137	100.0	2.47	2.10
	Urban	1,000	50.1	1,120	50.2	1,279	50.2	1,440	50.2	1,560	1,575	50.2	2.49	2.10
	Rural	996	49.9	1,113	49.8	1,269	49.8	1,428	49.8	1,546	1,562	49.8	2.45	2.10
Myanmar	Total	40,786	100.0	44,744	100.0	50,125	100.0	55,396	100.0	59,130	59,780	100.0	2.08	1.78
	Urban	20,215	49.6	22,227	49.7	24,907	49.7	27,540	49.7	29,400	29,723	49.7	2.11	1.78
	Rural	20,571	50.4	22,517	50.3	25,218	50.3	27,856	50.3	29,730	30,057	50.3	2.06	1.77

Source: Statistical Yearbook 2011, Central Statistics Office

3.2 Agriculture

3.2.1 Agriculture in Myanmar and Southeast Myanmar– an overview

(1) Agriculture in Myanmar

1) Cultivated area

Paddy is by far the most important crop in Myanmar, cultivated in 8,050,000 ha in 2010/11, increased by 25% since 2001/02. The average yield increased from 3.42 ton/ha to 4.07 ton/ha during this period. Other major crops are pulses and beans cultivated in 4,500,000 ha, sesame in 1,585,000 ha, groundnut in 877,000 ha and rubber in 504,000 ha in 2010/11. Rubber increased the area most significantly by 171% since 2001/02.

2) GDP and export value

Contribution of agriculture to the gross domestic product (GDP) of Myanmar used to be higher at 47.8% in 1990/91, 45.1% in 1995/96, 42.7% in 2000/01 and 50.1% in 2005/06. Since then, it has been declining consistently to reach 37.9% in 2010/11. The present contribution consists of 30.0% by crop production, 7.4% by livestock and fishery, and 0.4% by forestry.

Major export commodities of Myanmar are natural gas constituting 38% of the total export value in 2009/10, followed by precious stones and pearl with 13%, and pulses with 12%. Including rice and its products and other agricultural commodities, agricultural products as a whole account for 17% of the total export value for Myanmar.

(2) Position of Southeast Myanmar

1) Net area sown and irrigation

The net area sown in Kayin State is 1,124,000 acre as of 2009/10, corresponding to 3.33% of the net area sown in Myanmar in the same year. This share is larger than its population share (3.03% in 2009) and smaller than the land area share (4.49%). The irrigated area in Kayin State has a share of 1.06% in the national total, even smaller than the above share.

The net area sown in Mon State is 1,705,000 acre as of 2009/10, accounting for 5.06% of the net area sown in Myanmar also in 2009/10. This share is slightly smaller than its population share (5.25% in 2009) and much larger than its land area share (1.82%). The irrigated agricultural land in Mon State accounts for 3.08% of the total irrigated area in Myanmar.

2) Paddy production

Contribution of the Southeast Myanmar to the national production of paddy is rather small. As compared to the national paddy production of 32.58 million ton in 2010/11, paddy production in the Southeast Myanmar is 935,487 ton in Kayin State and 1,292,065 ton in Mon State in 2011/12. The total production corresponds to about 6.8% of the national rice production, and the share is slightly larger than the land area share. The total rice production in the Southeast Myanmar is still around double the self-sufficiency level in the Region, based on the estimation using the government statistics.

3) Fishery

Ayeyarwady Region and Tanintharyi Region are two most important fish producing areas. Production of fish and shrimp is 1,417,387 ton in Ayeyarwady Region and 1,066,693 ton in Tanintharyi Region in 2009/10. Despite its long coast lines, Mon State produces only 259,669 ton of fish and prawn in the same year.

3.2.2 Agricultural development policy

(1) Framework for Economic and Social Reforms (Policy Priorities for 2012-2015)

This document was prepared as a link to the ongoing programs of the Union Government to the National Comprehensive Development Plan, a 20-year long-term plan, which the Government is presently drawing up. In the document, there is the following description of immediate actions as "Quick Wins" for food security and agricultural growth:

GOM will ensure that food security is achieved throughout the country, and will develop strategies that will channel benefits of reforms and growth strategies towards helping improve the welfare and income of farmers, farm laborers and their dependent families.

Immediate measures on boosting agricultural productivity can be achieved by increasing extension services and government loans, removing barriers throughout the supply chain and promoting demand-oriented market support mechanisms, which will pave the way for long-term structural and institutional reforms needed in the sector.

Options for improving agricultural performance in the near term center around the following key interventions: improving productivity of rice sector (through improved seed quality, better agronomic practices, optimized fertilizer and input dosages, and integrated pest management); promoting dry season diversification into high-value horticulture, fresh fruits, poultry and small livestock by both small farmers and landless; improving water management at the farm level through low-cost micro-irrigation and expanding micro-finance activity in rural areas, to improve access to inputs and reduce reliance on money lenders.

Agricultural and rural development is taken up as the first section in the chapter of sector policies for inclusive growth and poverty reduction. This section mentions that a reform strategy for the sector will be developed in parallel with the implementation of the above immediate actions. In the strategy, three important issues are pointed out: 1) how to allocate and ensure equitable and sustainable use of land resources among various stakeholders; 2) a substantial improvement in the government's extension and other support services; and 3) to improve supply chain management in the trading and marketing of agricultural produce.

In addition, it says that development of livestock and fisheries is important by focusing on measures to reduce production costs and improve product quality. Also, it is mentioned that broader development of the rural sector should also be encouraged through cash for work in public projects; community-driven development projects; promotion of one-village-one-product (OVOP) schemes for small enterprise development; encouraging micro, small and medium sized enterprise in rural areas through microfinance and other measures; and so on.

(2) Policy of the Ministry of Agriculture and Irrigation

According to the Myanmar Agriculture in Brief, 14 policies are shown as the agriculture and irrigation development policy. They are summarized in Table 3.7.

Table 3.7 Policies of the Ministry of Agriculture and Irrigation

Sr.	Policy
1	To emphasize production and utilization of high yielding and good quality seeds
2	To conduct training and education activities for farmers and extension staff to provide advanced agricultural techniques
3	To inculcate agricultural knowledge into primary and secondary level students
4	To spawn qualified agricultural technicians from State Agricultural Institutes and Yezin Agricultural University
5	To implement research and development activities for sustainable agricultural development
6	To protect farmers' rights and benefits
7	To assist farmers to get fair price on their produce
8	To assist in reduction of production cost, increasing high quality crop production, strengthening and developing the market infrastructure
9	To encourage transformation from conventional agriculture to mechanized agriculture
10	To undertake renovation and maintenance works for old irrigation, pumping and underground water systems
11	To support rural development and poverty reduction activities through development of agriculture sector
12	To help strengthen the market and allow the farmers freedom of choice in crop cultivation
13	To encourage local and international investment in agriculture sector
14	To appropriate and amend the existing agricultural laws and regulations in line with current situation

Source: Myanmar Agriculture in Brief 2012

(3) Land development policy

Land in Myanmar is basically owned by the Country, and farmers only have rights to cultivate land. Previously there was a strong policy to promote paddy in the country, and to tend to force farmers to cultivate mainly paddy. However, liberalization had gradually taken place during 2000-2010, and currently farmers can in general grow any crops they want, though paddy is still placed as the basic important staple crop. In principle, farmers are supposed to cultivate crops required depending upon the land type registered to Settlement and Land Record Department (SLRD). Under the low land registered to SLRD, farmers are encouraged to grow paddy at least once during monsoon seasons. On the other hand during dry seasons, farmers can practically grow any upland crops in the low land. However, even under such situation, permission is required to convert the "Rice Land", namely the low land, into permanent perennial crop land.

This policy is applicable to the government irrigation schemes. Though irrigated paddy cultivation in dry seasons are encouraged in the schemes (there is a case that the government provides loan etc for irrigated paddy to promote paddy cultivation during dry seasons), irrigated upland crops can also be grown.

The Farm Land Law was enacted in 2012, and by this law rights to cultivate can officially be sold, leased, exchanged, and gifted. Due to this, it is expected to raise land utilization rate e.g. by easily accessing agriculture finance and using fallow lands by new persons who do not have right to cultivate but have wills to cultivate.

(4) Agricultural development policy and plans for Southeast Myanmar

1) Department of Agriculture

According to the hearing from the Department of Agriculture in the Ministry of Agriculture and Irrigation in Naypyitaw, the agriculture in the Southeast Myanmar is considered suitable for some perennial crops due to heavy rain and distinct dry season.

The Ministry of Agriculture and Irrigation sets the priority crops as 10 major crops, namely paddy, sugarcane, long staple cotton, maize, groundnut, sesame, sunflower, black gram, green gram and pigeon pea. These crops have target yields to be achieved as shown in Table 3.8. The current yields of main crops in the two states are also shown in Table 3.8 for comparison.

Table 3.8 Target Yields of Main Crops and Current Yields in the Two States

Crop	Target Yield[1)] ton/ha (basket/acre)	Kayin state[2)] ton/ha (basket/acre)	Mon state[2)] ton/ha (basket/acre)
Paddy	5.16 (101)	Monsoon 3.5 (69) Summer 3.9 (76)	Monsoon 3.5 (68) Summer 4.1 (80)
Maize	4.93 (80)	Monsoon 5.4 (87)	-
Ground nut	1.4 (50)	Monsoon 1.1 (41) Winter 2.1 (76)	Monsoon 1.2 (43) Winter 1.6 (58)
Sesame	1.21 (20)	Monsoon 0.6 (10) Winter 0.8 (13) Summer 0.9 (16)	Monsoon 0.42 (7) Summer 0.72 (12)
Green Gram	1.61 (29)	Monsoon 0.9 (17) Winter 1 (17)	0.8 (15)

Source: 1) Myanmar Agriculture in Brief 2012; 2) Department of Agriculture in both states (as of 2011-2012)

Except monsoon maize in Kayin State and winter groundnut in both Kayin and Mon States, yields of other crops are below the targets. The yield of each crop should be increased within the possible extent in consideration of natural conditions.

Discussion with the Department of Agriculture in Kayin and Mon States provides their idea of development. First of all, it is the top priority to raise paddy productivity through production and distribution of high yield varieties, and guidance of appropriate input of fertilizer. Second priority is to raise cropping intensity through introduction and encouragement of dry-season cultivation. Especially in Mon State, due to heavy rain it is said that perennial crops such as fruits are suitable and promising for promotion.

According to the five-year plan of the Department of Agriculture in Kayin State, total cultivated area in 2010/11 was 1,577,612 acres, and it is planned to be increased as 162,237 acres in 2015/16 with 162,237 acres of increment. This increment is attributed mainly by rubber (82,921 acres), fruits (79,298 acres), green gram (12,995 acres), and betel nut (10,847 acres). Total cultivated area of food crops such as paddy and maize is not planned to be increased much (only 2,422 acres).

2) Irrigation Department

Planning for new irrigation development is the mandate of the Union Government. According to an officer of the Irrigation Department in the Ministry of Agriculture and Irrigation, new irrigation development projects planned in both states are summarized in Table 3.9.

Table 3.9 New Irrigation Development Projects in Kayin and Mon States

State	Sr. No.	Township	Project Name	Fact/Data		Effective Area (acre)
				Length (ft)	Height (ft)	
Kayin	1	Kyainseikgyi	Kya Khat dam	920	82	600
	2	Tantung	Yardo dam	80	30	600
		Total				1,200
Mon	1	Thanbyuzayat	Nee Pa Dawe dam	2,500	80	12,000
	2	Thanbyuzayat	San Taw Taung dam	2,100	120	2,000
	3	Mudon	A Pit dam	2,300	170	20,600
	4	Mudon	Thar Yar Gone dam	600	50	400
	5	Mudon	Htar Wae dam	1,900	40	1,000
	6	Mudon	Gong Gong Kya dam	1,050	85	1,400
	7	Mudon	Tan Ta Tar Kyi dam	1,000	90	1,600
	8	Mudon	Yel Tha Khun dam	2,100	70	1,300
	9	Mudon	Ka Mar Watt dam	2,100	150	5,000
	10	Thaton	Kyeik Kaw (Win Pa) dam	1,500	30	1,300
	11	Thaton	Zayitt Goung dam	2,750	43	300
	12	Thaton	Kyauk Sa Yitt dam	1,000	60	40,000
	13	Thaton	Tit Htate head gate	6'×12'(9)gates		10,000
	14	Thaton	Kyeik Kaw head gate	6'×8'(7)gates		5,000
	15	Thaton	Myae Ni Gone head gate	-		-
	16	Thaton	Noung Kalar head gate	6'×12'(21)gates		20,000
	17	Thaton	Dan Ben dam	1,000	90	2,000
	18	Bilin	Apine Inn dam	750	20	1,000
	19	Bilin	Yinn Onne dam	1,320	90	1,000
	20	Bilin	Shan Choung head gate	6'×18'(21)gates		1,100
	21	Bilin	Kone Nying Nawe dam	21,000	90	8,000
	22	Chaungzon	ka Taung Sein dam	2,200	30	1,000
	23	Kyaikto	Mae Yone Kyi dam	2,800	35	1,500
		Total				137,500

Source: Irrigation Department, Ministry of Agriculture and Irrigation, Naypyitaw

According to Table 3.9, there are two projects planned in Kayin State, totaling 1,200 acres, and 23 projects in Mon State totaling 137,500 acres.

The Irrigation Department in Kayin and Mon States told that the importance of drainage in order to prevent damage of paddy cultivation from flooded water during the monsoon season, and of proper operation and maintenance of existing schemes including raising dry-season cultivated area (actual irrigated area) in the existing irrigation schemes.

3) Department of Industrial Crops

The Department of Industrial Crop in both Kayin and Mon States expressed their intention for promotion of rubber plantation in future. Some of the reasons that they explained are that 1) rubber earns high profit, and 2) trees can be used as materials for wooden furniture after production phase is over (more than 30 years). In the five year plan of the department in Mon State, cultivated areas of main industrial crops are mentioned as summarized in Table 3.10.

Table 3.10 Five Year Plan of Major Industrial Crops in Mon State (Cultivated Acre)

Crop	2012-13	2013-14	2014-15	2015-16
Rubber	470,066	475,122	479,878	484,710
Sugarcane	701	5,200	5,500	5,700
Cashew nut	4,906	2,432	2,432	2,432

Source: Department of Industrial Crop, Mon State

According to this plan, rubber has the largest area, and its cultivated area is planned to be expanded up to 484,710 acres in 2015-16. On the other hand, the cultivated area of cashew nut is planned to be kept at 2,432 acres as half size of the area in 2012-13. The area of sugarcane is also planned to be increased up to 5,700 acres. In Kayin State, rubber cultivated area is planned to be expanded up to 246,265 acres in 2015-16 according to the Department of Agriculture in Kayin State.

3.2.3 Administration for agricultural development

(1) Ministry of Agriculture and Irrigation

Administration for agriculture development is headed by the Ministry of Agriculture and Irrigation in Naypyitaw. The organization chart of the Ministry of Agriculture and Irrigation is illustrated in Figure 3.3. In the ministry, there are several departments, which play important roles in agricultural development. For these departments, they have their state department in states and divisions. Currently, policies, budget, and human resources are decided and directed by the central ministry. However recently, report and direction to/from chief ministers and ministers of agriculture and irrigation in states are also made by each department at state level due to the progress of decentralization.

As related sectors to agriculture, livestock and fisheries are under the Ministry of Livestock and Fisheries.

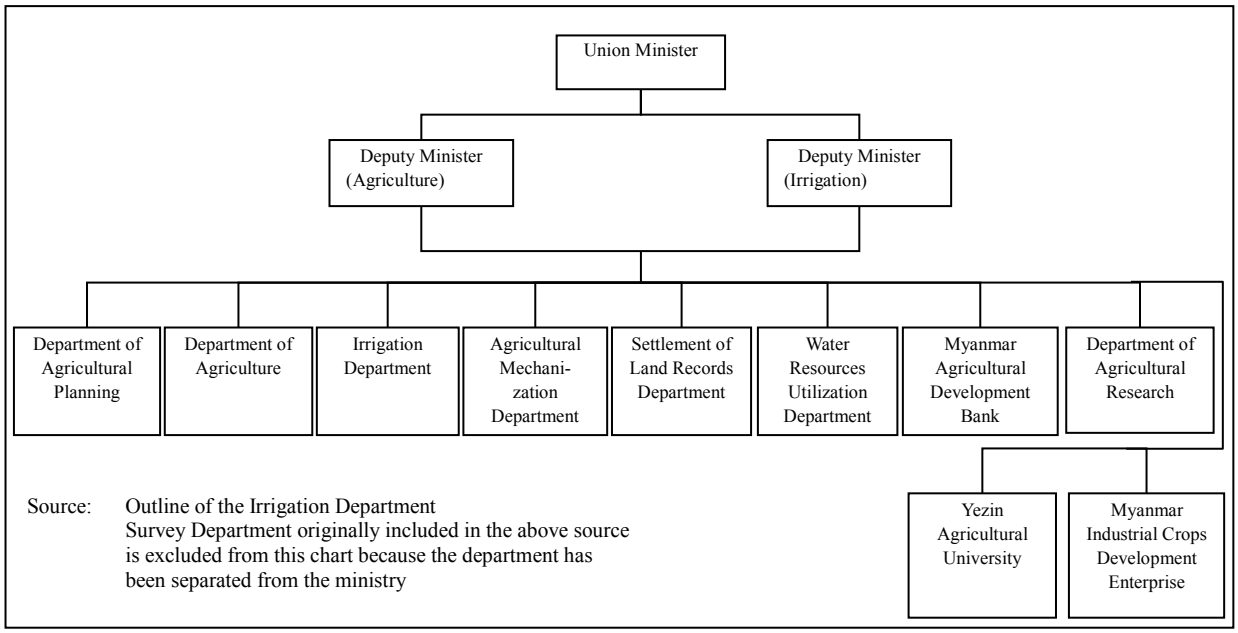


Figure 3.3 Organization Chart of Ministry of Agriculture and Irrigation

(2) Administration in Southeast Myanmar

In the Southeast Myanmar, departments and institutions for agriculture and related sectors are Department of Agriculture, Irrigation Department, Industrial Crop Department, Settlement and Land Records Department, etc. Main departments and institutions at state level are summarized in Table 3.11.

Table 3.11 Main Departments and Institutions Related to Agriculture Development

Related Department	Ministry in charge	Main Job Description
Department of Agriculture (DOA)	MOAI (Ministry of Agriculture and Irrigation)	General works to increase production of agricultural products, Introduction of modernized agricultural technology (fertilizer management, soil management, guidance of appropriate inputs), Development and dissemination of good quality seed variety, etc., targeting paddy, maize, pulses and beans, oil crops, perennial crops such as fruits crops, etc.
Irrigation Department (ID)	MOAI	Operation, management and maintenance of existing irrigation and drainage facilities, Guidance of farmers' water user association, etc. (planning, survey, and design of new irrigation and drainage development projects are not done by state-level ID, but national-level ID)
Water Resources Utilization Department (WRUD)	MOAI	The above works for intake facilities and their irrigation/drainage by pumping water from river
Settlement and Land Record Department (SLRD)	MOAI	Preparation, management, and update of land maps and registers, Surveys on cultivated area and farm households, Collection of land tax (3~5 kyats), Management of Cultivable wasteland, etc.
Industrial Crop Department	MOAI	Similar job description of Department of Agriculture targeting sugarcane, rubber, cashew nut, and oil palm in general
Agricultural Development Bank (ADB)	MOAI	Implementation of agriculture finance to farmers, etc.
Agricultural Mechanization Department	MOAI	Land reclamation and land development, Provision of farm mechanization services needed for farming activities, etc
Livestock Breeding and Veterinary Department	MLF (Ministry of Livestock and Fisheries)	Enhancement of livestock production by technology and services, Management of animal health care, disease control and activities of animal breeding and production
Department of Fishery	MLF	Supervision of Fishery sectors, Conservation and rehabilitation of fisheries resource, Extension services, Promotion of fisheries researches and surveys, etc.
Cooperative Department	MOC (Ministry of Cooperative)	Formation of cooperative, Holding seminars to raise agricultural productivities, Provision of finance to farmers for agricultural inputs and other initial investment (animal, fertilizer, machineries), Collective marketing (for part of cooperatives)

Source: JICA Study Team based on Data Collection Survey on Supporting Border Areas for Myanmar

Organizations of two main departments, Department of Agriculture and Irrigation Department both in Kayin and Mon States are described as below:

1) Kayin State

➢ Department of Agriculture

Organization of the department is shown in Table 3.12. In this department, there are 28 sections/farms with 132 numbers of staff. Size of annual budget is around 200 million kyat.

Table 3.12 Organization of Department of Agriculture in Kayin State

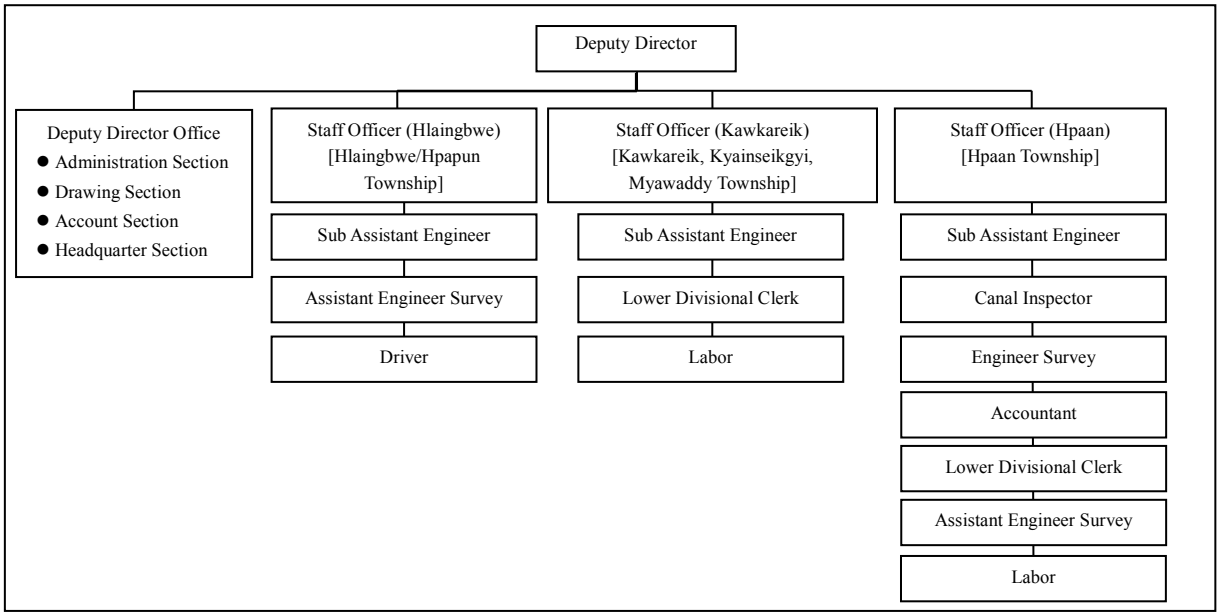
No	Sections in Department of Agriculture	No. of extension workers	Total no. of staff
1	State Office	-	24
	District Office		
2	Hpaan	-	7
3	Kawkareik	-	7
4	Myawaddy	-	7
	Township office		
5	Hpaan	7	7
6	Hlaingbwe	5	5
7	Hpapun	6	6
8	Thandaunggyi	9	10
9	Kawkareik	7	7
10	Kyainseikgyi	5	5
11	Myawaddy	8	9
	Sub Township office		
12	Shanywarthit	4	4
13	Paingkyon	2	2
14	Kamamaung	2	2

No.	Sections in Department of Agriculture	No. of extension workers	Total no. of staff
15	Bawgali	3	3
16	Leiktho	2	2
17	Hpayarthonesu	4	4
18	Kyaikdon	3	3
19	Wawlay	1	1
20	Sukali	2	2
	Research Farm		
21	Baho Central Research Farm	-	4
22	Zwekabin Research Farm	-	2
23	Kawkareik Mango Research Farm	-	1
24	Pathichaung Research Farm	-	3
25	Shwe Nyaung Pin Research Farm	-	1
26	Nagahle Research Farm	-	2
27	Pathise Research Farm	2	1
	Village Tract Camp		
28	Myainggyingu	1	1
	Total	73	132

Source: Data Collection Survey on Supporting Border Areas for Myanmar

➢ Irrigation Department

Figure 3.4 indicates the organization of Irrigation Department in Kayin State. Annual budget of 2012-2013 is as follows: expenditure is 525 million kyat including both current and capital expenditure. Revenue is 1.8 million kyat including 146.7 thousand kyat of tax revenue.



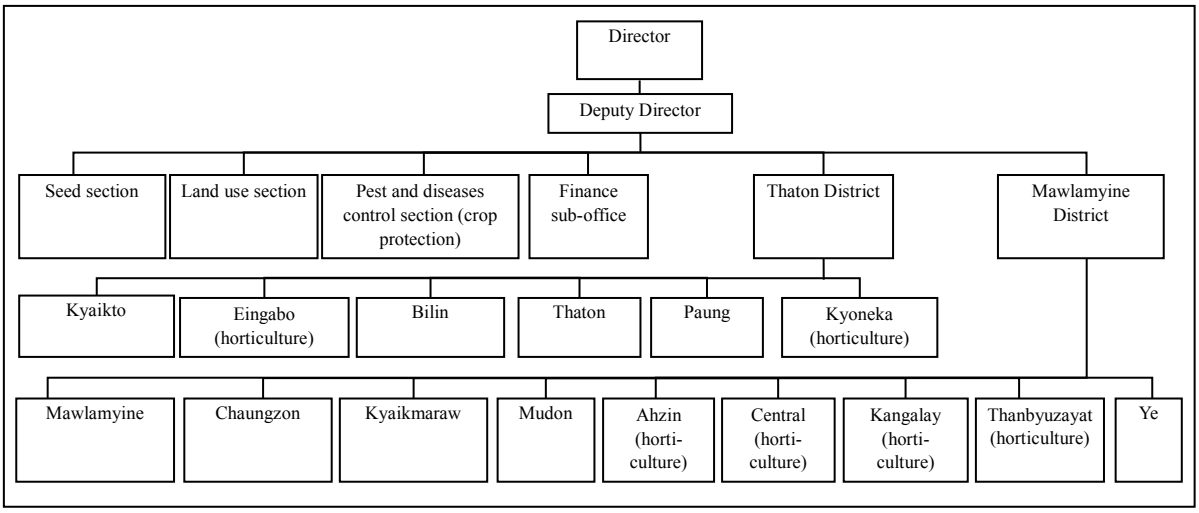
Source: Irrigation Department, Kayin State

Figure 3.4 Organization Chart of Irrigation Department in Kayin State

2) Mon State

➢ Department of Agriculture

Figure 3.5 shows organization of Department of Agriculture in Mon State. Number of staff is 322, and Annual budget of 2012-13 is 491 million kyat.

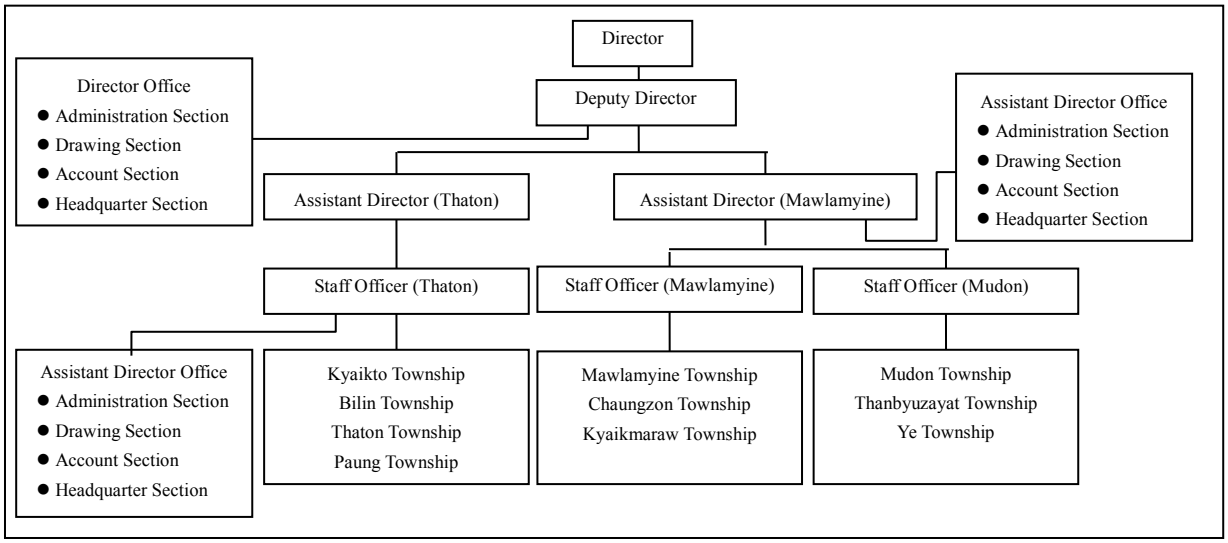


Source: Department of Agriculture, Mon Stat

Figure 3.5 Organization Chart of Department of Agriculture in Mon State

➢ Irrigation Department

Organization chart of Irrigation Department in Mon State is illustrated in Figure 3.6. Annual budget of 2012-2013 is as follows: expenditure is 1,253 million kyat including both current and capital expenditure. Revenue is 11 million kyat including 2.7 million kyat of tax revenue. As a whole, the main organizations related to agriculture development in Mon state are larger in budget and staff than those in Kayin State.



Source: Irrigation Department, Mon State

Figure 3.6 Organization Chart of Irrigation Department in Mon State

3.2.4 Agricultural land and land holding size

(1) Land use

Land use data in Kayin State and Mon State are summarized by township and sub-township in Table 3.13 and Table 3.14, respectively. In Kayin State, proportion of other wood land has large portion (42%), and net area sown occupied small portion out of total land use (14%). In Mon State, the area of other wood land has been gradually decreased, and proportion of net area sown has increased and is large (51%). Agricultural land occupies 1,064,747 acres or 14.2% of the total land in Kayin State, and 1,568,437 acres or 51.6% of the total land in Mon State.

Table 3.13 Land Use by Township in Kayin State (2012-13)

(Unit: acre)

Name of Township/ Sub-township	Agriculture land							Reserved forest	Other wood land	Culturable waste land	Other	Total
	Net area sown						Current fallows land					
	Rice land	Dry land	Alluvial/ island land	Garden Land (tree crop)	Shifting cultiva-tion	Total						
Hpaan District	355,322	4,073	15,046	169,248	45,115	588,804	11,276	1,042,757	1,748,124	73,149	888,080	4,352,190
Hpaan	182,939	715	8,422	79,596	8,243	279,915	9,622	69,124	217,384	49,800	91,012	716,857
Hlaingbwe	153,541	1,932	4,958	29,101	13,124	202,656	1,407	176,659	203,060	1,413	484,721	1,069,916
Hlaingbwe	89,189	148	3,922	15,539	1,467	110,265	1,251	94,806	51,205	135	73,758	331,420
Paingkyon	60,715	1,784	964	12,681	9,492	85,636	156	76,255	104,276	1,183	151,268	418,774
Shanywarthit	3,637	0	72	881	2,165	6,755	0	5,598	47,579	95	259,695	319,722
Hpapun	15,971	306	1,288	12,130	14,426	44,121	247	482,789	1,034,957	21,936	77,117	1,661,167
Hpapun	9,165	236	530	6,117	9,021	25,069	149	404,755	860,756	15,430	55,613	1,361,772
Kamamaung	6,806	70	758	6,013	5,405	19,052	98	78,034	174,201	6,506	21,504	299,395
Thandaunggyi	2,871	1,120	378	48,421	9,322	62,112	0	314,185	292,723	0	235,230	904,250
Thandaunggyi	110	168	0	15,504	3,585	19,367	0	8,900	104,454	0	69,611	202,332
Bawgali	704	732	378	8,088	773	10,675	0	254,806	48,608	0	52,439	366,528
Leiktho	2,057	220	0	24,829	4,964	32,070	0	50,479	139,661	0	113,180	335,390
Kawkareik District	214,434	319	989	190,605	19,788	426,135	5,173	666,785	1,191,024	29,819	61,669	2,380,605
Kawkareik	137,842	103	356	65,188	3,960	207,449	145	153,075	23,708	12,269	44,112	440,758
Kyainseikgyi	76,592	216	633	125,417	15,828	218,686	5,028	513,710	1,167,316	17,550	17,557	1,939,847
Kyainseikgyi	51,438	216	276	50,532	971	103,433	5,000	160,280	45,155	17,550	7,419	338,837
Kyaikdon	14,444	0	357	27,808	7,669	50,278	0	255,603	446,308	0	6,988	759,177
Hpayarthonesu	10,710	0	0	47,077	7,188	64,975	28	97,827	675,853	0	3,150	841,833
Myawaddy District	10,190	69	1,002	14,911	7,187	33,359	0	525,583	207,202	0	8,804	774,948
Total area of state	579,946	4,461	17,037	374,764	72,090	1,048,298	16,449	2,235,125	3,146,350	102,968	958,553	7,507,743

Source: SLRD, Kayin State

Table 3.14 Land Use by Township in Mon State (2012-13)

(Unit: acre)

Township	Agriculture land							Reserved forest	Other wood land	Culturable waste land	Other	Total
	Net Sown Acre						Current fallows land					
	Rice land	Alluvial/ island land	Garden land (tree crop)	Dhani Land	Shifting cultiva-tion	Total						
Kyaikto	24,623	1,885	97,095	0	1,052	124,655	0	44,451	1,104	6	63,801	234,017
Bilin	93,637	7,023	123,337	0	23,289	247,286	0	81,759	138,329	0	67,157	534,531
Thaton	135,208	247	61,675	4	2,589	199,723	0	24,840	12,251	717	106,736	344,267
Paung	131,863	407	36,019	1,735	0	170,024	3,350	28,648	0	0	77,499	279,521
Mawlamyine	12,501	2,072	6,293	1,492	0	22,358	998	1,117	0	0	29,596	54,069
Chaungzon	65,192	0	13,465	10,486	0	89,143	0	0	0	0	73,480	162,623
Kyaikmaraw	87,762	0	97,278	0	0	185,040	21,946	72,836	6,614	11,819	32,013	330,268
Mudon	77,117	0	35,940	3,260	0	116,317	2,474	33,531	0	31	49,050	201,403
Thanbyuzayat	26,057	0	63,989	497	17	90,560	52	1,741	0	0	110,962	203,315
Ye	22,162	0	91,262	1,249	8,590	123,263	2,571	101,670	6,939	362	48,378	283,183
Lamaing	32,756	0	83,982	566	987	118,291	149	23,930	19,400	245	48,771	210,786
Kawza	7,642	0	37,722	157	3,565	49,086	1,151	118,481	7,040	26	24,797	200,581
Total area of state	716,520	11,634	748,057	19,446	40,089	1,535,746	32,691	533,004	191,677	13,206	732,240	3,038,564

Source: SLRD, Mon State

(2) Land holding size

The total agricultural land of 1,064,747 acres in Kayin State is used by 239,148 farmer households. The average land holding size per farmer household is 4.45acres. It ranges from 1.78 acres in Myawaddy, where agricultural land itself is the smallest, to 5.30acres in Hpaan and 5.39 acres in Kyainseikgyi.

The total agricultural land of 1,568,437 acres in Mon State is used by 240,671 farmer households. The average land holding size per farmer household is 6.52 acres. It ranges from 2.18 acres in Mawlamyine and 3.54 acres in Thanbyuzayat to 12.44 acres in Bilin, 12.68 acres in Ye, and 23.02 acres in Kawza.

(3) Landless farmers

In rural areas, there are landless farmers or agriculture laborers without right to cultivate. According to Poverty Profile of Integrated Household Living Conditions Survey in Myanmar (2009-2010), 11.7% in Kayin State and 24.9% in Mon State out of total rural people of which main economic activity is agriculture are landless. These landless farmers normally have no other ways than working as agriculture laborers in farms nearby, therefore it is said that they are very poor.

In the Southeast Myanmar, farmers hire these agriculture laborers to do their farming. According to the interview conducted by the JICA Study Team, it is becoming more and more difficult recently to hire these landless farmers in the Region, and sometimes farmers call agriculture laborers from other areas such as Ayeyarwady and Bago. One of the reasons could be that they go to Thailand and/or Malaysia to seek job opportunities and stay there. Perhaps due to this shortages of laborers, there is the information that wage of these laborers tends to go up (3,000~4,000 kyat/day).

3.2.5 Crop production

(1) Crop cultivation

Cropping pattern in Kayin and Mon States is similar reflecting climatic conditions. Typical cropping

pattern in the Southeast Myanmar is illustrated in Figure 3.7. Since the annual rainfall reaching 4,000-5,000 mm in some areas concentrates in the monsoon seasons from May through October in most areas, especially the flat and low land, rainfed paddy is dominant, while upland crops are not suitable. During the dry season, irrigated paddy is grown only in areas that can be irrigated, and upland crops such as pulses, beans, sesame, and groundnuts are normally planted after monsoon paddy using residual soil moisture. In areas where annual rainfall is less than 2,000 mm such as in Myawaddy District, upland crops can be grown even in the monsoon season.

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Paddy												
Monsoon Paddy	·····				———	———	———	———	———	·····	·····	·····
Summer Paddy	———	·····	·····	·····						———	———	———
Green Gram												
Monsoon					———	———	———	·····	·····			
Winter	·····	·····							———	———	———	·····
Groundnut												
Monsoon					———	———	———	·····	·····	·····		
Winter	·····	·····	·····							———	———	———

Legend: ——— Growing period ····· Harvesting period

Source: Data Collection Survey on Supporting Border Areas for Myanmar

Figure 3.7 Cropping Pattern in Southeast Myanmar

(2) Crop production

1) Kayin State

In Kayin State, the cultivated area under paddy is by far the largest with 670,967 acres in 2009/10, followed by rubber with 145,696 acres. Other crops have much smaller cultivated areas including green gram, fruits, maize, oil crops such as groundnut and sesame, and cow peas (bocate and pelum).

Green gram is found mostly in Myawaddy during the monsoon period (50,235 acres), with the third largest cultivated area after rubber. Maize has the cultivated area with 37,664 in 2009/10, found mostly in Myawaddy during the monsoon period for export to Thailand. Sesame and groundnut are the major oil crops in Kayin State, grown after monsoon paddy during the winter season. Groundnut is grown mostly in Hpaan and Hlaingbwe, and sesame is produced mainly in the southern part: Kyainseikgyi and Kawkareik. Cow peas are produced in the winter season mostly in Hpaan and Kawkareik.

Betel nut and fruits are major perennial crops in Kayin State. Betel nut is grown mostly in Kyainseikgyi, and fruits in Thandaunggyi, Hpaan, Kawkareik and Kyainseikgyi. In Thandaunggyi, coffee, tea and spices, mainly cardamom, are cultivated as characteristic products. Rubber is grown mainly in Kyainseikgyi, followed by Hpaan and Kawkareik. Only 20-30% of rubber cultivated area is actually producing rubber sap. Cashew is cultivated in 3,875 acres in 2011/12 mostly in Kyainseikgyi, Kawkareik and Hpaan. Sugarcane is cultivated in 7,955 acres in 2012/13 mainly in Hlaingbwe.

2) Mon State

In Mon State, the paddy cultivated area is the largest with 1,016,750 acres, followed by rubber with 423,692 acres in 2009/10. The third main crops are fruits, and other crops have all much smaller cultivated areas such as betel nut, vegetables and green gram. Although upland crops are not grown so much in Mon State, main producing areas of winter groundnut, sesame and cow pea are Bilin, Thaton and Kyaikto.

Major fruits in Mon State are mango cultivated in 7,937 acres, durian in 7,926 acres, pineapple in 7,249 acres and lemon/lime in 6,428 acres. Durian is produced mainly in Thaton and mango in Kyaikto, and other fruits in the southern part such as Kyaikmaraw, Mudon and Ye (figures are all as of 2011/12). There is a government Azin irrigation scheme in Mudon, planted with fruits for 1,038 acres command area.

Rubber is produced more in the southern part of Mon State in Ye, Kyaikmaraw and Mudon. Of the total cultivated area, about 60% is producing rubber sap. The cashew cultivated area in the State is 15,127 acres in 2011/12, led by Kyaikmaraw and Kyaikto. Sugarcane is cultivated in 5,021 acres in 2009/10, mostly in the northern part, led by Bilin.

(3) Rice production and self-sufficiency

1) Kayin State

According to the data provided by the Department of Agriculture in Kayin state, of the total paddy production of 935,486 ton in Kayin State, Hpaan contributes the largest production with 286,359 ton, followed by Hlaingbwe with 233,950 ton and Kawkareik with 211,024 ton in 2011/12. The average yield ranges from 3.7 ton/ha in Hpaan to 2.9 ton/ha in Thandaunggyi with the overall average in the State at 3.5 ton/ha as the one for monsoon paddy.

Rice self-sufficiency in Kayin State is examined by township in Table 3.15. As seen from Table 3.15, most TSs has over 200% of self-sufficiency, except Myawaddy with 67% and Thandaunggyi with 56%. Rice surplus is the largest in Hlaingbwe with 89,407 ton, followed by Hpaan with 86,976 ton.

Table 3.15 Rice Self Sufficiency in Kayin State

Township	Population*	Total Rice Consumption (ton/year)	Total Production per year			Surplus Deficit
			Paddy (Basket)**	Paddy (ton)	Rice (ton)	
Hpaan	424,195	84,839	13,968,715	286,359	171,815	86,976
Hlaingbwe	254,813	50,963	11,412,205	233,950	140,370	89,407
Hpapun	46,880	9,376	2,018,783	41,385	24,831	15,455
Thandaunggyi	93,393	18,679	852,677	17,480	10,488	-8,191
Kawkareik	293,397	58,679	10,293,869	211,024	126,614	67,935
Kyainseikgyi	186,438	37,288	6,095,203	124,952	74,971	37,683
Myawaddy	89,030	17,806	969,762	19,880	11,928	-5,878
State Total	1,388,146	277,629	45,633,474	935,486	561,292	283,663

Source: Prepared by the Study team based on 1) Township Health Profile 2009 by WHO and 2) statistics as of 2011-2012 provided by Department of Agriculture, Kayin State

Remark: Per capita consumption 200 kg/person, 1 basket of paddy = 0.0205 ton, milling rate 60%

2) Mon State

According to the data provided by the Department of Agriculture in Mon state, of the total paddy production of 1,292,065 ton in 2011/12, Paung contributes the largest production with 217,917 ton, followed by Thaton with 212,468 ton, Bilin with 185,831 ton and Kyaikmaraw with 184,750 ton. The average paddy yields are at similar levels in all the TSs ranging in 3.2-3.7 ton/ha with the overall average of 3.5 ton/ha in the State, for monsoon paddy.

Rice self-sufficiency in Mon State is examined by township in Table 3.16. As seen from Table 3.16, self-sufficiency levels vary widely between TSs, from 22% in Mawlamyine and 77% in Kyaikto to 323% in Bilin and 267% in Paung. Rice surplus is the largest in Paung with 81,796 ton, followed by 78,581 ton in Thaton and 77,019 ton in Bilin.

Table 3.16 Rice Self Sufficiency in Mon State

Township	Population*	Total Rice Consumption (ton/year)	Total Production per year			Surplus Deficit
			Paddy (Basket)**	Paddy (ton)	Rice (ton)	
Kyaikto	154,119	30,824	1,919,370	39,347	23,608	-7,216
Bilin	172,398	34,480	9,064,917	185,831	111,499	77,019
Thaton	244,501	48,900	10,364,278	212,468	127,481	78,581
Paung	244,771	48,954	10,630,086	217,917	130,750	81,796
Mawlamyine	277,250	55,450	977,131	20,031	12,019	-43,431
Chaungzon	152,757	30,551	4,313,555	88,428	53,057	22,506
Kyaikmaraw	211,601	42,320	9,012,638	184,759	110,855	68,535
Mu Don	210,224	42,045	5,964,773	122,278	73,367	31,322
Thanbyuzayat	166,217	33,243	2,598,033	53,260	31,956	-1,287
Ye	246,026	49,205	8,182,771	167,747	100,648	51,443
State Total	2,079,864	415,973	63,027,552	1,292,065	775,239	359,266

Source: Prepared by the Study team based on 1) Township Health Profile 2009 by WHO and 2) statistics as of 2011-2012 provided by Department of Agriculture, Kayin State

Remark: Per capita consumption 200 kg/person, 1 basket of paddy = 0.0205 ton, milling rate 60%

(4) Irrigated agriculture

The irrigated area in Kayin State has not increased much as the net area sown, and it covers 61,000 acres in 2009/10, corresponding only to 5.4% of the total cultivated area. The irrigated area in Mon State has increased more rapidly in the middle of 2000s and reached 177,000 acres in 2009/10 or 10.4% of the total net area sown.

Main irrigation schemes managed by the government consist of dam irrigation managed by ID and river pump irrigation under the management of WRUD. Dam irrigation schemes in the Southeast Myanmar are summarized in Table 3.17, and river pump irrigation schemes in Table 3.18.

Table 3.17 Dam Irrigation Schemes in Southeast Myanmar

Township	Name of dam	Reservoir Storage Volume (Acre-ft)	Irrigable area (Acre)	Irrigated area (Acre)			Remarks
				2010-2011	2011-2012	2012-2013	
Kayin State							
Hlaingbwe	Yeboke Dam	36,000	3,000	0	0	50	Demonstration only for 2012-2013
Mon State							
Bilin	Kazing Dam	2,380	300	300	300	300	irrigation (sugarcane)
Thaton	Waba Dam	4,150	2,038	500	500	500	irrigation, water supply
Paung	Kadaik Dam	56,000	10,000	10,000	10,000	10,000	irrigation
Mawlamyine	Shwenattaung Dam	5,250	302	302	302	302	irrigation
Mudon	Azin Dam	15,427	3,038	1,438	1,438	1,438	irrigation (paddy and fruit), water supply
	Winpanon Dam	47,882	5,068	700	700	700	irrigation
Total		131,089	20,746	13,240	13,240	13,240	

Source: Irrigation Department, Kayin and Mon States

Table 3.18 River Pump Irrigation Schemes in Southeast Myanmar

1) Kayin State

Sr.	Township	Irrigation Name	Water Source River	Common Benefited (Acre)	2012-2013 (Acre)			
					Estimated	Post Monsoon paddy	Summer paddy	Total
(A) Power Source (Electricity)								
1	Hpaan	Ta YokHla	Thanlwin	1,000	400	72	356	428
2	Hpaan	Hpa-Gat	Thanlwin	1,200	360	27	293	320
3	Hpaan	Htone-Aie(1)	Thanlwin	180	120	0	0	0
4	Hpaan	HTone-Aie(2)	Thanlwin	1,220	400	36	267	303
5	Hpaan	Zathapuin	Gyaing	500	150	0	82	82
Total				4,100	1,430	135	998	1,133
(B) Power Source (Diesel)								
1	Kawkareik	Gyaing	Gyaing	600	250	138	216	354
2	Kawkareik	Kanne	Howtheyaw	500	300	75	190	265
Total				1,100	550	213	406	619
Grand Total				5,200	1,980	348	1,404	1,752

2) Mon State

Sr.	Township	Irrigation Name	Irrigable Acres	Type of Pump	Name of Source of River	Actual Irrigated Area		
						2010- 2011	2011- 2012	2012- 2013
Constructed Irrigation								
1	Kyaikmaraw	Kyaik Pa Ran (1)	200	Diesel	Atta Yan	100	100	0
2	Kyaikmaraw	Kyaik Pa Ran (2)	500	Diesel	Atta Yan	200	250	0
3	Mawlamyine	Ni Ton	200	Diesel	Atta Yan	110	100	100
4	Kyaikmaraw	Ka Doe-Kaw Nat	1,000	Diesel	Jiainge	0	0	0
5	Thaton	Don Wun	2,000	Diesel	Bilin	0	0	80
	Total		3,900			410	450	180
Under Construction Irrigation								
1	Kyaikmaraw	Damatha	5,000	Electrical	Jiainge	110	100	0
2	Thaton	Don Tha Mi	33,000	Electrical	Donthami	0	0	0

Source: Water Resource Utilization Department, Kayin and Mon States

1) Kayin State

Most government irrigation schemes in Kayin State are provided in Hlaingbwe, Hpaan and Kawkareik TSs, where population is large and the land is relatively flat. Actual irrigated area is small compared with planned command area or irrigable area. For the Yeboke dam, only a demonstration farm has been cultivated because the construction has just been completed. For river pump irrigation schemes, electricity is their power source and the supply is not stable, and

therefore continuous water supply is difficult. Also it is possible that irrigation water may not reach tail ends due to insufficient canal maintenance. There is also another socio-economic possibility that incentive for dry-season cultivation tend to be low because of remittance by their family members from Thailand.

The total irrigable area of both dam and river pump schemes is 8,200 acres, and actual irrigated area in 2012-2013 was 1,802 acres. The irrigated area in Kayin State was 61,000 acres in 2009-2010, and there is a huge gap between them. One of the reasons is that the above government schemes do not include the gate type irrigation. These gates are normally used for the purpose of flood protection, and also for irrigation when monsoon is finished using excess water by closing gates. This can also indicate that there are many small scale micro irrigation schemes that farmers are managing by small pumps and other means.

2) Mon State

Dam irrigation schemes in Mon State are in five townships of Bilin, Thaton, Paung, Mawlamyine, and Mudon, where the flat areas for paddy are available. Irrigation efficiency (i.e. irrigated area/command area) during the dry season is 64% in 2012-13. The reasons why farmers do not cultivate during the dry season may be both socio-economic (remittance from Thailand family members) and engineering (not well maintained structure) reasons. Therefore, it is necessary to plan and conduct comprehensive measures to increase irrigation rate in dry seasons.

Regarding the river pump irrigation schemes, the total irrigable area for the above five existing schemes is around 4,000 acres, and will increase to 41,900 acres eventually. On the other hand actual irrigated area in 2012-13 is only 180 acres or 4.6%. The reasons are similar to the ones discussed in Kayin State but Mon State has its specific reasons that the cost for diesel is high for using pumps. These river pump schemes require relatively large rivers, and available therefore in Kyaikmaraw, Mawlamyine and Thaton.

In Mon State like Kayin State, there is a huge difference between irrigated area of 177,000 acres and total acreage of the government schemes. The reasons are considered the same as the case of Kayin State.

3) Irrigation management

The government irrigation schemes are operated, maintained, and managed by the government, ID or WRUD. Specifically, the government is in charge of dam, pump station, gate control, and main canal to tertiary canal, and farmers are responsible for field canals below tertiary level.

In general, farmers' water user associations have not been well developed in Myanmar according to ID in Kayin and Mon States, and the situation in the Southeast Myanmar is the same. Currently, the Union Minister for Ministry of Agriculture and Irrigation has the policy to foster water user associations, and it is said that some successful cases are observed in the central dry zone.

In the government irrigation schemes, farmers must pay water tax as below, the same both in Kayin and Mon States.

(a) Dam irrigation (gravity)
   i) 1,950 kyat/acre for summer paddy
   ii) 900 kyat/acre for upland/fruits
(b) River pump irrigation
   i) 2,000 kyat/acre-feet for fuel type pump (e.g. diesel)

ii) 1,500 kyat/acre-feet for electricity pump

According to the interview to the staff of ID, collection rate of water tax is currently not so high. According to the ID staff, every year, certain agricultural land suffers from flooded water due to poor drainage conditions and therefore drainage during monsoon seasons is more important than dry-season irrigation because of heavy rain. According to ID in Kayin state, total 47,771 acres of monsoon paddy were submerged by flood as of August 2012. Out of this, affected and damaged acres were 21,178 and 7,145 respectively.

3.2.6 Livestock and fishery

(1) Livestock

In the Southeast Myanmar, farmers normally keep livestock as one of livelihood means. Buffalo and cattle are kept as drought animals for paddy cultivation, and in addition goat, pig, and poultry are commonly owned. The livestock population by township in Kayin State is summarized in Table 3.19.

Table 3.19 Number of Livestock by Township in Kayin State

Sr.	District/ Township	Buffalo			Cow			Goat			Pig		
		Owner	No.	No./ Owner	Owner	No.	No./ Owner	Owner	No.	No./ Owner	Owner	No.	No./ Owner
1	Hpaan	3,692	19,277	5	21,836	131,274	6	2,290	20,883	9	14,324	129,557	9
2	Hlaingbwe	5,502	23,359	4	11,334	69,861	6	1,555	26,142	17	12,880	76,292	6
3	Thandaunggyi	1,319	6,299	5	1,130	6,844	6	102	1,626	16	3,325	27,914	8
4	Hpapun District	918	5,325	6	832	10,012	12	309	2,428	8	1,602	12,972	8
5	Kawkareik	2,400	12,133	5	22,442	71,619	3	1,568	13,236	8	5,338	53,065	10
6	Kyainseikgyi	2,075	22,215	11	9,058	55,071	6	1,758	12,353	7	6,497	47,268	7
7	Myawaddy District	459	3,017	7	1,792	10,376	6	543	5,089	9	2,076	19,704	9
Grand Total		16,365	91,625	6	68,874	355,057	5	8,125	81,757	10	46,042	366,772	8

Sr.	District/Township	Chicken			Duck			Turkey		
		Owner	No.	No./ Owner	Owner	No.	No./ Owner	Owner	No.	No./ Owner
1	Hpaan	19,454	1,864,048	96	8,595	154,510	18	1,648	17,435	11
2	Hlaingbwe	24,934	970,582	39	5,812	50,513	9	623	7,439	12
3	Thandaunggyi	3,772	326,842	87	419	5,784	14	245	2,291	9
4	Hpapun District	2,384	212,447	89	767	13,522	18	57	1,572	28
5	Kawkareik	19,508	636,225	33	5,258	49,667	9	493	7,542	15
6	Kyainseikgyi	9,607	521,516	54	3,006	46,337	15	570	6,510	11
7	Myawaddy District	3,991	198,242	50	678	19,756	29	414	4,303	10
Grand Total		83,650	4,729,902	57	24,535	337,419	14	4,050	47,092	12

Source: Livestock Breeding and Veterinary Department, Kayin State

Based on the interview result, a typical farm household has two to four cattle (recently number of cattle has been decreased due to mechanization), around five goats, 10-20 chickens, and two to three pigs on an average. These livestock are important as a household asset. Farmers grow these livestock and sell them when the prices are high enough or farmers need money. If water pond is available, ducks are also kept.

In Kayin State, Livestock Breeding and Veterinary Department has been planning to establish eight livestock zones, one in Hpaan and Hpapun, and two in Kawkareik, Myawaddy, and Hlainwe to promote commercial livestock.

(2) Fishery

In Myanmar, fishery products are important and precious sources of protein. In Kayin State, fisheries in rivers and inland aquaculture are popular as the State is land locked. JICA implemented the technical cooperation project, "Small-scale Aquaculture Extension for Promotion of Livelihood of Rural Communities in Myanmar" aiming at improvement of protein intake and income generation of farmers in Hpaan TS. In Mon State, marine fishery in addition to inland aquaculture and river fishery is common. The marine fishery situation in Mon State is summarized in Table 3.20.

Table 3.20 Marine Fisheries in Mon State

Sr.	Township	In shore license			Off shore license		
		No. of Inshore fishing boat	Annual Production (ton)	Total Tax (kyat)	No. of Offshore vessel	Annual Production (ton)	Total Tax (kyat)
1	Mawlamyine	20	91	144,000	1	6	97,750
2	Chaungzon	132	9,096	1,078,000	10	1,112	810,000
3	Thanbyuzayat	376	60,135	3,619,550	76	4,339	5,634,000
4	Ye	468	71,782	4,930,150	59	19,772	8,063,850
5	Paung	135	477	827,500	-	-	-
6	Thaton	79	338	299,300	-	-	-
7	Kyaikto	67	2,385	385,050	-	-	-
8	Bilin	50	1,968	274,300	-	-	-
	Total	1,327	146,273	11,557,850	146	25,230	14,605,600

Source: Department of Fishery, Mon state

In-shore license is the license that fishermen can catch fish within 10 miles from seashore, and off-shore license is the one that fishery over 10 miles away from seashore can be permitted. For both licenses, marine fisheries in the southern part of Mon State are active particularly in Thanbyuzayat and Ye TSs.

3.2.7 Agricultural support services

(1) Agricultural finance

1) Agricultural Development Bank

The Agricultural Development Bank is in charge of agricultural finance under the Ministry of Agriculture and Irrigation. It is almost the only bank that provides financial services for agriculture in Myanmar. The annual interest rate is 8.5%, and the main scheme is the crop loan as described below.

The crop loan for monsoon paddy is for about eight months with the maximum borrowing amount of 50,000 kyat/acre/person. The borrowing limit is supposed to be increased to 100,000 kyat/acre/person from 2013/14. The maximum land size per person for borrowing is 10 acres. The crop loan provides loan for about five months for winter upland crops is for pulses, beans and oil crops with the maximum loan amount of 10,000 kyat/acre/person, which is also supposed to be increased to 20,000 kyat/acre/person in 2013/14.

The crop loan does not require collateral, but needs recommendation from village administration officer and several guarantors (group guarantee system to use peer pressure). Only cash is used

when farmers borrow and repay. Repayment in kind such as paddy is not accepted. There are also other schemes including sugarcane under the crop loan, and the agriculture machinery loan.

The State office of the Agricultural Development Bank is in Hpaan and its branch offices to service farmers directly are in Hpaan, Hlaingbwe, Kawkareik and Kyainseikgyi. The total disbursement amount of the crop loan scheme is increasing steadily in Kayin State in recent years. Disbursement of crop loan for monsoon paddy was 2,040 million kyat in 2012/13 for 6,298 farmers, and that for winter crops was 280 million kyat in 2012/13 for 1,095 farmers. Still, less than 10% of the total cultivated area under monsoon paddy is covered by the crop loan, and much smaller portion of farm households have access to the loan in Kayin State.

The State office of the Bank in Mon State is in Mawlamyine, and all the 10 townships have a branch office. The total disbursement amount of the crop loan scheme is increasing rapidly in Mon State in recent years. Disbursement of crop loan for monsoon paddy was 15,261 million kyat in 2012/13 for 35,525 farmers, and that for winter crops was 1,301 million kyat in 2012/13 for 5,487 farmers. Over one-third of the total cultivated area under monsoon paddy is covered by the crop loan, and one out of seven farm households have access to the loan in Mon State.

2) Other sources of finance

The Cooperative Department provides a micro finance scheme, which can be used for agricultural purposes at the interest rate of 2.5% per month provided to village cooperatives. The Irrigation Department also has some finance scheme to promote irrigated paddy cultivation in the dry season. Other institutions providing finance to farmers include the Myanmar Economic Bank (MEB), and the Myanmar Small Loan Enterprise (MSLE). According to Poverty Profile of Integrated Household Living Conditions Survey in Myanmar (2009-2010), 50% of total source of agriculture credit is the informal sector (2009).

(2) Agricultural marketing and farmers organizations

1) Agricultural marketing

In Myanmar, the private sector deals with agriculture marketing for not only paddy but also other crops. Agriculture commodities are purchased from farmers by traders and flows to consumers' area.

- Rice

Farmers in general sell paddy to traders. Traders sell paddy to millers or they themselves mill paddy to milled rice. In the Southeast Myanmar, paddy tends to go once to Mawlamyine and Hpaan, then is distributed to retailers in rural towns. Some wholesalers of rice in Mawlamyine said that most of rice consumed in Mon State is produced in the State, but some wholesalers in Hpaan told that there are several cases that they buy rice from Yangon and Mon state. Also, they raise an issue of post-harvest of rice that drying of paddy after harvest may not be appropriate due to rain during the harvest time.

- Other crops

In the Southeast Myanmar, vegetables, especially cauliflower, potato, cabbage, and onion mostly come from Mandalay, Magway, and Shan where agriculture is more developed. Most fruits come from Thailand, but grapes come from Mandalay, pomelo found in market is produced in Mon State, and durian is partially from Mon State, while majority of durian comes from Thailand.

Generally, the amount of agriculture products harvested in the Southeast Myanmar in markets depends on cropping calendar. During the rainy season, there are less upland crops (pulses and beans, groundnut, and sesame) and vegetables, but more fruits, produced in the Region. In the dry season on the contrary, more local upland crops and vegetables are found in markets and less local fruits.

- Cashew nut

Traders nearby buy cashew nuts from farmers and bring them to processing factories. Farmers harvest cashew nuts during the dry season. Farmers collect dropped cashew nuts and sell them with shell. Regarding cashew apples, a farmer in Kyaikto does not collect them, but a farmer interviewed near Hpaan said he collects, dries up, and sells them to traders/businessmen who process them into jam. In processing factories, outer shells are taken out, and cashew nuts as seeds are produced.

- Rubber

Rubber is also harvested in the dry season. Farmers tap trees in midnight till early morning, when temperature is low, wash collected latex with water, add formic acid and process it to rubber blocks using tray or thin it into rubber sheet. Traders buy either rubber blocks or rubber sheets from farmers.

In the Southeast Myanmar, basically small scale individual farmers (majority of farmers, 16,197 farmers in Mon State, cultivate lands of 5-10 acres) plant rubber trees. According to the interview with rubber farmers, there are some cases that Chinese traders approach to farmers to lend initial investment, and receive repayment back in kind. Raw rubber export in 2009-2010 was 41,000 ton, and total production both in Kayin and Mon States was 81,255 ton in 2009-2010. The rest would go to processing factories, and possibly illegal export.

2) Farmers' organizations

According to the interviews with Department of Agriculture, Irrigation Department, and farmers, there seem no or few farmers' organizations in the agriculture sector of Myanmar. Even in the field of irrigation water management, which normally requires farmers' organization, such organization has not yet been developed or even active except in the central dry zones. This may be because the Government has so far led the activities which need farmers' collective actions, or farmers themselves have not need to form groups and just act as they want individually. This has not yet been raised as major problems due to abundant natural resources.

3.2.8 Farm household economy

(1) Crop budget

1) Seasonal crops

Crop budget of main seasonal crops are summarized in Table 3.21. As shown in Table 3.21, winter groundnut has the largest net profit with 354,500 kyat/acre, followed by maize in Myawaddy with 299,450 kyat/acre. Winter sesame with 153,000 kyat/acre and green gram with 141,500 kyat/acre have larger net profit than monsoon paddy with 70,000 kyat/acre and summer paddy with 80,000 kyat/acre. Summer paddy is more profitable than monsoon paddy as shown,

but its superiority may be even higher if the average yield of monsoon paddy is taken to be 68.5 baskets in Kayin State as the state statistics show.

According to the interview survey, wide variance exists in crop production costs. Costs of paddy production ranges from 40,000 kyat/acre for farmers not using any fertilizer to 250,000 kyat/acre for others using agricultural input to obtain higher yield. Since costs of paddy production excluding family labor for monsoon paddy is 155,000 kyat/acre, the crop loan of 50,000 kyat/acre as described above did not fully cover the production cost (it is supposed to be increased to 100,000 kyat/acre in 2013/14).

Table 3.21 Crop Budget of Major Seasonal Crops

Item	Monsoon Paddy	Summer Paddy	Maize (in Myawaddy)	Winter groundnut	Winter Sesame	Green gram
Yield (basket)	80	80	85	68	12	17
Farm gate price (kyat/basket)	3,500	4,000	6,000	8,000	25,000	16,500
Gross Sales	280,000	320,000	510,000	544,000	300,000	280,500
Cost including family labor	210,000	240,000	210,550	189,500	147,000	139,000
Net Benefit	70,000	80,000	299,450	354,500	153,000	141,500
Net benefit adding cost of family labor	125,000	112,000	329,450*	389,500	183,000	171,500

Source: Department of Agriculture, Kayin State

Remark: Data of maize in Myawaddy given by the government did not specify the cost of family labor (data must include the cost), and here the cost is assumed 30,000 kyat borrowing this cost from other crops.

2) Rubber and cashew nut

Profitability of rubber and cashew nut is compared in Table 3.22. Rubber needs relatively large initial investment, while it will produce profits for longer period of time. Thus, investment in rubber production is a long term investment. Cashew requires smaller initial investment, and provides profits earlier. Its profitability will be improved if cashew apples and shells are also utilized.

Table 3.22 Profitability of Rubber and Cashew Nut

Item	Unit	Rubber[1)]	Cashew nut[2)]
Year to start production	-	8th year	5th year
Maximum cumulative loss and year	kyat	1,719,049 (at 7th year)	611,000 (at 5th year)
Year to recover all investment	-	12th year	9th year
Average annual net income (for only positive figures)	kyat	418,913	248,800
Total cumulative net profit for 30 years	kyat	7,915,951	5,609,000

Source: 1) Department of Industrial Crop, Mon state; 2) Department of Agriculture, Mon State, modified by JICA Study Team

(2) Farm income

1) Agricultural income

Based on the information so far obtained, agriculture income in the Southeast Myanmar is examined. The important assumptions are: 1) average farm land per household is 5.0 acres; 2) three typical cropping patterns are assumed, namely a. monsoon paddy only, b. monsoon paddy – summer paddy, c. monsoon paddy – winter/summer upland crops; 3) the 5.0 acres land is entirely cultivated; and 4) net benefit is used without consideration of family labor.

The net profit for monsoon paddy is 125,000 kyat/acre, and thus a total of 625,000 kyat/household is obtained annually for the 5.0 acres land. If the yield is assumed low at 68 baskets, the annual household income is reduced to 315,000 kyat. If monsoon paddy is combined with summer paddy, the net annual profit is 237,000 kyat/acre, and therefore annual income becomes 1,185,000 kyat/household. If the yield for monsoon paddy is reduced, 975,000 kyat is annual income for household. Access to water for irrigation during the dry season is a necessary prerequisite for this model.

A combination of monsoon paddy and winter/summer upland crop produces annual net profit of 2,136,500 kyat/household, with 1,511,500 kyat/household of net benefit from winter/summer upland crop assuming three acres of groundnut and two acres of green gram. Even adopting low monsoon paddy yield, annual income is 1,826,500 kyat.

2) Non-agricultural income

Most farmers interviewed explained that at least one family member, typically young generation in their 20's is in Thailand, Malaysia, and Singapore, and remits some money to their families in the Region. The amount of remittance differs, ranging from 100,000 to 600,000 kyat/month per household. In addition, some farmers obtain another income from small business such as small retail shops and meal shops, and from casual labor to public works e.g. road construction. In Mon State, rural areas are relatively developed and might have more job opportunities, but there seem very limited job opportunities in remote rural areas in Kayin State.

For those who do not have right to cultivate (so called agricultural labor or landless farmer), their main income source is labor work for monsoon paddy cultivation. If they work for 120 days continuously for a year at a rate of 3,000 kyat/day, total income becomes 360,000 kyat and they are considered poor. However, there is information that such laborers recently go to Thailand and find jobs there. In that case, their family members receive remittance from him/her and are ~~is~~ able to live without any problem.

(3) Household expenditure

In this preliminary study, several interviews with farmers and related government officers were conducted to understand typical household expenditure. As a result, annual household expenditure in the Southeast Myanmar is found to be 1.2 ~ 1.8 million kyat. It should be noted that poverty line in 2010 is 376,151 kyat as an annual household expenditure according to Poverty Profile of Integrated Household Living Conditions Survey in Myanmar (2009-2010).

(4) Household economy

Assuming that farmers rely only on agriculture, agricultural income from cropping pattern "a. monsoon paddy only" (315,000 ~ 625,000 kyat) is not sufficient to cover the average annual household expenditure (1.2~1.8 million). Farmers who can access to water during the dry season are able to grow paddy two times a year, corresponding to cropping pattern "b. Monsoon paddy – Summer paddy", and earn 975,000 ~ 1,185,000 kyat, close to 1.2 million kyat of expenditure. If farmers choose cropping pattern "c. Monsoon paddy – Winter/summer upland crops", income only from agriculture can exceed 1.8 million kyat of expenditure though it depends on which crops they grow.

Most farmers in the Southeast Myanmar grow monsoon paddy for their home consumption as long as their lands are flat enough and suitable for lowland paddy (submerged paddy). Thus, an issue is

choice of second crops. If farmers have enough non-agricultural income to meet expenditure, they may not have strong incentive to cultivate their lands during the dry season. In this case, even if their lands are covered by irrigation schemes meaning that they can get water during the dry season, farmers might not cultivate. On the other hand, farmers who do not have any other source of income have to maximize their income from their lands. Such farmers tend to raise cropping intensity (following cropping pattern b. or c.) and earn maximized profit to meet household expenditure.

For perennial crops, profitability of rubber is high, and this is the reason why the cultivated area of rubber is expanding. Average annual net income from rubber is 418,913 kyat/acre, and therefore only 3.0 acres are sufficient to cover 1.2 million kyat of expenditure. Cashew nut is also profitable, and several fruits are generally high value crops, and considered profitable.

3.2.9 Agriculture labor force

Agriculture labor in the Southeast Myanmar may not be sufficient and there is a possibility that labor cost rises and affects profitability of agriculture. According to the interview conducted by the JICA Study Team, labor force in other parts of Myanmar comes to this area for agricultural labor works. Therefore, here, whole agriculture labor force in the Southeast Myanmar is preliminary estimated to understand current conditions of labor force in a quantitative way, taking monsoon paddy as an example.

Labor requirement for monsoon paddy cultivation in Kayin State is estimated to be 35.5 person-days/acre including family labor. The total cultivated area of monsoon paddy in Kayin and Mon States are 527,017 acres and 835,326 acres, respectively, and thus each state needs 18,709,104 person-days for Kayin State, and 29,654,073 person-days for Mon State if this figure is applied to both states. On an average, one farm household needs to manage 5.0 acres of monsoon paddy area for five- to six-month monsoon seasons. Supposing farmers continue working throughout the monsoon season, one acre of monsoon paddy requires 30 days in net working days. Hence, in terms of number of laborers, monsoon paddy cultivation needs 623,637 persons in Kayin State and 988,469 persons in Mon State. Economically active population, over 15 years old, in rural areas of the Southeast Myanmar is estimated in Table 3.23.

Table 3.23 Estimation of Economically Active Population over 15 Years Old in Rural Area of Southeast Myanmar

State	Population*	Percentage of population above 15 years old**	Population above 15 years old	Percentage of population in rural area**	Population in rural area
Kayin	1,388,146	70.56%	979,476	85%	832,554
Mon	2,079,864		1,467,552	65%	953,909

Source: *Health Profile, 2009; **CSO, 2011

This simple estimation indicates that there are around 200,000 people of surplus in Kayin State, and about 35,000 people of deficit in Mon State for monsoon paddy cultivation. In the above estimation and statistics, it seems not to consider number of people working in Thailand. Depending upon the figure of workers in Thailand, the agriculture labor situation may become worse. The interview result gives the information that number of migrant workers in Thailand is around two to three million. Assuming a half of them come from Kayin and Mon State, and one third of the rest come from Kayin State, migrant workers from Kayin State could be 500,000. Applying 85% of rural population, 425,000 people would be assumed from rural areas of Kayin State (more than 200,000 of surplus labor in rural areas in Kayin State), meaning that agriculture labor might not be sufficient even in Kayin

State. Just for reference, number of farm households is 239,148 in Kayin State and 240,671 in Mon State.

3.2.10 Specialty products

As already mentioned, there are unique potential products for the Southeast Myanmar such as fruits, coffee, betel nut, rubber, maize, and green gram for Thailand as raw products of agriculture crops and industrial crops. From the viewpoint of rural development and local economic development, other examples are shown as unique products in the Region.

Near the Gyaing bridge across the Hlaingbwe River on the road between Kawkareik and Hpaan in Kayin State, river prawn is famous. Though production cost of this prawn may be high compared with sea prawn in Ayeyarwady, size of the prawn is large, and it could make a potential unique product.

In Chaungzon TS (island) in Mon Sate, there are artisans in a village (Ywarlut village), who produce wooden pipes and ball point pens. It is said that foreigners sometimes come to buy them. Unfortunately the material of this product (wood) is not produced in Mon State but in Kayin State, but it may be regarded broadly indigenous resources. For others such as honey production and cardamom in the northern part, bamboo in forest areas, and agriculture processing such as jam from fruits, there are several potential products in the Region. It is said that the Region would have the potential for medicinal plants.

These are not all, and finding such unique products, and fostering them as industry may lead to local economic development. In the Southeast Myanmar, lots of people go to Thailand as migrant workers, and some people may think this area is economically behind and want to change. This situation is similar to the one when the Japanese One Village One Product (OVOP) movement was started in Oyama town in Oita Prefecture. Though it is difficult to achieve macro-economic impact only by this OVOP movement, it can be one measure to realize rural development and local economic development by adopting this concept which utilizes local resources, creates awareness of pride, and adds value on them. This is perhaps similar idea of fostering vertical industrial cluster using indigenous resources.

3.2.11 Development issues, directions and strategy for agricultural development in Southeast Myanmar

Issues, directions and strategy for agricultural development in the Southeast Myanmar are summarized as follows. In planning for supports for livelihood activities in agriculture by returnees, these development issues should be reflected, and such activities that are in line with these development directions and strategy should be planned and supported.

(a) As large percentage of population still lives in rural areas and engages in agriculture, improvement of conditions of the agriculture sector will benefit lots of people and thus is considered a priority.
(b) In examining the development strategy, it is necessary to understand recent policy change of the agriculture sector to liberalize crops grown and marketing. Also to be considered are the socio-economic conditions in the Southeast Myanmar that farmers may get remittance from their family member in Thailand or Malaysia, and possible shortages of young labor force. Hence, as the overall direction, it is important to aim at promoting attractive agriculture to ensure appropriate farmers' income. To do so, conventional measures of agriculture

development such as increase of agriculture production, improvement of productivity, and large scale irrigation development are still valid and important; however, appropriate selection of crops and cropping patterns as well as cultivation methods are even more important.

(c) As a priority, productivity of monsoon paddy shall be raised, aiming at keeping self-sufficiency throughout the Region for increasing population. As second crops during the dry season, upland crops such as maize, oil crops, and pulses and beans are recommended to secure farmers' choice. Fruits in Mon State, and coffee in the northern part of Kayin State are also recommended for promotion as strategic crops, and expected to be grown as unique agriculture products representing the two states (branding). In addition, the eastside of the mountain (Dawna range) in Kayin State can be positioned as the place of upland crops, mainly maize and green gram, aiming at markets in Thailand. The southern part of Mon State is characterized as rubber and fruits area.

(d) Recommended cropping pattern in general is monsoon paddy – upland crops (pulses and beans, oil crops, and if possible vegetables) in consideration of farmers' income. To increase productivity of rain-fed paddy during the monsoon season, current farming practices including seed, fertilizer, postharvest should be improved through the government extension system. For upland crops during the dry season, farmers are not so familiar with their farming practices, and therefore the training should be provided to farmers through the extension system, which is also to be improved with TOT training.

(e) As for industrial crops, rubber must be the most important crop for the time being as more rubber plantations will start producing in a few years. Investment in rubber plantations is long term, and rubber fields cannot be easily changed to other crops, and therefore expansion of rubber area should be carefully examined in view of market conditions. Mon State is the biggest producer of rubber in the Country, and therefore, it is recommended to establish a rubber industrial cluster to provide employment opportunities to local people and contribute to regional economic development.

(f) In addition to rubber, cashew is also one of the potential tree crops having potentials to generate a range of unique products in the Southeast Myanmar. Currently only seed without shell is used as commercial part, but apples and shells can be used as commodities for sale such as apple for vinegar, wine and jam, and shell for industrial oil and lacquer. Thus, from cashew, another industry cluster can also be envisioned. Cashew trees compete against rubber in terms of land suitability, and currently farmers tend to choose rubber due to its high profitability. In the future, when the cluster is developed with apples and shells sold for processing, and farm gate profitability of cashew is expected to become higher.

(g) Livestock is important as a livelihood means of typical farmers. Nearby towns where income of people is getting higher, it is also recommended to promote commercial livestock development. Fishery is also important and recommended for promotion depending upon the local needs and characteristics such as inland fish culture and river fishing in Kayin State, and deep sea fishery in Mon State especially in the south.

(h) Soil in the Southeast Myanmar generally is acidic and not so fertile, though land affected by river flood might be relatively fertile as long as flood does not harm agriculture. Soil amelioration such as liming is recommended.

(i) In improving productivity, farm mechanization and modernization are also important (tiller, harvester, thresher, and miller, etc.). This would probably be more important to cope with labor shortages. For mechanization, it is necessary to introduce machinery to farmers who are capable enough, and to places where spare parts are available or easily accessible. In addition,

land development for farmers to easily use machineries is also necessary. An important issue of post harvest technology is to control water content in paddy. To keep dryer conditions than practiced now leads to reduction of losses.

(j) For irrigation development, irrigated paddy during the dry season is not well grown in the existing irrigation schemes. Recommended upland crops may not require so much water, therefore, it is desirable to develop minor irrigation depending upon the micro local conditions rather than just constructing new irrigation schemes. For new development of irrigation schemes, it is recommended to adopt fully participatory approach and ask farmers commitment to use the scheme in the dry season selecting the best scheme based on the list. This must be an advanced example of participatory irrigation development and a new showcase to envisage promotion of irrigated upland cash crops during the dry season.

(k) For the existing irrigation schemes where the irrigated area during the dry season are far less than command area, it is important to clarify the reasons, and take necessary actions. As more lands are used, participation of farmers (water users association) for O&M of the schemes is expected to become more active.

(l) Agriculture finance must be strengthened to support the agriculture activities mentioned above. Especially in Kayin State, the Agriculture Development Bank has not enough branches and credit schemes. It is also important to increase number of branches, raise maximum loan amount per person, diversify loan schemes e.g. to create new schemes such as monsoon upland loan and fruits/cashew nut/coffee as proposed strategic crops.

(m) From the viewpoint of rural development and rural industrialization, it is important to promote agriculture/fishery products as unique products for these two states as already discussed. In addition, it is also recommended to foster micro, small and medium enterprises (or entrepreneur) in rural areas using local resources, through, for example, promoting agriculture/fishery processing (probably simple processing such as making jam from fruits, etc.), handicraft using forest products (hardwood, bamboo), and tourist development using potential local tourist spots, and so on.

(n) Shifting cultivation, which is still conducted in the mountainous areas in a conventional way, are permitted if farmers want to continue (this could be minor in terms of its size considering overall state agriculture). In doing so, it is important to manage shifting cultivation within the recovery capacity of forests and soil in order not to degrade forest resources. Recently, farmers plant rubber trees after two to three years of upland paddy cultivation. Hence, this land won't be again farm land for around 30 years until rubber stops producing latex, leading to increase of rubber planted areas.

(o) When detailed programs and projects are formulated following the development directions and strategy described above, it is important to consider micro local characteristics spatially such as soil, slope, current land use, and crop cultivation for example by township.

3.2.12 Tentative list of proposed programs and projects

Possible programs and projects for agriculture development in the Southeast Myanmar are tentatively listed below. The list is not comprehensive and subject for future revision, and the inclusion in the list does not imply priority.

(1) Promotion of crop diversification (upland crops)

Upland crops as second crops during the dry season shall be promoted. Strategic crops are maize,

green gram, cowpea, black gram, groundnut, sesame, and vegetables. Technical training to extension staff regarding framing practices about upland crops as TOT training is recommended to be given. Pilot places are selected and the training to key farmers by trained extension staff is recommended to be given. Pilot places are preliminarily identified as: Hpaan, Kawkareik and Myawaddy (even in monsoon seasons as well in Myawaddy) in Kayin State, and Bilin and Thaton in Mon State. Department in charge is the Department of Agriculture.

(2) Improvement of paddy productivity

Paddy especially in the monsoon season is the dominant crop in the Southeast Myanmar. To raise paddy productivity is a key to regional rice self-sufficiency in line with the national policy. Important activities could be 1) extension services to farmers to follow standard farming practices (fertilizer application etc.); and 2) research activities such as to reveal relationship among climate (long rain), soil (generally acidic), and high yielding varieties (whether the varieties match with this climate and soil condition), and to try long duration varieties during the monsoon season, and short duration varieties during the dry season. Department in charge is the Department of Agriculture.

(3) Improvement of post-harvest of paddy

The issue on paddy post-harvest raised is the extent of dryness of paddy after harvest. Generally moisture content after harvest is recommended to be kept at around 15%, and if the content is higher, quality of rice becomes lowered. In the Southeast Myanmar, it sometimes rains during harvest seasons and paddy might not be dried at the appropriate level. It is necessary to study and clarify current loss, and if it is required, it is recommended to examine introduction of dryer machine (e.g. to test its viability as a pilot project). Department in charge is the Department of Agriculture.

(4) Promotion of mechanized agriculture

The farming practice in most cases relies on a conventional labor intensive way. Modernized agriculture is aimed by the current policy, and even more importantly, it is said that agriculture labor gets less and less recently, most probably due to migrant workers in Thailand. Therefore, there are possibly high needs to save labor. Thus, mechanized agriculture is recommended to be promoted in the Southeast Myanmar. The Department of Agriculture Mechanization is recommended to be the implementing agency; the staff is to be trained; appropriate agriculture machineries (e.g. thiller, harvester, thresher, tractor, etc.) are examined and introduced considering the natural and socio-economic conditions in the Region. As a pilot, demonstration farm using introduced machineries could be operated and examine their viability such as labor saving effect and economic relevance, etc.

(5) Micro irrigation development for crop diversification

In collaboration with the project mentioned in (1), micro irrigation is recommended to be promoted especially for upland crops during the winter and the summer seasons. Current idea of micro irrigation is small pump irrigation from creek, water pond, and well, depending upon the local condition. Assumed crops are maize, pulses and beans, vegetables. Development of micro irrigation systems from water source to fields and associated technical training to extension staff and key farmers are recommended.

(6) Improvement of drainage to protect agricultural land from flood water

During the rainy season, agriculture land close to rivers is affected by flood water. By this, monsoon paddy is damaged, leading to farmers' loss. In this program excavation of drainage and construction/rehabilitation of embankments shall be made together with the Irrigation Department in both Kayin and Mon States. Exact target places and components should be examined.

(7) Improvement of cropping intensity in existing irrigation schemes

As seen, in some of the government schemes, utilization of dry-season cultivation is low. First of all, the reasons are recommended to be revealed from socio-economic and engineering points of views. To do so, surveys on farmers about their wills to cultivate land during the dry season and also on the conditions on physical structures, are recommended to be conducted. If socio economic reasons are critical (possible reason would be low incentive of farmers who receive remittance), one of the measures is to call private companies during the dry season. In this case, right to cultivate must be rented out from individual farmers to companies. Win-win relationship is envisaged for both farmers who can earn rent from companies during the dry season and companies that need a certain size of farm land with water. If the critical reasons are related to engineering, it is necessary to rehabilitate canals and consolidate lands to distribute water to each field. As farmers cultivate the irrigated land during dry seasons, water management by water users' association is recommended to be trained in the program. The counterpart organizations are the Irrigation Department and the Water Resources Utilization Department in both Kayin and Mon States in existing government schemes to be selected.

(8) New irrigation development by participatory planning maximizing utilization during dry seasons

In parallel with micro irrigation development, new irrigation development is also recommended to be promoted by participatory approach. New development is planned and implemented by the central Ministry of Agriculture and Irrigation. In Kayin and Mon States, there are 25 new future projects. Also, the Study Team identifies some water resources development plans. Out of these plans, several plans that farmers in the potential command area strongly desire to cultivate the land during the dry season are recommended to be selected for implementation. In implementation, the Government may ask some commitments from farmers, e.g. some contributions on initial investment. In selecting schemes, it could be a trial to open private firms to be owner's of part of command areas. To do so, coordination and negotiation with current people who have right to cultivate are necessary.

(9) Strengthening of agriculture finance

In rural areas, there is a vast finance demand for agriculture practices. ~~v~~As discussed, ADB is the almost only formal institution that provides agriculture finance. Especially in Kayin State, ADB has only four branches. Therefore, first of all, strengthening of ADB in Kayin State is supported by the program. At first, a branch shall be opened in Myawaddy. As peace building progresses, branches in other sub-townships are recommended to be established.

Second, the maximum loan amount of winter upland crop is examined to be raised. Third, ~~a~~ new loan schemes shall be advised to be created, e.g. monsoon upland (especially in Myawaddy), perennial tree crops such as rubber, cashew nut, fruits, coffee etc.

(10) Promotion of diversified perennial crops (fruit, cashew, coffee) as unique products

In the Southeast Myanmar, there are potential unique products which can be advertized for all of the

Myanmar people or even neighborhood countries. Specifically, fruits in Mon State and partly Kayin State must be promoted. The department in charge is the Department of Agriculture. There are several horticulture centers in both states. Centering on these centers, encouragement of farmers to plant the above perennial crops is assisted. At the same time, technical training to farmers is to be provided for proper management of trees and making sure of good harvest. Current preliminary pilot places are the southern part of Mon State for fruits (Thaton for durian); Kyaikto and Kyaikmaraw in Mon State and Hpaan and Kyainseikgyi in Karen State for cashew nut; Than Taunggyi for coffee.

Marketing activities are also important to be conducted. Using current production, agriculture fairs in Yangon, matching activities with buyers and producers, branding activities shall be implemented to make the products well known.

(11) Local economic development through activating rural industry

In this program, potential local products in Kayin and Mon States are to be discovered and identified. These products can include raw agriculture/fishery products, and agro/fishery processed products, and handicrafts. Once identified, several advices on business skills, marketing of products shall be made. Important points are not just providing materials and seed money, but drawing their willingness and utilizing current conditions to start, expand, and continue their business. The concept of One Village One Product movement in Japan could be used as one of the references. Potential ones could be honey production in the northern part of Kayin State, cashew processing (wine/vinegar from apples, lacquer from shell), handicraft of bamboo and wood, river prawn in the Hlaingbwe River, fish processing in the southern part of Mon State, particularly in Ye.

3.3 Industry

3.3.1 Industrial development policies in Myanmar and for Southeast Myanmar

(1) Industrial development policies in Myanmar

Eight industrial development policies and 20 work programs, which are obtained from the Ministry of Industry (MOI), are shown below.

1) Policies

(a) To utilize modernized and advanced techniques of agriculture as the base to set up an industrialized nation; to expand and develop agro-base industries, agro-business, agro-products and value-added business.
(b) To simultaneously continue the task for the establishment of heavy industries while making unremitting efforts for the implementation of small and medium enterprises.
(c) To implement small and medium enterprises and sustain efforts for establishment of heavy industry to stimulate substitution of imports with domestic products and also strengthen increased exports.
(d) To foster improved cooperation among private sectors and between the public and private sectors to boost industrial development.
(e) To utilize effectively the natural resources and raw materials of the country and increase the production of value-added commodities.
(f) To successfully develop human resources and provide necessary training and schooling of personnel for a continuous supply of technologically qualified and capable human resources.
(g) To utilize energy efficiently and cost-effectively and for renewability.
(h) To increase and expand green industries in accordance with sustainable development principles in the interest of environmental conservation.

2) Work Programs

(a) To synchronize the implementation of the production sector, services sector, IT multimedia cluster and the financial sector.
(b) To carry out the following industrial enterprises as priority/simultaneous tasks.
- ✓ Light industry (i.e. SMI)
- ✓ Export oriented/import substitute industry
- ✓ Labor intensive industry
- ✓ Knowledge-based, technology-based industry
- ✓ Capital intensive industry

(c) To open SME Centers with technical assistance for SME promotion.
(d) To provide financial assistance with funding and an annual budget by opening an SME finance center and SME bank for the following:
- ✓ A special fund
- ✓ Facility upgrading and modernization fund
- ✓ Emergency financial assistance fund
- ✓ Reserve funds

(e) To take measures and make arrangements for the opening of appropriate supportive organizations and One Stop Service Centers to facilitate the development of SMEs.

(f) To make arrangements for the reduction of oppressive revenues such as double taxation and allow tax exemption or tax relief and alleviation for long term survival, sustainability and success of SMEs.
(g) To establish close linkage between State and private entrepreneurs and mutual coordination in implementing industrial development.
(h) To encourage and promote private entrepreneurs, public and private cooperation in industrialization and facilitate the production and services sectors by giving necessary assistance in revenue and legal issues.
(i) To give factories and workshops, whether state-owned, privately-owned or cooperative-owned in industrial zones, every assistance and help (fuel/energy, raw materials, technology, capital investment etc.) for full capacity production.
(j) To achieve effective capacity and innovation through liberalization and regulatory reform in management.
(k) To draw up and enact a law for standardization, a patent law and competition policy and law in order to raise the quality of industrial products.
(l) To apply the regulatory authority by the government with solid and tangible results.
(m) To strengthen and reinforce industrial clusters.
(n) To give every assistance and support for the successful transition from an industrial technology base to an information technology base.
(o) To provide assistance to forge international links for industrial enterprises.
(p) To employ tactical teaching and training methods for the systematic nurturing of skilled workers to reach international standards of competency and thus gain the status of internationally recognized skilled labor.
(q) To encourage the creation and designing of innovative products utilizing domestic raw materials and promotion of value-added products.
(r) To make endeavors for the development of existing industrial zones and set up new industrial zones in the border regions as and when necessary.
(s) To promote and establish local and regional industrial enterprises to encourage the development of basic industries as well as other industries in regions where development has lagged behind.
(t) To carry out the task of developing the Special Economic Zone.

In sum, MOI emphasizes:
(a) development of SME including establishing one-stop centers for business start-ups that help reduce red-tape, reducing/eliminating administrative controls, supporting provision of land use rights and improving access to credit (both private and public),
(b) promotion of industry cluster development,
(c) introduction of labor intensive industries which absorb the large amount of employment,
(d) provision of technical and vocational education and training (TVET) to workers,
(e) utilization of local resources and agricultural products, and
(f) development of industrial zones.

According to MOI, 18 industrial zones/estates are currently operated in the country including Mawlamyine Industrial Zone in Mon State and seven zones are being additionally implemented or designed for development. Among seven industrial zones, three zones, namely, Hpaan Industrial Zone, Myawaddy Industrial Zone and Hpayarthonesu Industrial Zone are located in Kayin State.

Besides policies and work programs by MOI, in Policy Priorities for 2012-15 towards the Long-Term Goals of the National Comprehensive Development Plan, private sector development and foreign direct investment (FDI) have been stated as follows.

The Union Government has revised the foreign investment law as well as citizen investment law, with the goal of eventually merging the two before the scheduled formation of the regional economic integration of ASEAN Economic Community (AEC) by 2015. The laws represent an important opportunity to reintegrate the country back to the global economy. The new laws envisage not only a wide range of new business lines where foreign investment can operate at 100% equity ownership but also favorable tax incentives, longer lease of real estate, and vigorous standards for environmental and social protection. Specific provisions in law will improve the transparency of the foreign investment regime while the government is planning to build capacity among the domestic judiciary with regard to their regulatory enforcement and intermediations.

(2) Industrial development policies for Southeast Myanmar

The policies by MOI in Kayin State and Mon State are basically the same as those of the Union Government, although some work programs such as developing the Special Economic Zone are excluded. It is also stated that (i) promotion of export as well as import substitution is to be carried out and (ii) potential industries are to be encouraged through converting basic raw material utilization industries into value-added industries.

3.3.2 Overview of industrial development in Myanmar and Southeast Myanmar

(1) Myanmar

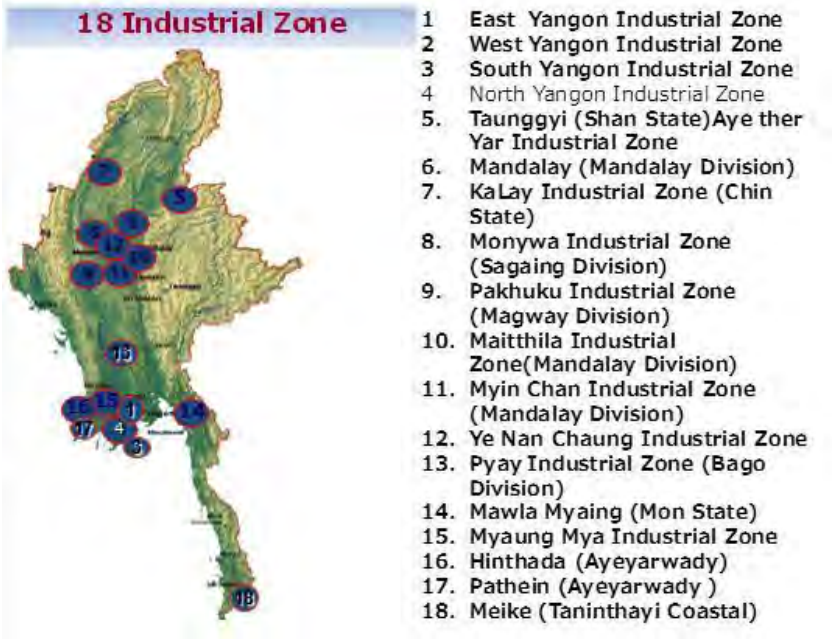
The current industrial structure in Myanmar is shown in Table 3.24. In terms of number of private firms, manufacture of food and beverages hold the largest share with 64%, followed by general industries including miscellaneous industries with 14%, construction materials industries with 8%, metal and mineral production industries with 4% and clothing & wearing apparel industries with 4%. Share of agriculture machinery industries, industrial tools and equipment production industries or electrical equipment industries is less than one percent. In terms of size of industries, small industries hold the largest share with 72%, followed by medium industries with 17% and large industries with 11%. The share of large industries in Myanmar may be bigger compared to that of other countries since the size of company is defined by the combination of number of employment, amount of investment and horse power of installed machinery/equipment.

Table 3.24 Number of Industries by Sub-sector in Myanmar in 2012

No.	Type of Sub-sectors	Size of Industries				%
		Large	Medium	Small	Total	
1	Food & Beverages Industries	2,369	4,110	20,976	27,455	63.5
2	Clothing & wearing apparel Industries	341	380	1,001	1,722	4.0
3	Construction materials Industries	510	650	2,117	3,277	7.6
4	Personal goods Industries	375	410	330	1,115	2.6
5	Consumer/Household goods Industries	144	79	97	320	0.7
6	Literature and Art Industries	60	117	183	360	0.8
7	Raw good production Industries	169	240	282	691	1.6
8	Metal and Mineral Production Industries	315	381	1,204	1,900	4.4
9	Agriculture Machinery Industries	9	25	37	71	0.2
10	Industrial tools and equipment production Industries	15	49	66	130	0.3
11	Automobile production Industries	194	40	33	267	0.6
12	Electrical equipment Industries	43	15	12	70	0.2
13	General Industries	264	791	4,799	5,854	13.5
	Total	4,808	7,287	31,137	43,232	100.0
	Share (%) by size among the total	11.1	16.9	72.0	100.0	

Source: Ministry of Industry,

As of 2012, 18 industrial zones/estates including Mawlamyine Industrial Zone in Mon State have been developed in Myanmar as shown in Figure 3.8.



Source: Ministry of Industry

Figure 3.8 Industrial Zones in Myanmar

On the other hand, six (6) industrial training centers (ITCs) by Ministry of Industry are located in Sinde, Mandalay, Thagaya, Pakokku, Magway and Myingyan. They are financially and technically supported by Germany, China, Korea and India. Various training courses such as basic electrician training, boiler operator training, machinery fitter training, machine tool operator training, automobile mechanic training, automobile electricity & electronics training, CNC machine tool operator training, CAD / CAM training, and welding, electroplating & surface treatment training are provided although

training programs are different among ITCs.

(2) Southeast Myanmar

1) Kayin State

Table 3.25 and Table 3.26 show the distribution of private industries in Kayin State in 2011/12 by size, sub-sector, employment, gross production and so on. In terms of size of industries, small industries hold the largest share with 82% (761 out of 930), followed by large industries with 11% and medium industries with 7%. Compared to the national average, the share of small industries is higher in Kayin State.

In terms of the number of industries, manufacture of food and beverages hold the largest share with 46% (430 out of 930), followed by other and miscellaneous industries with 21%, household goods production industries with 18%, mineral production industries with 11% and clothing & wearing apparel industries with 1%. As for employees, food and beverages industries also hold the largest share with 36% (1,838 out of 5,060), followed by clothing & wearing apparel industries with 25% and household goods production industries with 18%. It should be noted that the share of employees in clothing & wearing apparel industries is much larger than that of number of firms.

Gross production value amounted to 26,134 million kyat. Food and beverages hold the overwhelming share with 85% (22,299 out of 26,134).

Table 3.25 Number of Industries by Size in Kayin State

Size of industries	Before March 30/2011		March 31/2011- March 31/2012		Increased Number	
	Number of Industries	Number of employees (person)	Number of Industries	Number of employees (person)	Number of Industries	Number of employees (person)
Large	64	600	105	2,451	41	1,851
Medium	27	204	64	423	37	219
Small	711	2,000	761	2,186	50	186
Total	802	2,804	930	5,060	128	2,256

Source: Ministry of Industry, Industrial Supervision and Inspection, Kayin State

Table 3.26 Number of Industries by Sub-sector in Kayin State

Industrial Sub-Sector	Number of Industries	Number of employees (person)	Investment (million kyat)	Production (million kyat)
Food & Beverage	430	1,838	9,056	22,299
Clothing Apparel & Wearing	13	1,268	5,325	1,485
Household Goods	168	851	482	1,267
Personal Goods	11	43	38	31
Industrial Raw Materials	1	30	161	151
Mineral Products	101	305	135	127
Agricultural Equipment	4	16	9	25
Industrial Equipment	7	18	2	2
Transport Equipment (Vehicles)	2	29	143	528
Others & Miscellaneous	193	662	228	220
Total	930	5,060	15,578	26,134

Source: Ministry of Industry, Industrial Supervision and Inspection, Kayin State

In addition to the above-mentioned private factories, several state-run or public-run factories including Myaingkalay Cement Factory in the suburb of Hpaan are located in Kayin State.

2) Mon State

Table 3.27 shows the distribution of private industries in Mon State in 2011/12 by size, sub-sector, employment, investment and gross production. Number of industries (2,183) is much larger than that of Kayin State (930). In terms of size of industries, small industries hold the largest share with 84% (1,832 out of 2,183), followed by medium industries with 10% and large industries with 6%. Compared to the national average, the share of small industries is higher in Mon State.

In terms of the number of industries, manufacture of food and beverages hold the largest share with 56% (1,231 out of 2,183), followed by workshops and miscellaneous industries with 17% and construction materials with 14%.

As for employees, food and beverages industries also hold the largest share with 53% (4,449 out of 8,455), followed by construction materials with 18% and workshops and miscellaneous industries with 17%. In Mon State, clothing & wearing apparel industries do not play an important role.

Gross production value amounted to 14,338 million kyat. Food and beverages hold the largest share with 49% (7,041 out of 14,338). Gross production of industries in Mon State is smaller than that of Kayin state, although number of firms is larger than that of Kayin State.

Table 3.27 Number of Industries and Employees by Sub-sector in Mon State

Industrial Sub-Sector	Size of industry				Number of employees				Invest-ment (million kyat)	Produc-tion (million kyat)
	Large	Medi-um	Small	Total	Large	Medi-um	Small	Total		
Food & Beverage	67	101	1,063	1,231	793	731	2,925	4,449	4,613	7,041
Clothing Apparel & Wearing		2	1	3		23	5	28	9	23
Construction Materials	25	48	267	340	302	454	733	1,489	1,085	2,109
Personal Goods	3	9	5	17	29	32	14	75	308	88
Household Goods	1	1	2	4	6	4	16	26	17	50
Printing & Publishing		2	6	8		16	12	28	11	16
Industrial Raw Materials	11	8	27	46	121	52	62	235	460	915
Mineral Products	2	13	119	134	24	134	221	379	446	370
Agricultural Equipment	1		2	3	10		6	16	42	283
Transport Equipment (Vehicles)	11		4	15	243		62	305	549	2,602
Electrical Equipment		1		1		5		5	2	10
Workshops & Miscellaneous	1	44	336	381	15	171	1,234	1,420	520	834
Total	122	229	1,832	2,183	1,543	1,622	5,290	8,455	8,061	14,338

Source: Ministry of Industry, Industrial Supervision and Inspection, Mon State

Mawlamyine Industrial Zone (170 acres or 69 ha) started operation in 2002. As of 2012, 159 industries with 972 workers are located in the zone as shown in Table 3.28.

In terms of the number of industries, workshops and miscellaneous industries hold the largest share with 35% (56 out of 159), followed by food and beverages industries with 30%, mineral product with 11%, personal good production industries with 8%, transport equipment industries with 7% and industrial raw material industries with 6%.

Among industrial raw materials industries, a natural crumb rubber production industry for tire is included. One of the main reasons to locate in the zone is an access to raw materials (natural rubber) according to the managing director of this company,

As for employees, transport equipment (parts of small vehicles, etc.) hold the largest share with 25% (243 out of 972), followed by food and beverages industries with 24%.

Gross production value amounted to 4,607 million kyat. Transport equipment industries hold the largest share with 56% (2,594 out of 4,607).

The numbers of firms, employment, investment amount and gross production in Mawlamyine Industrial Zone account for 7%, 12%, 25% and 32%, respectively in those of the Mon State.

Table 3.28 Number of Industries and Employees by Sub-sector in Mawlamyine Industrial Zone

Industrial Sub-Sector	Size of industry				Number of employees				Invest-ment (million kyat)	Produc-tion (million kyat)
	Large	Medi-um	Small	Total	Large	Medi-um	Small	Total		
Food & Beverage	11	35	2	48	71	155	4	230	499	908
Clothing Apparel & Wearing		1		1		13		13	5	8
Personal Goods	2	9	1	12	14	32	3	49	286	36
Household Goods	1	1		2	6	4		10	14	48
Industrial Raw Materials	4	6		10	46	37		83	118	503
Mineral Products	2	12	3	17	24	87	9	120	324	100
Agricultural Equipment	1			1	10			10	40	280
Transport Equipment (Vehicles)	11			11	243			243	545	2,594
Electrical Equipment		1		1		5		5	2	10
Others & Miscellaneous	1	42	13	56	15	153	41	209	181	121
Total	33	107	19	159	429	486	57	972	2,015	4,607

Source: Ministry of Industry, Industrial Supervision and Inspection, Mon State

Table 3.29 shows the state-run factories in Mon State. Some factories are not currently operated.

Table 3.29 State-run Factories in Mon State

	Type of product	Location
1	Porcelain (chinaware) Factory	Mawlamyine (Mutpun)
2	Alcohol Factory	Mawlamyine (Mutpun)
3	Tire Factory	Thaton
4	Concrete Sleeper (for railway) Factory	Paung
5	Tire Factory	Bilin
6	No. 2 Crank Rubber Factory	Thanbyuzayat
7	Timber Factory	Mawlamyine
8	Palm Oil Factory	Kyaikto
9	No. 5 Timber Factory	Mawlamyine (Mutpun)
10	No. 8 Timber Factory	Kyaikto
11	Sugar Factory	Bilin

Source: Ministry of Industry, Industrial Supervision and Inspection, Mon State

3.3.3 Existing industrial development plans in Southeast Myanmar

(1) State Governments' plans and projects

Besides the specific industrial zone development project, the State Governments' plans and projects for industrial development are basically coming from those of the Union Government or MOI. As a result, some programs by MOI such as (i) provision of financial assistance and opening an SME finance center and SME bank, (ii) opening of One Stop Service Centers, (iii) arrangements for the reduction of oppressive revenues such as double taxation, (iv) provision of assistance and help (fuel/energy, raw materials, technology, capital investment etc.) for full capacity production will also be applied to industries in the Kayin and Mon States.

(2) Development of industrial estates/zones

Kayin and Mon State Governments and their industrial zone development committees take a step to formulate the industrial zones/estates as an important tool for attracting local and foreign investors and to be integral to the local economic growth.

As of May 2013, the following zones are being implemented or under planning for materialization. Hpaan Industrial Zone, Myawaddy Industrial Zone and Hpayarthonesu Industrial Zone are officially listed by MOI as newly planned industrial zones.

1) Hpaan industrial zone

The zone construction took place in 2011 after several meetings and discussions between industrial development committee of the State Government and local people. The site preparation has been conducted by a local developer (Than Lwin Ayeer Company). Electricity (66 kVA cable) and water supply system is not completed. A few factories are under operation as of May 2013.

The total development area of the zone is about 969 acres (392 ha), which is situated in a part of two villages; Sanfree and Mizan, seven (7) miles away from Hpaan. The zone is divided by four (4) sub-zones. The first sub-zone especially for foreign investors has 177 acres with 59 lots. The second sub-zone especially for local investors has 585 acres with 191 lots. The third sub-zone is for regional investors with 112 acres and 69 lots. The fourth sub-zone is prepared for SMEs with 99 acres and 324 lots. According to Ministry of Industry in Kayin State, most of lots except first sub-zone have already been allocated for applicants/investors, although factories or facilities are not yet constructed. In the first sub-zone, 30 lots (about 100 acres in total) out of 59 are allocated to a Yangon based garment factory group and 8 lots are allocated to a cease-fire group cooperative jointly with Thai capital. CEO of the garment industry group has a plan to formulate an industrial park through inviting their group factories and foreign client factories.

2) Myawaddy industrial zone

Myawaddy industrial zone is located along the road between Myawaddy and Kawkareik, seven miles west of Myawaddy city. The zone has two sub-zones: one is located in the north of the road with 200 acres (80 ha with two phases; 44 lots in the first phase) and the other is in the south of the road with 1,000 acres (400 ha)[1]. The latter is especially for foreign investors. The site preparation is conducted by a local developer (Nyi Naung Oe Company) for the first sub-zone and a Thai developer (Regina Company) for the second sub-zone, respectively. The planning and

[1] According to the master plan by Thai developer, total development area will be 800-900 acres.

design have already been completed in the first sub-zone. Power supply and transmission system depend on the Thai side.

In the second sub-zone, sub-sector industries such as: (i) garment, (ii) food processing, (iii) fertilizer, (iv) wood product/furniture (v) tire manufacturing, (vi) transport equipment/auto parts, (vii) battery and (viii) electrical equipment/parts production are designated as prioritized ones.

The flow of exported or imported raw materials/products will be handled through the Myawaddy Trade Zone which has a function of customs clearance and transit/transshipment of commodity.

3) Other industrial zones

- Hpayarthonesu industrial zone (Kayin State)

Although there is an idea for development of industrial zone, the detail of the plan including location is not decided.

- The Second Mawlamyine industrial zone (Mon State)

The site is located in a few miles south of Mawlamyine. This was a candidate site before the site of the existing Mawlamyine Industrial Estate was selected. The total development area is about 200 acres (80 ha). Expected sub-sectors to be introduced are garment, agro-product and rubber product industries. Electric power is not currently transmitted to the zone. This zone development is not officially listed by MOI.

- Ye industrial zone (Mon State)

Although an idea of development of the industrial zone is released about two years ago, no progress is seen. The total development area is about 300 acres (120 ha). This zone development is not officially listed by MOI.

3.3.4 East-west corridor and a proposal of Myanmar-Thai border area development by Thai professors/researchers

In Tanintharyi Region, industrial development with a deep sea port at Dawei has been promoted in cooperation with Thailand. Similar development in the Southeast Myanmar will be seen especially in Myawaddy. The Region is located at the western end of the east-west corridor in the Southeast Asia defined by ADB.

Hpayarthonesu located on the Thai border links Bangkok and Mawlamyine, and an economic development corridor may be newly conceived along this link.

A research titled “Job Creation by Border Area Development between Thailand and Myanmar” by Thai professors and researchers in 2012-2013, which is financially supported by JICA, states that the border area development is a milestone for facilitation of industrial reform/innovation in Thai and an essential for inclusive growth and social stability including job creation in Myanmar.

As scenarios assumed in this research, transfer of labor-intensive industries (e.g. garment, food processing) from Thailand (Maesot) to Myanmar (Myawaddy and Hpaan) is expected mainly due to the minimum wage hike to 300 baht through combination of Thailand’s assistance and Myanmar’s facilitation in supply of road and electricity in the Myanmar border and institutional reform (e.g. legal framework of FDI and SEZ/Free Zone). In quantitative analysis of the research, about 200,000 employees will be created in Myawaddy and Hpaan.

3.3.5 Challenges and constraints for industrial development in Southeast Myanmar

Based on the analysis of current conditions discussed in the preceding sections and interviews with Union and State Governments officials who are in charge of industrial development, members of chamber of commerce and industries, and owners and managing directors of companies, challenges and constraints for industrial development in the Southeast Myanmar are summarized as shown below.

(1) Infrastructure

Electricity is not provided stably for industries. Most of factories have generators. This is one of the most serious constraints for industrial development in the Southeast Myanmar. Also, some of local roads are not paved or not well maintained. The infrastructure outside industrial zones is not well developed.

(2) Linkage among industries

Linkages among industry groups and industries within the same industrial zones through associations or chambers of commerce & industries are weak. In order to start cluster development or high value-added products production utilizing the indigenous or local raw materials (e.g. industrial crops such as rubber) or semi-finished product, strong linkages among industries are imperative.

(3) Institutional arrangement

Institutional reform and arrangement should be promoted, although new foreign investment law and its regulations have been promulgated. Careful arrangements for practical operation are indispensable for investors. One stop services for industries/investors in the industrial zone should be strengthened since local industrial zone developers are not responsible for management and maintenance.

(4) Human resource development/Technical and Vocational Education and Training (TVET)

Few full-fledged vocational training centers in order to support industries are located in the Southeast Myanmar. Industrial Training Centers (ITCs) for employees, which have been established by Ministry of Industry, are not located in the Region.

(5) SME development

Technical, marketing, and management capacity of SME business people/owners/managing directors should be powered up, although MOI has work programs for SMEs.

3.3.6 Industrial development directions and tentative list of plans/programs

(1) Direction of industrial development in Southeast Myanmar

Currently manufacturing is not robust in the Southeast Myanmar. However, the industrial development potential in the Region seems to be high through (i) utilization of industrial crops such as rubber and indigenous raw materials and (ii) establishment of industrial zones and the border area development. In this connection, this sector is expected as the driving force of economies and the provider of job opportunities in the current five-year plans in Kayin State and Mon State.

In order to meet the expectations or requirements of the industry sector in the five-year plans of the State Governments, the implementation of four (4) programs: (i) industrial cluster development, (ii) industrial zone development, (iii) border zone development and (iv) SME development as discussed

below seems to be appropriate not only for growth but also for balanced development in the Southeast Myanmar.

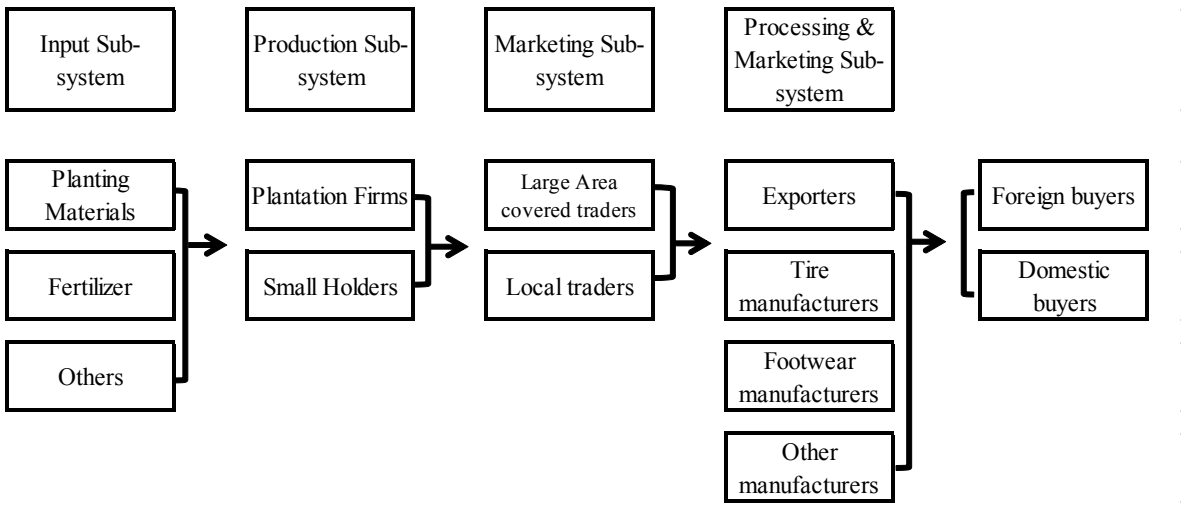
(2) Industrial cluster development

Development of the following industrial clusters is proposed. It should be noted that activities by private sector may be beyond the assumption based on the analysis of the current conditions and may be diversified in terms of products, services and linkage system.

1) Rubber industry cluster

Development of Rubber Industry Cluster is proposed since a large amount of rubber has been produced in the Southeast Myanmar, especially in Mon State. (The natural rubber production in Mon State amounted to 97,000 ton in 2011/12, while that of Kayin State is about 11,000 ton in the same year.)

As shown in Figure 3.9, Rubber Industry Cluster is typically composed of several sub-systems such as input, production, marketing and processing. The input sub-system includes the supplier of fertilizers, agrichemicals, labor and planting materials. The production sub-system is the farmers, the post-harvest workers and primary processors. The marketing sub-system consists of the local traders of raw rubber, and exporters and traders of finished goods. The processing sub-system is the manufacturers and users of intermediate rubber for the manufacture of industrial goods such as tires and foot wears. These sub-systems will be supported by government, industry associations, R&D institutions, financial institutions and logistics.



Source: Cecilio P. Costales for Philippine Chamber of Commerce and Industry (PCCI) in the paper on Natural Rubber Industry Cluster Assessment for Trade Liberalization in line with the finalization of Doha Development Agenda 2006 and JICA Study Team

Figure 3.9 Typical Component of Rubber Industry Cluster

In order to formulate Rubber Industry Cluster, the existing rubber manufacturers including Ministry of Industry-run tire factories in Bilin and Thaton[2] should be fully utilized, including the existing automobile tire factories in Thaton and Bilin. Also, tire industry, which may be introduced in Myawaddy industrial zone, is a candidate of core factory. Moreover, new or niche rubber products should be produced in the Southeast Myanmar although a large amount of intermediate or semi-finished rubber products are currently used for tire and foot wear. The production of household/kitchen glove and medical glove as well as sanitary goods is an idea. As per medical glove, currently Malaysia has the largest share in the world.

The Union and State Governments should be the primary advocate of the Rubber Industry Cluster (manufacturers, traders and farmers). Their support ranges from policy generation to rules and regulation implementation, provision of fiscal and monetary incentives.

2) Cashew industry cluster

Development of Cashew Industry Cluster is also proposed since cashew is used for various purposes and produced in the Southeast Myanmar; 197 ton in Kayin State and 1,031 ton in Mon State in 2011/12.

Cashew nuts grow on trees and the raw nut is attached to and hangs below a false fruit. Cashew nuts and fruit contribute in various ways to livelihoods. The shell contains caustic oil (cashew nuts shell oil) and it is currently used as lacquer for housing materials such as wooden door. A false fruit (cashew apple) is eaten fresh or processed as wine, vinegar, juice, puree or jam. Tree sap is used for ink and paint, and bark is used for leather products after tanning. Also, leaves will be used for forage.

As the cashew nut is one of the most valuable processed nuts on global commodity markets, it is an important cash crop for farmers and has the potential to generate employment through processing and export revenue.

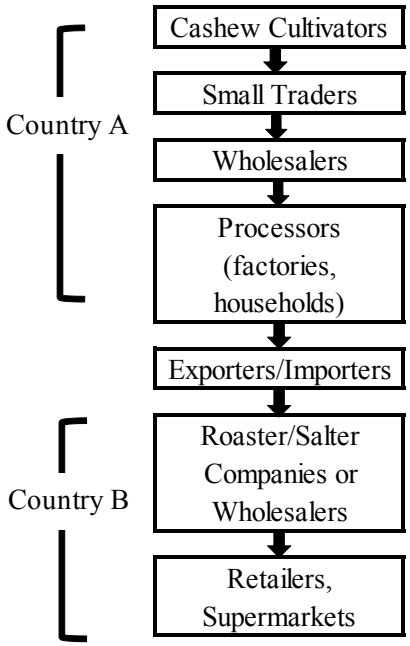
Raw nuts can be roasted and then cut using impact-shelling machines or hand-held hammers to separate shell from kernel. The processing steps in the factories are: Washing, Steaming and then Cooling the raw nuts; Cutting to separate shell from kernel; Drying the kernel; Peeling; Sorting the kernels (separating broken pieces); Grading and Packing.

Figure 3.10 shows a simplified cashew supply chain from place of cashew production (Country A) to place of producing final product including confectionary (Country B).

As shown in Figure 3.9, it is also indispensable for Cashew Industry Cluster to link the sub-systems such as input, production, marketing and processing. In order to increase the value added, companies or factories which produce final product of cashew nut should be included as a component of the cluster in the Southeast Myanmar. Also, utilization of cashew apple (fruit) and shell should be taken into account.

[2] Ministry of Industry-run tire factory (No.22 Heavy Industries Enterprise) in Bilin, which was established in February 2010, produces 300,000 radial tires annually. Its annual sale amounts to about 12 billion kyats. However, rubber sheets as local raw materials for this factory are coming from the rubber plantations run by Ministry of Industry and the linkages with local farmers and local industries are weak. Also, in Thaton, another Ministry of Industry-run tire factory (No.21 Heavy Industries Enterprise), which was established almost 30 years ago, produces 400,000 low-speed tires for small vehicles and agricultural tractors.

It should be noted that competition between different producers are keen and international prices for both raw and processed nuts are sometimes fluctuated. At the same time, quality requirements – physical (e.g. size and color) and chemical (e.g. rancidity) – are increasingly applied by buyers of kernels. Trends of cashew nut production with shell (metric ton basis) have varied over the decades. African countries used to be the major producers before 1980s. India became the largest producer in 1990s, followed by Vietnam which became the largest producer in mid 2000s. Since 2008, Nigeria has become the largest producer.



Sources: Nazneen Kanji, Corporate Responsibility and Women's Employment: The Cashew Nut Case, International Institute for Environment and Development (IIED), March 2004 and JICA Study Team

Figure 3.10 A simplified Cashew Supply Chain

3) Bamboo and wood product industry cluster

Bamboo and Wood Product Industry Cluster are proposed in order to utilize local resources and the existing saw mills and furniture industries in Hpaan. Although the Union Government prohibits cutting of young teak trees, old teak trees, old rubber trees as rubber plywood, and other tress can be used for furniture and handicrafts production. An investor, who has a plan to start furniture industry, tries to introduce a fast-growing tree from Australia as raw materials.

Development of new product from bamboo such as bamboo charcoal, vinegar (acetic acid), which is used for medicine, is also expected.

4) Other industry clusters

The following clusters are also proposed as a tool of local community development, which may be similar to One Village One Product scheme, since the production volume may be small at this moment. Their activities may be varied and expanded through linkages with above-mentioned cluster development, industrial zone development, SME development, agriculture development, and tourism development

- Sugarcane:

The State-run sugar factory in Bilin was closed. The feasibility study will be needed if private factory will start sugar business in the Southeast Myanmar.

- Bee keeping:

Small amount of honey produced in the northern area of Kayin State is exported. Although the volume is small, it will be a good potential to establish a brand name in the whole country. Also, utilization of royal jelly for food supplements, medicine and cosmetic, propolis for health food and medicine and beeswax for candles, wax and so forth is expected.

- Coffee:

A sophisticated packaging may be needed. The production volume in the northern area of Kayin State is limited.

- Spices and condiments:

Spices, condiments and their derived products (e.g. pharmaceutical and cosmetic products) are expected to have high value added in the markets. Spices and condiments include chilies, cardamom, turmeric, tamarind, betel nut and other local specialties.

(3) Promotion of industrial zone development

The following projects for promotion of industrial zone development are proposed.

1) Provision of training on industrial zone management, marketing and maintenance

As compared to the government officials who are in charge of industrial zone/estates development in the surrounding countries, those in Myanmar or in Kayin and Mon States are not familiar with industrial zone management and maintenance. The services provided by the zone management are critical to location decision of foreign investors in particular.

In this connection, provision of capacity building training on industrial zone management, marketing and maintenance is proposed for the government officials in Kayin and Mon States. The contents are (i) operation and maintenance (O&M) of the industrial zone, (ii) rules and regulations of the zone, (iii) one stop service system, which may be related to the laws/regulations of central government, (iv) marketing and promotion, and so on.

2) Establishment of technical and vocational training center

It is important to establish a technical and vocational training center or industrial training center adjacent to industrial zones to supply capable laborers to its tenants/factories.

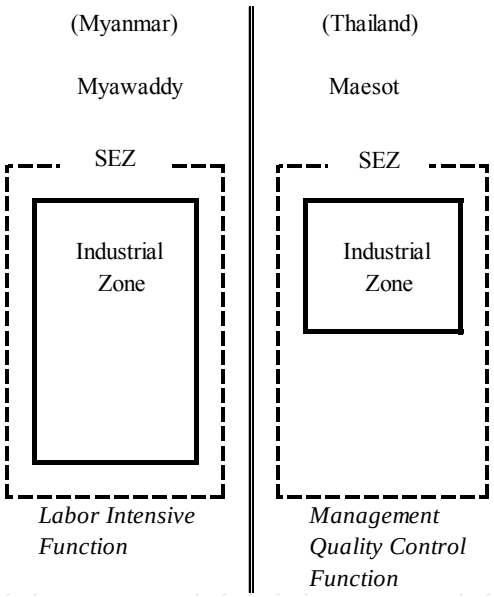
3) Infrastructure development outside industrial zones

In Hpaan industrial zone, development of a 3-mile road from the industrial zone to the birth site of Thanlwin River is proposed. Also, completion of a few mile electricity transmission line to the zone is proposed in case that the Union Government cannot complete it within a couple of months since electricity supply is indispensable for smooth operation of industries. In the new Mawlamyine Industrial Zone, which is planned by Mon State Government, electrical supply and flood prevention measures in the rainy season are proposed. In Myawaddy industrial zone, electricity currently relies largely on supply from the Thai side. Development of electrical supply and water supply systems are proposed by Myanmar side in the medium term basis. However, Thai developer Regina Company, which is formulating a master plan of the industrial zone for foreign investors (mainly Thai investors), indicates that relatively higher costs of electricity and ambiguous schedule of development of electrical supply system by Myanmar side may be an issue when they invite tenants in the industrial zone. Also, in Hpayarthonesu industrial zone (Kayin State) and Ye industrial zone (Mon State), development of infrastructure outside the zones may be needed as well as detailed study and design works.

(4) Border zone development

In the border zone of Myawaddy, development of special economic zone (SEZ), which will be

designated in the certain area of Myawaddy, is proposed through coordination and linkage with SEZ in Thai. This concept is mainly coming from a research by Thai professors/researchers and the current development strategies of the border area in NESDB/Thailand. In SEZ, Myawaddy industrial zone has a function of introducing labor intensive industries as shown in Figure 3.11.



Source: JICA Study Team

Figure 3.11 Concept of Border Area Development

As a similar example of this concept, the US-Mexico border area development especially between 1980 and 2000 is seen through Maquiladora system[3]. Making use of this system, many enterprises set up factories in both US and Mexico, which is known as "twin plants."

In order to develop SEZ, Myanmar and Thai governments should set up the common framework including (i) efficient administrative procedures (single stop windows services, offshore banking/foreign currency transaction and support for human resources development/technological and vocational education and training (TVET), (ii) demarcation of infrastructure investment in the zone and (iii) security of the legal status of returnee and refugee workers.

This concept will also be applicable to the border area between Hpayarthonesu (Kayin State) and Sangkhlaburi (Kanchanaburi Province, Thailand).

(5) Comprehensive SME development

As discussed in work programs of MOI, the Union Government has a program to provide assistance to SMEs. In addition to this program, the following program/projects are proposed.

1) Business development services

Provision of a program on business development services (BDS) in a broad sense is proposed especially for industrial cluster development. The program is mainly for SMEs and covers services such as promotion of marketing, training of human resources, legal and accounting consultation and technological development, and strengthening of business associations and business networking.

2) Consultation of legal and institutional framework/reform

The Union and State Governments should give a consultation to private sector on the recent legal and regulatory frameworks such as the Foreign Investment Law, its rules and regulations and other business laws since some of SMEs try to formulate a joint-venture with foreign investor and the number of actual samples on the enforcement of laws is still small.

[3] A maquiladora or maquila system is developed for manufacturing operations in a free trade zone (FTZ) in 1965, where factories import material and equipment on a duty-free and tariff-free basis for assembly, processing, or manufacturing and then export the assembled, processed and/or manufactured products, sometimes back to the raw materials' country of origin. (Wikipedia)

3) Strengthening of vocational training system

As discussed in the previous section, roles of technical and vocational training centers are important to local people. Besides full-fledged vocational training centers adjacent to industrial zones, at least two centers should be established in each of Hpaan and Mawlamyine. The training fields in the center include textile/garment, construction, machinery, furniture and others. However, the similar vocational training centers or activities are being developed by other donor agencies and international NGOs based on demand survey. The targeted training fields and number of courses to be supplied should be selected properly to avoid duplication.

Establishment of Skills Development Fund (SDF) is an option to provide technical training. The SDF aims to provide financial assistance to employers in SMEs to encourage them to train and upgrade the skills of their workers. Financial resources of the SDF may be supported by the Union Government and the private sector through a tax from the large companies.

CHAPTER 4 EXISTING CONDITIONS OF INFRASTRUCTURE IN SOUTHEAST MYANMAR

This chapter presents existing conditions of various infrastructure in the Southeast Myanmar, covering water resources related infrastructure, water supply, power development, rods and bridges, and transport and logistic infrastructure. For water resources related infrastructure and water supply, basic hydro-meteorological data are compiled to clarify characteristics of water resources in the Southeast Myanmar, and existing conditions are described for urban and rural water supply, industrial water supply, hydropower development, irrigation, and flood management. For power development, existing conditions of power supply system in the Southeast Myanmar and existing plans are described, and a regional power supply system is proposed.

For roads and bridges, sector policies and related institutions are reviewed, development issues for the road sector in the Southeast Myanmar are clarified, and a road system development plan is presented with tentative project proposals. For transport and logistic infrastructure, international and national logistic trends are clarified together with institutions and organizations involved, issues for transport and logistic development for the Southeast Myanmar are clarified, and finally directions for development and strategy are discussed.

4.1 Water Resources Development and Water Supply

4.1.1 Existing water resource endowments in Southeast Myanmar

(1) Precipitation

Kayin and Mon States receive two predominant seasonal monsoons in a year, namely: (a) southwest monsoon originating from Andaman Sea and (b) northeast monsoon from the Continent. The southwest monsoon is predominant during a period from May to October bringing about the moisturized air and the extremely heavy rainfall, while the northeast monsoon is predominant from November to April, during which the rainfall amount drops to be almost nil.

Mon State is located on the plain with little undulations along the west coast. Due to such topography and location, the State is directly influenced by the southwest monsoon. Likewise, the rather flat land opens out in the west of Kayin State receiving the large amount of rainfall during the season of the southwest monsoon. Hpaan in Kayin State and Kyaikkhami in Mon State are located in the western part of the Southwest Myanmar and their average annual rainfalls are extremely large recording at 4,529 mm and 5,046 mm, respectively as shown in Table 4.1.

The monsoons also cause the large seasonal variations of rainfall, whereby about 95% of the annual rainfalls concentrate during the rainy season from May to October and the monthly rainfall exceed

1,000 mm as the peak in July and August in Hpaan and Kyaikkhami as shown in Table 4.1:

Table 4.1 Monthly Average Rainfall in and around Kayin and Mon State

(Unit: mm)

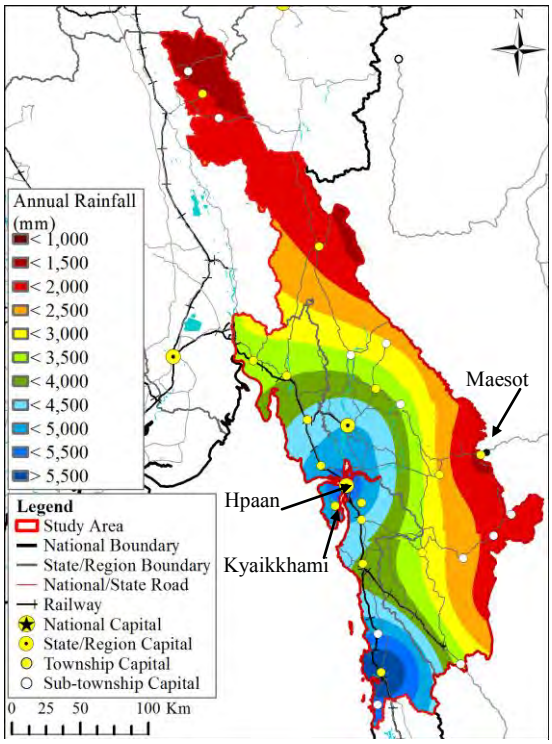
Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Hpaan	6	7	8	41	468	862	1122	1170	619	201	17	8	4,529
Kyaikkhami	1	11	7	123	604	996	1165	1072	741	254	41	31	5,046
Maesot	1	10	12	40	157	242	314	324	156	105	25	5	1,391

Source: Agricultural Atlas of the Union Myanmar, 2005, FAO and Meteorological Department in Thailand

Note: The data at Hpaan and Kyaikkhami are under administration of Myanmar, while those at Maesot under administration of Thailand.

Several mountain ranges lie north and south in the Southeast Myanmar. Mt. Layit with a peak of EL. 2,000 m in particular soars in the southeast of Kayin State, and the "Dawna mountain range" extends from Mt. Layit in the south up to Hpapun District in the north. The influence of the southwest monsoon is gradually weakened toward the east by the mountain ranges and finally intercepted by the Dawna mountain range. As the results, the eastern part of the Dawna mountain range receives much less rainfall than the western part (refer to isohyetal map of annual rainfall in Figure 4.1).

The rainfall data in the eastern part of the mountain range are made available from the gauging records at Maesot meteorological station in Thailand, which is about 4.8 km away from Myawaddy in Kayin State. The rainfall data at Maesot station indicate much smaller average annual rainfall of 1,391mm and the peak monthly rainfall of about 320 mm in July and August than those at Hpaan and Kyaikkhami as listed Table 4.1.



Source: Agricultural Atlas of the Union Myanmar, 2005

Figure 4.1 Isohyetal Map of Annual Rainfall

(2) Rivers

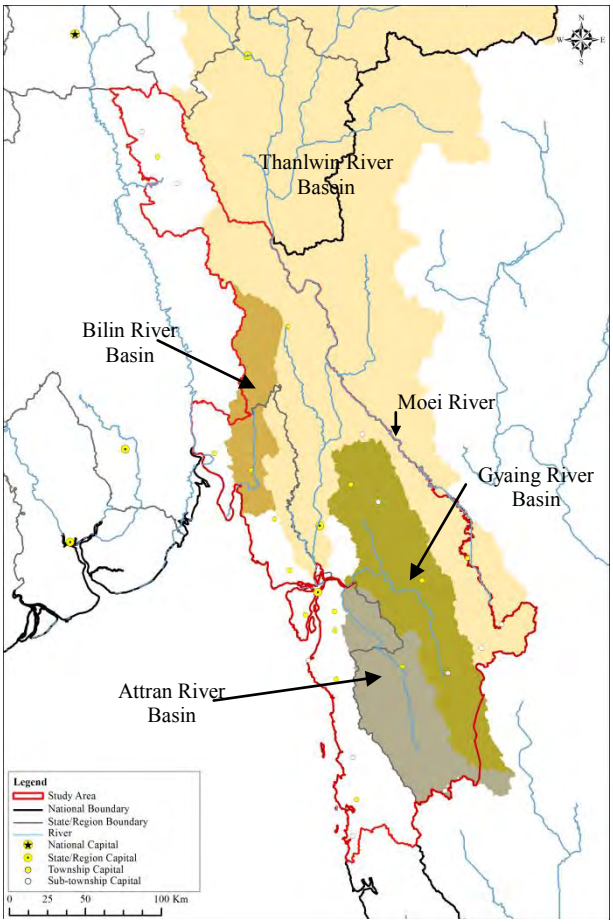
In Kayin and Mon States, there are four principal rivers, namely, Thanlwin, Bilin, Attran and Gyaing Rivers. The approximate extents of the catchment area and the mainstream channel lengths of these rivers are as listed in Table 4.2 (refer to divisions of the principal river basins in Figure 4.2).

Table 4.2 Principal River Basins in Kayin and Mon State

Name of River Basin	Catchment Area (km^2)	Mainstream Channel Length (km)
Thanlwin River Basin	324,000 (1)	2,800 (1)
Bilin River Basin	3,342 (2)	191 (2)
Attran River Basin	5,972 (2)	231 (2)
Gyaing River	8,563 (2)	229 (2)

Source: (1): Wikipedia (for information on Thanlwin River,) and
(2): JICA Study Team (estimated based on the digital elevation model of SRTM)

All of the above four rivers and their tributaries are being used as the important water sources for domestic water use, irrigation/agricultural water use and hydropower generation in both Kayin and Mon States. The Thanlwin River in particular is the international river and one of the representative rivers in Myanmar. The River originates from Tibetan Plateau in the Himalayas running southward through: (a) Yunnan Province in China, and (b) three states (Shan, Kayah and Kayin) in Myanmar. Then, the River finally flows into Andaman Sea at Mawlamyine in Mon State. The catchment area and stream length of the River are 324,000 km^2 and 2,800 km, respectively, which is the second largest next to the Mekong River in Southeast Asia. The discharges of the River are widely used as the principal water source not only for Kayin State but also other States in Myanmar as well as China and Thailand.



Source: JICA Study Team

Figure 4.2 Boundary of Principal River Basin in and around the Southeast Myanmar

The mainstream of Thanlwin River forms the national border between Myanmar and Thailand during its first passage of about 12 0 km through Kayin State. A tributary of the Thanlwin River called "Moei River in Thailand" originates from the aforesaid Mt. Layit and flows northwest ward and joins the mainstream at the downstream end of the said national border of the mainstream. The entire stretch of Moei River also forms the national border between Myanmar and Thailand.

The preliminary river discharge measurement of the Thanlwin River was carried out by the JICA Study Team in March 2013. As the results of the measurement, it is clarified that the River could maintain the flow discharge of some hundred cubic meters at Hpaan even during a dry season.

(3) Groundwater and springs

Since the groundwater is abundant due to recharge of a large amount of rainfall during a rainy season, a large number of tube wells, shallow wells and dug wells are widely used in Kayin and Mon States. Many springs also come out from the mountain ranges. These wells and springs are important water sources for domestic uses in Kayin and Mon States.

However, the amount of rainfall drops to be almost nil during the dry season from November to April and some of the wells and/or springs cause shortages of the water supply capacity for daily water requirements especially at the end of the dry season. The salinity intrusion and other water pollution also occur in some of the wells especially in the dry season.

4.1.2 Present conditions of hydropower generation

(1) Large scale dams for hydropower generation

There exist two large-scale hydropower dams in the Southeast Myanmar: (a) Baruchan No.1 and No.2 with the total install capacity of 196 MW on Baruchan River and (b) Kengtawng hydropower plant with 54 MW. These dams are placed on the tributaries of the Thanlwin River. In addition to these existing dams, several projects for the large-scale hydropower dams have been planned in the Thanlwin and the Bilin River basins as described hereinafter.

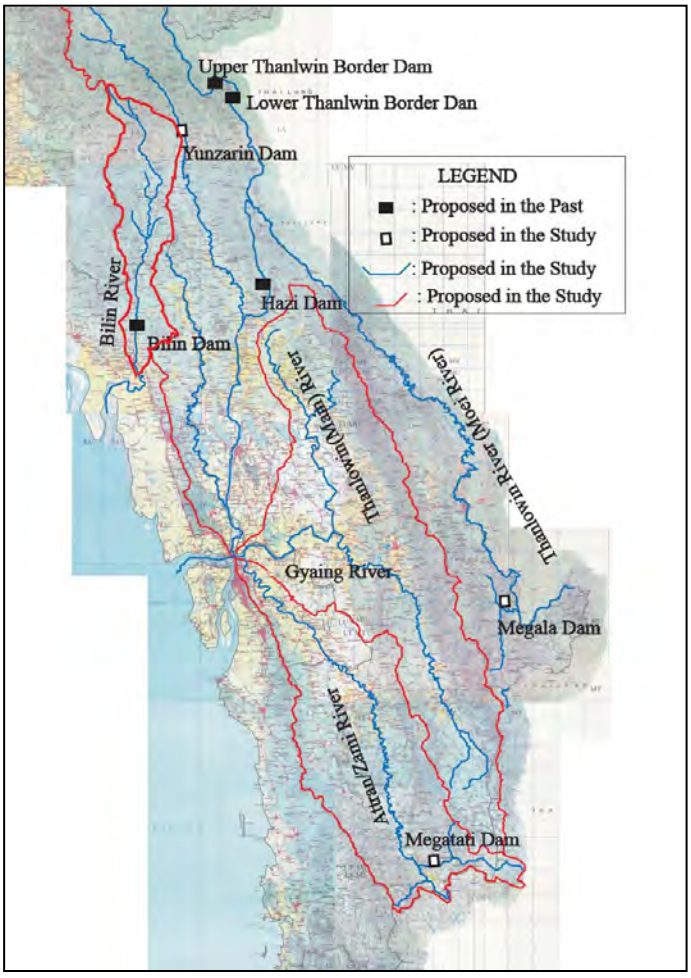
1) Projects in Thanlwin River basin

The Thanlwin River possesses the following advantages for development of large-scale hydropower dams:

(a) The River runs through the V-shape gorges in the upper and middle reaches, and takes rather steep slope of the river bed. The River also provides the abundant discharge throughout a year. These river morphologies are suitable for large-scale hydropower dam sites.

(b) The River runs close to Thailand and/or just as the international border between Myanmar and Thailand, which allows easy export of electric power to Thailand.

With these advantages, the joint hydropower development by Myanmar and Thailand was proposed through cabinet meeting for Greater Mekong Sub-region (GMS) held in Hanoi in 1994. Myanmar could expect the foreign currency revenue by export of the hydropower generated, which could support the finance of Myanmar together with export of the natural gas.



Source: JICA Study Team

Figure 4.3 Potential Dam Site in the Southeast Myanmar

Seven dam projects have been proposed on the mainstream of Thanlwin River in Myanmar and/or on the border between Myanmar and Thailand. Of the proposed seven dams, three dams, namely; Upper Thanlwin border line dam, Lower Thanlwin border line dam and Hazi dam are located within Kayin State as shown in Figure 4.3.

Minutes of Agreement (MoA) for project implementation were signed for the Hazi dam in 2006 and for Upper/Lower Thanlwin border line dams in 2010 between the Ministry of Electric Power (MOEP) as the Union Government of Myanmar and the Electricity Generation Authority of Thailand (EGAT)

International Co. Ltd. as the investor for the project. Of these three proposed dams, however, Upper and Lower Thanlwin border line dams are across the border between Myanmar and Thailand, and the MOEP is likely to have excluded such trans-states dams from the objectives of the immediate development.

As for the Hazi dam, its development had been officially approved in 2013 by the Ministry of Electric Power. The dam height and installed capacity of the Hazi dam were originally proposed as 37 m and 300 MW, respectively in the prefeasibility study by NEWJEC in 1998. On the other hand, the dam height has been raised to 116 m and the installed capacity increased to 1,360 MW through the latest feasibility study by EGAT. The updated structural features of the Hazi dam are as listed in Table 4.3.

Table 4.3 Salient Features of Hazi Dam Proposed on Thanlwin River in Kayin State

Item	Description
Location of Dam Site	About 33km downstream from confluence of Moei River in Kayin State
Catchment Area	311,167 km^2
Dam Height	116 m
Installed Capacity	1,360MW

Source: Department of Hydropower Planning and Electric Supply Enterprise in Karen State, Ministry of Electric Power

In accordance with the MoA for the Hazi dam, Myanmar is entitled to take 10% of the electricity power generated by the dam without compensation and further purchase other 40% from EGAT. The remaining 50% of the power generated could be taken by EGAT. In spite of the MoA completed in 2006, however, the actual dam construction has not been commenced yet.

2) Projects in Bilin River basin

The Bilin dam is proposed about 20 km upstream from the Bilin town in Mon State. The location and salient structural features of the dam are as shown in Figure 4.3and Table 4.4, respectively.

Table 4.4 Salient Features of Bilin Dam Proposed on Bilin River in Mon State

Item	Description
Location of Dam Site	About 20 km upstream from Bilin Town in Mon State
Catchment Area	2,274 km^2
Dam Height	80 m
Gross Storage Capacity	10,400 million m^3
Installed Capacity	280 MW

Source: Preliminary Survey on Master Plan for Hydropower Development in Burma, by JICA, 1988

The dam site is topographically superior in power generating efficiency and it is located rather close to Yangon, the largest consumption area of the electric power, which could reduce the cost of power transmission from the dam site to Yangon. Moreover, the dam site could be easily accessed by car. Due to these advantages, development of hydropower dam on the Bilin River had been highlighted as one of eligible projects in Myanmar.

The development of the Bilin dam was officially approved on the premises of BOT systems and a memorandum of understanding (MoU) on development of the Bilin dam was completed in 2010 between the Ministry of Electric Power and Asia World Co Ltd as the private firm. However, the actual project implementation for the dam has not been commenced yet.

(2) Small scale hydropower dams

There exist mini hydropower plants in the Southeast Myanmar, namely (a) Hpapun Hydropower Plant (50 kW) and (b) Zinkyaik Plant (64 kW) under administration of the Ministry of Electric Power (MOEP). These existing hydropower plants have been damaged and the MOEP has proposed the rehabilitation for them as a part of the JICA-assistance projects. The preliminary study was also made on the Dagyaing hydropower plant (25 MW) at the Dagyaing creek about 2 km away from Paingkyon.

In addition to these hydropower plants developed by MOEP, a few of the existing and projected irrigation dams are equipped with mini or small-scale hydropower units with the install capacity of less than 200 kW supplying the electric power to the neighboring towns and villages under the administration of the Department of Irrigation of the State Government.

(3) Administration for hydropower development

The MOEP, the Union Government has been newly established, in September 2012, through unifying of the former two Ministries of Electric Power (1) and (2). The MOEP currently takes the full responsibility and authority for the development and management of hydropower at the Union Government level. Under the umbrella of the MOEP, seven departments are in charge of hydropower development and management as listed in Table 4.5.

Table 4.5 Departments under Ministry of Electric Power

Name of Department	Principal Function
Department of Electric Power (DEP)	Formulation of the strategic plan for the power systems
Department of Hydropower Planning (DHPP)	Formulate of the hydropower development plan
Department of Hydropower Development Implementation (DHPDI)	Implementation of the project for the hydropower development
Hydropower Generation Enterprise (HPGE)	Operation and maintenance of the hydropower and coal thermal power plants
Myanmar Electric Power Enterprise (MEPE)	Development, operation and maintenance of transmission network as well as operation and maintenance of gas-fired power plants
Yangon Electricity Supply Board (YESB)	Power distribution in the Yangon Region
Electric Supply Enterprise (ESE)*	Power distribution in 17 states and regions other than Yangon Region.

Source: JICA Study Team

Note: *: The ESE head office is placed at Naypyitaw. Under the head office, the state ESE offices, the district ESE offices and the township ESE offices are further set up at each administrative level.

4.1.3 Present conditions of industrial water supply

Two industrial zones of 1,000 acre and 1,200 acre are now being developed in Hpaan and Myawaddy TSs, respectively. The plan for bulk water supply system for the Myawaddy industrial zone has not been formulated yet, while the water supply system for the Hpaan industrial zone has been completed.

The Hpaan industrial zone has been originally equipped with a pond called “Showbeik water pond

No.1" as the sources for bulk industrial water supply. The pond could store the rainfall by its storage volume of 165 million gallon and possess the water supply capacity of 0.5 million gallon/day.

In order to cope with the expansion of the industrial zone, two new ponds called "Showbeik water pond No.2" and "Showbeik water pond No.3" have been newly developed and the supply capacity has increased to 3 million gallon/day. The features of the bulk water supply system for the Hpaan industrial zone are as shown in Table 4.6.

Table 4.6 Features of Water Sources for Hpaan Industrial Zone

Name of Pond	Water Source	Pond Area (acre)	Storage Volume (mil. gallon)	Supply Capacity (mil. gallon/day)
Showbeik Water Pond No.1	Rainfall	610.0	165.0	0.5
Showbeik Water Pond No.2	Rainfall & Thanlwin River (1)	867.0	236.0	2.5(2)
Showbeik Water Pond No.3	Water spilled from Pond No.2	69.5	18.9	
Total		1,546.5	419.9	3.0

Source: State Development Committee Kayin State

Note: (1) The pond No. 2 functions as the storage pond for rainfall and water abstracted from Thanlwin River. At the same time, the pond No. 2 is used as the sedimentation pond to trap the silt contained in the water abstracted from Thanlwin River

(2) The water supply capacity of 2.5 million gallon/day include 0.5 million gallon/day from the source of rainfall and 2.0 million from the source of Thanlwin River.

4.1.4 Present conditions of domestic water supply

(1) Classification of urban and rural areas for water supply

According to the census of population carried out for urban and rural areas in Kayin and Mon States, the urban area is defined as the most densely populated tract in any township, while the whole area other than the urban area is classified as the rural area. As shown in Table 4.7, the urban area covers 120.3 km^2 in Kayin State and 158.4 km^2 in Mon State in total, which corresponds to only 0.4% and 1.9% of the entire extent of the State.

On the other hand, the population in the urban area takes the substantial shares to the total population as estimated at 15.3% in Kayin State and 22.5% in Mon State. Thus, the urban area has much higher population density than the rural area. Moreover, there are large differences in the densities of the urban population among the townships varying from the maximum of 8,023 persons/ km^2 for Hpaan TS in Kayin State to the minimum of 636 persons/ km^2 for Paung TS in Mon State. The water source and distribution system for the domestic water supply are largely influenced by these population densities between urban and rural areas and/or among the townships as described later.

Table 4.7 Area, Population and Population Density in Urban and Rural Area of Each Township in Kayin and Mon State

State	Township	Area (km^2)			Population			Population Density (persons/ km^2)		
		Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Kayin	Hpaan	6.4	2,896.4	2,902.8	51,424	313,805	365,229	8,023	108	126
	Hlaingbwe	10.8	4,316.1	4,326.9	16,983	240,158	257,141	1,567	56	59
	Thandaunggyi	10.4	3,630.7	3,641.1	17,507	61,939	79,446	1,688	17	22
	Hpapun	14.8	6,726.3	6,741.1	14,696	98,038	112,734	993	15	17
	Kawkareik	21.5	2,412.4	2,419.5	44,490	189,985	234,475	2,069	79	97
	Kyainseikgyi	7.1	7,208.1	7,215.2	23,670	191,503	215,173	3,344	27	30
	Myawaddy	49.3	3,086.8	3,136.1	35,044	34,050	69,094	711	11	22
	Total	120.3	30,276.9	30,382.8	203,814	1,129,478	1,333,292	1,695	37	44
Mon	Mawlamyine	38.0	114.2	152.1	180,488	59,016	239,504	4,753	517	1,574
	Chaungzon	3.6	439.1	442.7	3,667	153,122	156,789	1,027	349	354
	Kyaikmaraw	10.1	1,436.6	1,446.7	14,437	198,670	213,107	1,426	138	147
	Mudon	14.6	784.5	799.1	44,646	131,576	176,222	3,049	168	221
	Thanbyuzayat	8.8	835.3	844.1	27,214	123,032	150,246	3,081	147	178
	Ye	6.9	2,970.4	2,977.2	33,509	200,762	234,271	4,890	68	79
	Bilin	9.8	2,169.4	2,179.1	16,093	134,842	150,935	1,646	62	69
	Kyaikto	9.3	1,031.6	1,040.9	29,288	109,825	139,113	3,157	106	134
	Paung	51.1	1,013.4	1,064.4	32,502	202,548	235,050	636	200	221
	Thaton	6.3	1,343.8	1,350.1	49,216	171,412	220,628	7,783	128	163
	Total	158.4	12,138.2	12,296.6	431,060	1,484,805	1,915,865	2,721	122	156

Source: General Administration Office of Kayin and Mon State

Note: The urban and rural population for Mon State is estimated by JICA Study Team based on the population census and the extent of the urban/rural area.

(2) Water sources for domestic water supply

Rural areas in Kayin and Mon States rely on natural streams, groundwater, springs and/or the rain-fed ponds as the water sources for domestic uses. The water is individually taken from the sources and no public water distribution system such as a pipe distribution system has been provided to rural areas.

The public water distribution systems do not cover the entire extent of respective urban areas. Kayin and Mon States have seven and ten townships, respectively, while the numbers of townships provided with public water supply systems are limited to five each for Kayin and in Mon States. The residents not served by any public water supply system rely on water supply services by private firms or their own water sources. Most water sources other than those for public water supply are, however, wells that could hardly cope with the requirement of bulk water supply. As the results, the public water supply with the piped water distribution system tends to rise in importance, as the urban area expands and the need of the bulk water supply increases.

The present principal water sources for the domestic water use in urban areas vary including the natural streams (river and/or creek), the groundwater, the springs, the rain-fed ponds and the dam reservoirs. The raw water is taken from these water sources and distributed through pipes but without any purification facilities. Only boiling of water and other private purification devises are applicable for purification of water taken from the sources. The present urban water supply sources in Kayin and Mon States are summarized as shown in Table 4.8.

Table 4.8 Present Domestic Water Supply Sources in Urban Areas of Kayin and Mon State

State	Township	Presence of Public Water Supply System	Water Source				
			Natural Stream (River/Creak)	Ground-water	Spring	Rain-fed Pond	Dam Reservoir
Kayin	Hpaan	O	O	O			
	Hlaingbwe		O	O			
	Thandaunggyi	O	O		O		
	Kawkareik		O	O			
	Kyainseikgyi	O	O	O			
	Myawaddy	O	O	O	O		
	Pa-pun	O	O	O	O		
Mon	Kyaikto			O	O		
	Bilin		O	O		O	O
	Thaton	O					O
	Paung	O			O		
	Mawlamyine	O	O				O
	Chaungzon	O				O	
	Kyaikmaraw			O			
	Mudon	O					O
	Thanbyuzayat			O			
	Ye			O	O		

Source: Kayin and Mon State Development Committee

(3) Domestic water supply facilities

Existing facilities used for the domestic water supply in the Southeast Myanmar are described.

1) Pumps for abstraction of natural stream water

Urban areas of rather large population such as Hpaan, Myawaddy and Mawlamyine are provided with pumps for bulk water abstraction from natural streams. The water pumped from the natural stream is once stored at the storage tank placed at the higher elevation and distributed to each household through pipe systems by gravity.

A sedimentation pond has been further installed near each of pumps with a few exceptional cases to leach out the soils contained in the natural stream water. However, the sedimentation pond is effective only to mitigate the turbidity of the stream but difficult to treat with other water pollution.

2) Wells for abstraction of groundwater

Groundwater is abstracted by the following three kinds of wells: (i) hand-dug wells (30 to 40 feet in depth), shallow-wells (80 to 150 feet in depth), and tube wells (more than 200 feet in depth). Of these facilities, hand-dug wells and shallow wells are widely used in rural areas, while the tube wells are used as the principal bulk water sources in urban areas.

3) Rain-fed ponds

A rain-fed pond system is adopted to Chaungzon TS and Bilin TS in Mon State where the alternative water sources are inadequate and/or difficult to be secured. The rain water is filled up during a rainy season and used as the water source during a dry season. One unit of the standard rain-fed pond has the extent of about 6,000 square feet and the storage volume of about 0.2 million gallon.

4) Dam reservoirs

The following three existing irrigation dams are being used as the sources for domestic water supply in Mon State.

i) Waba dam with an effective storage capacity of 5.0 million m^3 in Thaton TS,
ii) Shwenattaung dam with an effective storage capacity of 6.3 million m^3 in Mawlamyine TS and
iii) Azin dam with an effective storage capacity of 18.7 million m^3 in Mudon TS.

The actual conditions of the existing water supply facilities in the selected townships/sub-townships mentioned above are clarified based on the results of interview survey as shown in Table 4.9 and Table 4.10.

Table 4.9 Results of Interview Survey on the Water Sources in Kayin State

Township/ Sub-township	Water Source and Its Conditions
Thandaung TS	Main water source for town water supply is the Pathi creek supplemented by the Kyauk creek, which covers one third of total households in Thandaung STS (1,233 households). Its supply capacity is 300 – 400 gallon/hour. Other two third of households are supplied water from the source of spring water. UNHCR is implementing water supply program for schools.
Leiktho STS	Spring water is mainly used as a source for water source supplying the water to about half of total households (469 households) in town area.
Bawgali STS	The main water source for the town area is the spring water. The spring water is available for all seasons, but its flow volume is gradually reduced so that the number of the households to be served by the spring water is limited to only one third of total households (400 households) of town area. Other households take water from small stream near a Bannya big tree at the entrance of town area. This water is once stored at the water tank and then distributed to the houses. The residents report that the consumption of water tends to increase as the number of sanitary latrines increase.
Hpapun TS	The main water source for the domestic use is the spring water taken from the Rako creek.
Kamamaung STS	The main water sources for the domestic use are the dug wells and the Thanlwin River. Water supply in the dry season is not enough due to limited capacity of pumps for abstraction of the river water.
Kyainseikgyi TS	The main water sources for the domestic use are the river, the dug wells (896 wells) and the tube wells (four wells) which can cover the water demand for 75% of the population. However the water volume from the dug wells tends to be in short in the dry season.
Hpayarthonesu STS	The main water sources for the domestic use are the dug wells and the tube wells which can cover 50% of the population. On the other hand, the private firms are selling water in 3,500 – 4,000 kyats per 400 gallon. The water sources for public service water expansion project are expected with spring water in the Shwethawai mountain and seven tube wells. However, in this plan, the water price will be increased due to higher electricity price for pumping. Therefore a gravity flow system from the Megathat creek 7 miles away from the STS center is under consideration.

Source: JICA Study Team

Table 4.10 Results of Interview Survey on the Water Sources in Mon State

Township/ Sub-township	Water Source and Its Conditions
Kyaikto TS	Though the main water source is the dug wells (1,000 gal./day in total), the quantity of the water yield is not enough. Therefore as a new water source, the spring water in mountain area is being considered to make the water supply of 600,000 gal./day available. The cost for construction of the new water source will be about 300 million kyat. The water source in the eastern part of the township is the spring water, which is taken from Katet creek. Surface water is hardly used due to its salinity intrusion from the sea. One third of the dug wells in town area are also affected by the salinity intrusion.
Bilin TS	The water reservoir pond and the dug well are the main water sources in this township. However the water quantity of most of them is deteriorated in the rainy season. The water from Bilin River is also used for water supply but as the mining site is locate upstream of the River, the water quality should be carefully checked. As a new water source, the existing irrigation dam, which is 7 miles away from town area, can be considered. Most of households in the lowland areas have their own dug wells. Township Development Committee has constructed rainwater collection pond in the areas along shoreline. At eastern area close to the river basin near by Kayin State border, the river water is supplied through sedimentation pond.
Thaton TS	The water from dam is utilized for 15,000 residents but it is inadequate in the dry season. For about one month at the end of dry season, the water is sometimes delivered to residents by water car to cover shortage of water.
Paung TS	The main water source is the spring water in mountain area.
Mawlamyine TS	The main water sources are Shwenattaung Dam, Khinmonchua Dam and Attran river.
Chaungzon TS	The main water source is the rainwater pond.
Kyaikmaraw TS	The main water sources are two dug wells and two tube wells, having the supply capacity of. 35,000 gal./day.
Mudon TS	The main water source is the dam reservoir and its quantity is enough for all season.
Thanbyuzayat TS	The main water source is the dug well. The quality of this water source is good and 7,000 gal./day can be supplied from this water source.
Ye TS	The main water sources are the water reservoir pond and the spring water. About 300 households of two wards at town area in Ye Township are using the town water supply system with spring water source by their own expense. It is planned to increase capable supply capacity of this water source so as to cover 2,000 households. On the other hand, Township Development Committee (TDC) is supplying water from the dug wells to 60 households with gravity flow through its ground tank. It is expected to increase its supply capacity to cover 1,500 households in future. (The price of this water by TDC is 300 kyat/200 gallon.)

Source: JICA Study Team

(4) Water supply capacity for urban use

The adequacy of public water supply systems in urban areas are examined taking cases of Hpaan and Mawlamyine as the largest water consumption area in Kayin and Mon States, respectively.

As shown in Table 4.11, the river water abstracted by pumping and/or stored by the dam is the largest supply source taking 78% of the total supply capacity for Hpaan and 100% for Mawlamyine. Another water source is the groundwater abstracted by the tube well only for Hpaan.

Table 4.11 Supply Capacity of Public Water Distribution System in Hpaan and Mawlamyine

Service Area	Water Source	Facilities for Securing of Water	Supply Capacity	
			mil. gal./day	Share (%)
Hpaan	River	Pumping from Thanlwin River	0.35	78
	Groundwater	Tube Well	0.10	22
	Total		0.45	100
Mawlamyine	River	Pumping from Attran River	1.5	42
	River	Shwenattaung Dam	1.2	33
	River	Khinmonchua Pond	0.9	25
	Total		3.6	100

Source: State Development Committee in Kayin and Mon State

The State Development Committee estimates the full water demand at 1.75 million gallon/day for Hpaan and 6.6 million gallon/day for Mawlamyine. As compared with these full water demands, the present supply capacities of the public water supply systems are limited to 26% for Hpaan and 55% for Mawlamyine as shown in Table 4.12. Moreover, the water of the Thanlwin and the Attran River used as the water sources has extremely high turbidity of more than 300 NTU during a rainy season. The sediment contained in the water pumped from the Attran River for Mawlamyine is reduced through a sedimentation pond before distributing the domestic water to the end users. However, no sedimentation pond has been provided to the pumping system for Hpaan yet.

Table 4.12 Present Coverage Ratio of Public Water Distribution System to Full Water Demand in Hpaan and Mawlamyine

Description	Unit	Hpaan	Mawlamyine
(1) Full water demand	mil. gal./day	1.75	6.6
(2) Present supply capacity of the public water distribution system	mil. gal/day	0.45	3.6
(3) Coverage of piped water distribution system {=(2)/(1)}	%	26	55

Source: State Development Committee in Kayin and Mon State

In order to improve the supply capacity and the quality of the public water distribution systems, implementation of the following projects is scheduled through the financial assistance by JICA.

(a) Hpaan: The project with the investment cost of 628 million kyats for: (a) construction of the new sedimentation pond and (b) expansion of the water distribution system and
(b) Mawlamyine: The project with the investment cost of 623 million kyats for: expansion of two existing water distribution systems.

Upon completion of these projects, the supply capacity of the public water distribution systems is projected to meet about 63% of the full water demand for Hpaan urban area and 62% for Mawlamyine urban area as shown in Table 4.13. At the same time, the turbidity of the water supplied from the Thanlwin River for Hpaan could be lowered by the new sedimentation pond.

Table 4.13 Proposed Improvement Plan of Public Water Distribution System

Description	Year	Unit	Hpaan	Mawlamyine
Full Water Demand		mi. gal./day	1.75	6.6
Supply Volume	Present as of 2013	mi. gal./day	0.45	3.6
	Upon Completion of the Project in 2018	mi. gal./day	1.10	4.1
Coverage of Public Water Supply Capacity to Full Water Demand	Present as of 2013	%	26	55
	Upon Completion of the Project in 2018	%	63	62

Source: JICA Study Team

(5) Water supply capacity in Rural Area

The Southeast Myanmar is largely rural, and no data are available on domestic water supply capacity for rural areas. For these reasons, it is difficult to quantitative analysis on the present water supply capacity in rural areas.

The needs on improvement of the present water supply systems in rural areas have been investigated through an interview survey in rural areas. The results of the interview survey are as shown in Table 4.14 below:

Table 4.14 Needs of Improvement of the Present Domestic Water Supply System in Rural Area

State	Township/ Sub-township	Needs of Improvement of the Present Domestic Water Supply System
Kayin	Leiktho	Expansion of the domestic water supply system
	Thandaung	Expansion of the domestic water supply system
	Bawgali	Development of the alternative water sources for the existing sources of spring water
	Kamamaung	Increase of the capacity of the pumping used for abstraction of the water from Thanlwin River
	Shanywarthit	Purifying of the river water used for domestic and development of the alternative water sources
	Paingkyon	Purifying of the river water used as the principal water sources
	Kyaikto	Improvement of water quality of the dug-wells polluted by salinity intrusion
	Kyainseikgyi	Expansion of the domestic water supply by hand-dug wells
	Hpayarthonesu	Development of the spring water sources and the tube-wells.
	Wawlay	Increase of tube-well and monitoring of the quality of the groundwater
	Sukali	No particular improvement work required
Mon	Ye	Expansion of the dug-wells
	Thanbyuzayat	Expansion of the domestic water supply system through increase of the dug-wells and tube-wells
	Kyaikmaraw	Expansion of the public water supply system through increase of the tube-wells

Source: JICA Study Team

As shown in Table 4.14, the principal water sources for domestic water supply in rural areas are the groundwater, the natural streams and/or the springs. The principal issues on these water sources are evaluated based on the results of the interview survey as described.

1) Groundwater

Groundwater is the principal water source in all the objective areas of interview survey except Sukali. However, the present supply capacities of the wells in the areas except Wawlay are not sufficient causing the water shortages during a dry season. As for Wawlay, the present supply capacity is sufficient for the present water requirement but estimated to be insufficient for the future demand. Moreover, the salinity intrusion to dug-wells in Kyaikto is reported

2) Natural streams

Three sub-towns namely Kamamaung, Shanywarthit and Paingkyon rely on a river and/or creek as one of the principal water sources. The supply volume of the water source is sufficient to satisfy the water demand, while the water quality of the source tends to be deteriorated during a dry season.

3) Springs

Bawgali, Hpayarthonesu and Sukali rely on springs as the water source for the domestic water supply. In addition, Ye has just started to use springs for its domestic water supply. The supply volume of springs in Sukali is sufficient, while it tends to be insufficient in Bawgali and Paingkyon during a dry season.

(6) Water Supply Conditions in Resettlement Areas

The interview survey was made on the water supply conditions of the proposed four resettlement areas in Paingkyon STS、Shanywarthit STS、Wawlay STS and Sukali STS. The results of the interview survey area as described hereinafter:

1) Paingkyon STS and Shanywarthit STS

- Water supply and sanitation in Paingkyon STS

In the Paingkyon STS center, the dug wells and the tube wells are used as the sources for drinking water. The water quality of dug wells, which are a little far from Paingkyon River, are rather clean and stable for domestic uses, while the dug wells located near by the river, have the high turbidity of water during the rainy season.

The water from the Paingkyon River is used for irrigation to the paddy fields close to the river. This river water is sufficient even in the dry season.

The information about the present situation on water supply in Paingkyon STS was obtained through interviews to the officers of Paingkyon STS, as follows.

i) Each of the private dug wells are used by four to five households in town area as a source of drinking water.
ii) At other areas in the STS, the spring water and river water are also adopted as the source for the domestic use in addition to the dug wells
iii) The dug wells have no covers so that some dust and trashes could enter them. To improve accessibility to safe drinking water, the provision of top covers for dug wells or tube well is required.
iv) In case of using the river water for drinking, the filtration pond and its relevant facilities are necessary especially for strong turbid water in the rainy season.
v) About half of latrines in the town area are fly-proof typ.

- Water supply and sanitation in Shanywarthit STS

The main source for drinking water is the stream water in the STS. The dug wells are also used as sources for drinking and their qualities are suited as the potable water. Depth of dug wells is usually 35 feet in the STS.

In the village areas close to the town area in the STS, about 25% of people use the stream water and 75% dug wells. Treatment of the water such as boiling and/or chemical treatment is required for drinking.

i) The dug wells have no covers so that some dust and trashes could enter them. To improve accessibility to safe drinking water, the top covers for dug wells or tube wells are required.
ii) Of 12 dug wells in total in the STSs, seven dug wells tend to dry up in the dry season and the water of Yinbaing River with filtration facilities is used as the alternative water source.

2) Wawlay STS and Sukali STS

The information about the present situations on water supply in both STSs is obtained through interview to officers of Myawaddy TS, as follows;

➢ Water supply in Wawlay STS

i) There are 48 private dug wells and four tube wells (1 tube well is out of order) in Wawlay STS.
ii) Water supply system using the source of the Gowley creek will be considered after the returnees come back to STSs. However, the water of the Gowley creek is usually turbid so that the filtration facilities will be required for supply it.
iii) On the other hand, the tube well which would not require the filtration facilities, is more effective for water supply from long time views instead of river water supply system. Diameter of four existing tube wells is 4 inches and depth is 200 feet, which would require the construction cost of about 1,600,000 kyat/unit.

➢ Water supply in Sukali STS

There is a town water supply system in the Sukali STS center which could sufficiently provide water to all households of 68 units and government offices in the town area. The source of town water supply is the spring water so that there are less problems with turbidity but water quality should be checked. In village areas in Sukali STS, the dug wells, the stream and the spring water are used as sources of drinking water.

Conditions of water sources in Wawlay STS and Sukali STS are summarized in Table 4.15 and the outline of town water supply system in Sukali STS is shown in Table 4.16. It is further noted that UNDP has planned and submitted their project proposal to Kayin State Government on its assistance of water supply and electricity for the four STSs of Paingkyon, Shanywarthit, Wawlay and Sukali as shown in Table 4.17.

Table 4.15 Conditions of Water Sources in Wawlay STS and Sukali STS

Description			Wawlay STS	Sukali STS
Piped Water Supply System			Not Exist	Exist (Water Source is Spring Water)
Features if Water Supply System for Each of Water Sources	Dug Well (Lined)	Number of Units	40	-
		Covered Nos. of people	80	-
		Water Quality	Clean and Potable	-
	Dug Well (Unlined)	Number of Units	8	-
		Covered Nos. of people	5	-
		Water Quality	Clean and Potable	-
	Pond (Unprotected)	Number of Units	2	2
		Covered Nos. of people	-	-
		Water Quality	Not Potable without any treatment	Not Potable without any treatment
	Tube Well	Number of Units	4	-
		Covered Nos. of people	15	-
		Water Quality	Clean and Potable	-
	Spring Water	Number of Units	-	1
		Covered Nos. of people	-	80
		Water Quality	-	Clean and Potable
	Stream Water	Number of Units	-	1
		Covered Nos. of people	-	10
		Water Quality	-	-
Problems on Waters Supply in STS			Water is sufficient for present population of Wawlay and Sukali Sub-Township and water supply project should be expanded depends on increase of population.-	

Source: JICA Study Team

Table 4.16 Outline of Town Water Supply System in Sukali STS (Results of Answer for Questionnaires)

Maintenance	Once a week by STS Administrator
Population	323 persons
Served population	323 persons
Number of water supply connections (house connection, public faucets, Others)	40 houses (70%)
Average water distribution amount per day	5000 gallon
Average hours of water supply service per day	400 gallon
Length of water distribution network	6800 feet
Materials of water distribution network	PVC pipe (4”, 3”,2”,1”)
Age of water distribution network	1 year
Method of water distribution (by water tower, pump etc.)	Gravity Flow
Do you fulfill the demand of water quantity and quality of the customers. If no, please specify the amount of water and the reasons of shortage.	Water can be distributed adequately.
Monthly amount of water tariff (for household, commercial and industrial customers).	No water bill
Expansion plan and replacement plan on distribution network. (please provide the document if available)	Water is sufficient for present population.
Drawing of distribution network (paper based, Auto cad, GIS etc.)	Only drawn on normal map
% of meter installation	No water meter installed

Source: JICA Study Team

Table 4.17 Electricity and Water Supply Projects Proposed by UNDP

STS	Year	Nos. of Villages/ Locations			
		Electricity Supply			Water Supply
		Solar System	Hydropower System	Generator (Diesel)	4-6 inch diameter Tube Well 180-200 feet deep
Paingkyon	2013-2014	72	3	10	45
	2014-2015	49	-	1	35
	2015-2016	21	-	-	12
	Total	142	3	11	92
Shanywarthit	2013-2014	15	-	1	41
	2014-2015	17	-	-	8
	2015-2016	30	-	-	86
	Total	62	0	1	135
Wawlay	2013-2014	4	-	-	4
	2014-2015	3	-	-	3
	2015-2016	3	-	-	4
	2016-2017	-	-	-	2
	Total	10	0	0	13
Sukali	2013-2014	2	-	1	4
	2014-2015	3	-	-	3
	2015-2016	3	-	-	3
	2016-2017	-	-	-	2
	Total	8	0	1	12
Myawaddy TS excluding Wawlay and Sukali STS	2013-2014	15	1	1	29
	2014-2015	13	1	1	20
	2015-2016	9	-	-	12
	2016-2017	-	-	-	19
	Total	37	2	2	80
Grand Total		259	5	15	332

Source: From interview results to Kayin State Development Committee

(7) Water-related Sanitary Conditions in Southeast Myanmar

From the viewpoint of prevention against water borne diseases, the accessibility to the sanitary latrines should be considered. Here, the sanitary toilet means that the latrine is, in this rural context, the wet surface latrine and/or covered pit latrine (or fly-proof latrine).

According to the results of the previous social survey for the Southeast Myanmar[1], about 98% of people in Hlaingbwe TS including Paingkyon STS and Shanywarthit STS have no access even to pit latrines. In Myawaddy TS, 34% of people including Wawlay STS and Sukali STS could access to wet surface latrine but 63% have no access to even pit latrines.

The reasons of this high ratio of non-access to sanitary latrines are considered as follows.

(a) Living conditions have been poor especially in those townships as the communities have been targeted by counter-insurgency offensives for decades.
(b) Easy access to forest areas and a lack of public health awareness may also perpetuate unsanitary habits.

On the other hand, according to the results of another social survey[2], about 80 % of people in Kayin State and 87% of people in Mon State are estimated to be able to access to sanitary latrines. Thus, there is the remarkable deviation between two survey results. It might be due to the difference of

[1] "CHANGING REALITIES, POVERTY AND DISPLACEMENT IN SOUTH EAST BURMA/ MYANMAR" (31 OCTOBER 2012, The border Consortium)
[2] INTEGRATED HOUSEHOLD LIVING CONDITIONS SURVEY IN MYANMAR (2009-2010) POVERTY PROFILE (by MNP&ED, UNDP, UNICEF, SIDA)

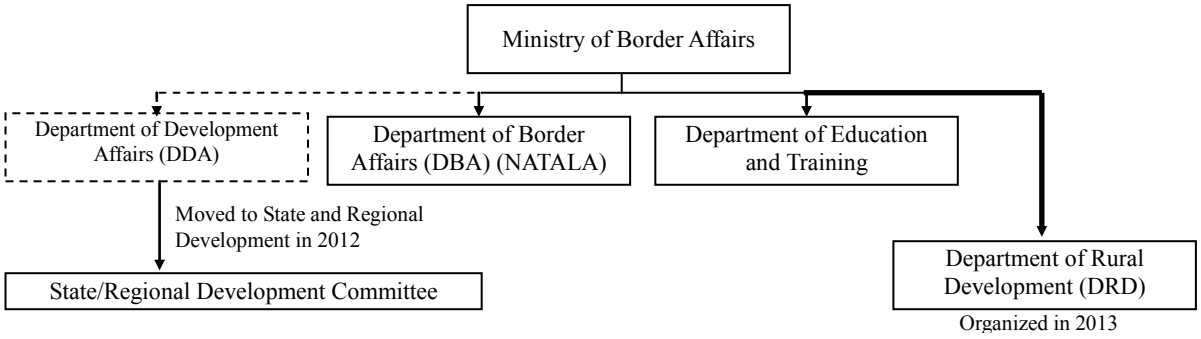
data sampling areas. The first survey does not include all town areas but include remote and mountainous areas. Therefore it could show almost the same or similar situations as those in the home villages of refugees and IDPs.

(8) Administration for Domestic water supply

The government agency in charge of domestic water supply has ever been the Department of Development Affairs (DDA) under the Ministry for Progress of Border Areas and National Races and Development Affairs. However this department was dismantled in 2012 and all staff members moved to each State/Regional Government then working as the State/Township Development Committee (SDC/TDC).

After the reform of the Ministry, the Department of Rural Development (DRD) was newly established under the Ministry of Border Affairs in 2013. The development of the domestic water supply and sanitation is currently undertaken by both of the two government units of the SDC/TDC and the DRD. The DRD is in charge of foreign donors' projects for development of the domestic water supply, while the SDC/TDC undertakes the projects for the domestic water supply under the budget of the local government.

The DRD has been established in this year so that they have not yet sufficient manpower in its department. Cooperation of State/ Regional development committee may be necessary especially for actual project implementation. The number of staff members for the Kayin State Development Committee/Township Development Committee is 249 including 30 engineers in total. Organization Chart of the Ministry of Border Affairs is shown in Figure 4.4.



Source: JICA Study Team

Figure 4.4 Organization Chart of Ministry of Border Affairs (including ex. DDA)

4.1.5 Present conditions of irrigation development

(1) Existing irrigation schemes

Water for existing irrigation schemes in Kayin and Mon States is secured by irrigation dams and pumping from a river or creek. Distinct features of these dam and pumping irrigation schemes are described.

1) Dam irrigation schemes

There exist seven irrigation dams in Kayin and in Mon States (Table 4.18). These are placed near to respective existing irrigable areas and along small rivers/creeks in flat areas. Due to such location, the storage capacities of the dams are relatively small being in a rage of the minimum 2,380 acre-ft (2.9 million m^3) to the maximum 56,000 acre-ft (69 million m^3).

The Department of Irrigation allows the irrigation for any crops selected by farmers on the premises of irrigation charges of 1,950 kyat/acre for paddy and 900 kyat/acre for other crops. Most existing irrigation dams are, however, used for the paddy production at present. Only the Azin dam in Mudon TS is both for the paddy production and fruit and Bilin Dam in Bilin TS solely for sugarcane.

Data on the actual irrigated area by the dam irrigation were furnished from the Department of the Irrigation in Mon State. However the data show exactly same figures of annual irrigated areas from 2010 to 2013 as shown in Table 4.18. This is regarded not natural, and the JICA Study Team withholds the evaluation on the actual irrigated area by the dams.

Of seven existing dams in Kayin and Mon States, five are used as multipurpose dams for domestic water supply or mini hydropower generation.

Table 4.18 Structural Features of Present Irrigation Dam in Kayin and Mon State

State	Name of Dam	Township	Name of River	Storage Volume (acre-ft)	Irrigable Area (acre)	Actual Irrigated Area (acre)			Other Purpose(1)
						'10-'11	'11-'12	'12-'13	
Kayin	Yeboke	Hlaingbwe	Yeboke	36,000	3,000	-	-	50	Hydro
Mon	Kazing	Bilin	Kazing	2,380	300	300	300	300	
	Waba	Thaton	Waba	4,150	2,038	500	500	500	Domestic
	Kadaik	Paung	Kadaik	56,000	10,000	10,000	10,000	10,000	
	Shwenattaung	Mawlamyine	Chaungsauk	5,250	302	302	302	302	Domestic
	Azin	Mudon	Azin	15,427	3,038	1,438	1,438	1,438	Domestic
	Winpanon	Mudon	Winpanon	47,882	5,068	700	700	700	Domestic
Total				131,089	20,746	13,240	13,240	13,290	

Source: Department of Irrigation, Ministry of Agriculture and Livestock Breeding in Kayin and Mon State

Note (1): Hydro=Hydropower Generation Domestic=Domestic Water Supply

(2): The dam type of all existing irrigation dams is the earth-fill dam.

2) Pump irrigation schemes

There are 12 irrigation pumping stations in Kayin and Mon States (Table 4.19). The pumping capacities in Kayin State are in a range of about 15 to 36 cusec (0.4 to 1.0 m^3/s). Those in Mon State were not obtained by the Study Team but they are likely to be in almost the same range as those in Kayin State judging from the irrigable areas by the pumps.

These pumping stations are located along the large rivers with the catchment area of more than 3,000 km^2 such as Thanlwin, Gyaing, Haungtharaw (a tributary of Gyaing River), Attran and Bilin Rivers. Since these rivers could keep the considerable volume of discharges throughout a year, the pumping stations could attain their full supply capacities even during a dry season. At the same time, however, it is necessary to protect the pumping equipment against floods during a rainy season.

The present irrigable area by the pumping schemes is 9,100 acre in total, while the actual irrigated areas by the pump are limited to 1,841 acre in 2011/12 and 1,932 acre in 2012/2013, corresponding to only 20 to 21% of the irrigable area. The pump irrigation is often interrupted by the cut of the electric and diesel power supply and mechanical troubles of the pump. This could be one of the principal factors of the low rate of the irrigated area.

Charge for pumping irrigation with electric power is 9,000 kyat/acre, while no charge for the diesel pumping, since the farmers supply the diesel by them.

Table 4.19 Structural Features of Present Irrigation Pump in Kayin and Mon State

State	Name of Pump Irrigation	Township	Name of River	Type of Pump	Pumping Capacity (cusec)	Irrigable Area (acre)	Irrigated Area (acre)	
							'11-'12	'12-'13
Kayin	Ta Yok Hla	Hpaan	Thanlwin	Electricity	36	1,000	347	428
	Hpa-Gat	Hpaan	Thanlwin	Electricity	36	1,200	285	320
	Htone-Aie (1)	Hpaan	Thanlwin	Electricity	0	180	0	0
	Htone -Aie (2)	Hpaan	Thanlwin	Electricity	45	1,220	291	303
	Zathapuin	Hpaan	Gyaing	Electricity	15.4	500	81	82
	Gyaing	Kawkareik	Gyaing	Diesel	23.1	600	205	354
	Kanne	Kawkareik	Haungtharaw	Diesel	23.1	500	182	265
Mon	Kyaik Pa Ran (1)	Kyaikmaraw	Attran	Diesel	Unknown	200	100	0
	Kyaik Pa Ran (2)	Kyaikmaraw	Attran	Diesel	Unknown	500	250	0
	Ni Ton	Mawlamyine	Attran	Diesel	Unknown	200	100	100
	Ka Doe-Kaw Nat	Kyaikmaraw	Gyaing	Diesel	Unknown	1,000	0	0
	Don Wun	Thaton	Bilin	Diesel	Unknown	2,000	0	80
Total					Unknown	9,100	1,841	1,932

Source: Department of Water Utilization, Ministry of Agriculture and Livestock Breeding in Kayin and Mon State

Note: 1 cusec=0.0283168 m^3 /s

(2) Planned irrigation development

The Department of Irrigation, Ministry of Agriculture and Irrigation proposed has three irrigation dams in Karen State. The Department also plans 20 irrigation dams and three head works in Mon State as shown in Table 4.20. These irrigation schemes would attain the irrigable area of 137,600 acre in total.

Of the total irrigable area, 134,900 acre (98% of the total) concentrates in Thaton and Mawlamyine Districts located in the west coast of the Southeast Myanmar. The largest irrigable area would be in Thaton District taking 88,600 acre (64% of the total) followed by Mawlamyine District with 46,300 acre (36% of the total.).

Table 4.20 Irrigable Area Developed by Proposed Irrigation Dam Project

State	District	Dam		Headwork		Total	
		Number of Structures	Irrigable Area (acre)	Number of Structures	Irrigable Area (acre)	Number of Structures	Irrigable Area (acre)
Kayin	Kawkareik	1	600	0	0	1	600
	Hpaan	1	600	0	0	1	600
	Total	2	1,200	0	0	2	1,200
Mon	Mawlamyine	10	46,300	0	0	10	46,300
	Thaton	7	53,600	3	35,000	10	88,600
	Kyaikto	1	1,500	0	0	1	1,500
	Total	18	101,400	3	35,000	21	136,400
Grand Total		20	102,600	3	35,000	23	137,600

Source: Department of Irrigation, Ministry of Agriculture and Irrigation, Union Government in Nay Pyi Taw

(3) Administration for development and management of irrigation

The Ministry of Agriculture and Irrigation, the Union Government takes the roles and authorities for formulating the national policy and plans for development of irrigation and implementing the relevant development projects. Under the umbrella of the Ministry, dams and pumps for irrigation are operated and maintained by the following two departments under the state government:

(a) Department of Irrigation for the irrigation by dams and head works and (b) Department of Water Utilization for irrigation by pumps.

The system for water use right is now under evaluation at the Parliament. Upon approval by the Parliament, the Department of Water Utilization of the State Government would be in charge of allocation and distribution of irrigation water based on water use rights. In lieu of the water use right, however, the ad-hoc requirements of the water users is the present base for water allocation and distribution.

4.1.6 Present conditions of flood management

(1) Floods damages in Southeast Myanmar

The floods in the Southeast Myanmar could be generally classified into to two types, namely: "the wide spread flood" and the "the flash flood". Most of them occur during the middle of the southwest monsoon from June to October.

The wide spread flood mainly hits the lower and middle reaches of the large rivers such as Thanlwin, Attran and Gyaing Rivers, having the catchment area of more than some thousand square kilometers. The water levels of the downstream/middle streams of these rivers tend to gradually rise. Because of such gradual rise of river water levels, the residents could have time for evacuation from the flood and therefore, the human damages including the death seldom occur. However, once the river water levels exceed the river bank levels, the extensive and prolonged flood inundation occur. As most major urban centers are located along the downstream of the large rivers and they are inundated for the long duration by the flood, the economic damages by the flood tends to be huge. For this reason, most recorded major flood damages in the Southeast Myanmar result from the wide spread flood.

In contrast to the wide spread flood, the flash flood tends to occurs along the small rivers and creeks causing the peak water level within a short time immediately after the heavy rainfall. Due to such features, the flash flood could contain the potential risk leading to serious human damages including the death calamities, if the residents resided at the flood hazardous areas. However, since the inundation by the flash flood is limited to a small extent and the residents are well aware of such flood hazardous areas, the flood damages are far smaller than those of the wide-spread flood described above.

Among the rivers in the Southeast Myanmar, the Thanlwin River tends to cause the most serious flood damages. The danger level to cause the flood of the River at Hpaan TS is estimated at 750 cm as the value of the staff gauge reading by the Department of Meteorology and Hydrology (DMH). According to the records of DMH, the river water levels of the Thanlwin River has exceeded the danger level in seven years among the recent ten years from 2003 to 2012 and the water levels above the danger level have continued for 5 to 46 days as shown in Table 4.21.

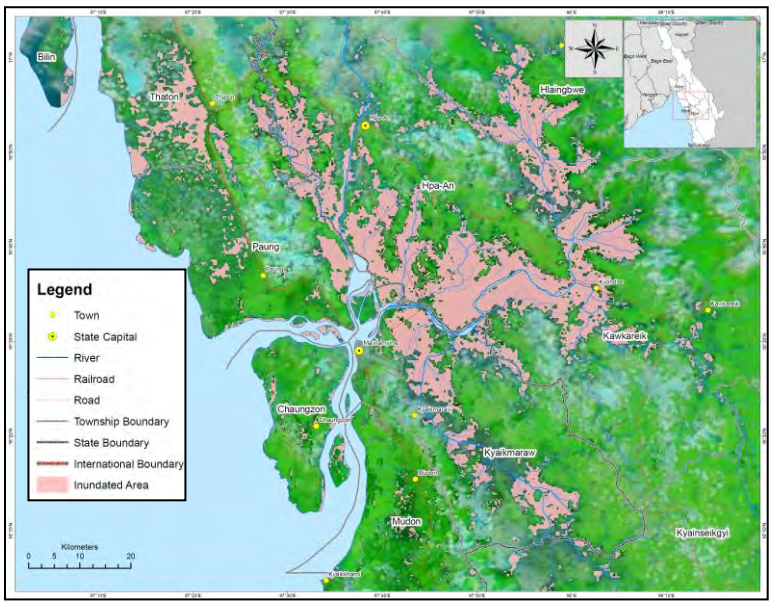
Table 4.21 Recorded Annual Maximum Flood Water Levels of Thanlwin River at Hpaan

Year	Highest. Water Level (cm)*	Excess of Highest Water Level above Danger Level (m)	Duration of Flood above Danger Level (Days)
2003	740	-	-
2004	887	1.37	31
2005	848	0.98	19
2006	790	0.4	5
2007	793	0.43	14
2008	908	1.58	46
2009	741	-	-
2010	719	-	-
2011	908	1.58	36
2012	876	1.26	23

Source: DMH
Note:*: The water level is the relative height above 0cm of the staff gauge set by DMH.

The flood damage data in Kayin and Mon State is scarce but partial data in the most recent 2012 could be collected.

The flood in 2012 has the fourth highest water level of 875 cm and the third longest flood duration of 23 days among those recorded in the recent ten years as listed in Table 4.21 above. Thus, the 2012 flood is not of extra-ordinary scale in terms of the river water level and the flood duration.



Source: Satellite Image - MODIS Rapid Respond Team

Figure 4.5 Inundated Area of 2012 Flood in Southeast Myanmar

Nevertheless, according to the satellite image taken during the 2012 flood, the inundation area extends over almost the entire lower reaches of Thanlwin River, Attran River and Gyaing River as shown in Figure 4.5. The number of residents, who evacuated to the shelters, is recorded at 5,415 persons or 1,043 households in Hpaan TS. Moreover, the number of village tracts affected by the flood in Kayin State was 182 and the paddy filed affected by the flood was 47,771 acres, equivalent to about 24% of the whole cultivated land in the State.

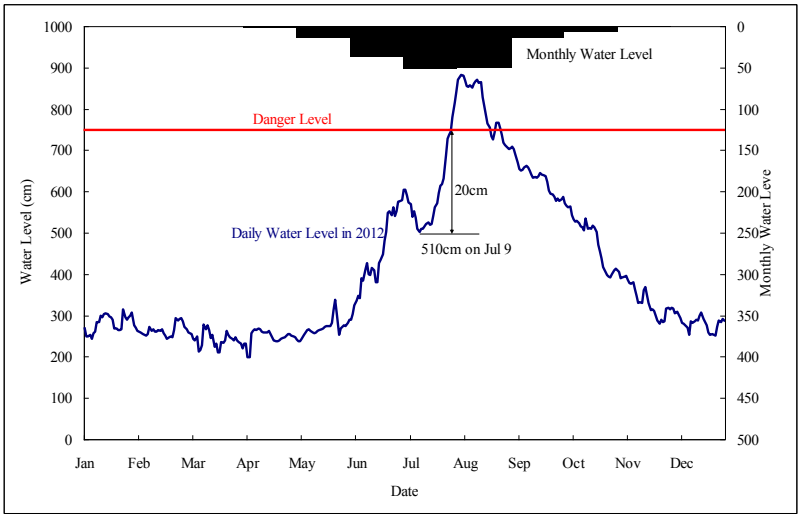
(2) On-going flood mitigation works in Southeast Myanmar

1) Flood forecasting and warning

DMH currently undertakes the nationwide flood forecasting and warning (FFW) for the eight major rivers including the Thanlwin River. The FFW for Thanlwin River is based on the water level manually gauged at Hpaan TS. That is, the flood warning is issued when the water level is

gauged at 650 cm (i.e., 1m below the aforesaid danger level) and the flood bulletin continues to be released during the water level is equal to and/or higher than the danger level.

In case of the flood in 2012, the water level was gauged at 501 cm on July 9 and it reached the danger level of 750 cm 20 days later as shown in Figure 4.6. This means that the water level rose at a rate of about 12.5 cm/day. If the flood warning is issued 1 m below the danger level, the residents could receive the flood warning eight days in advance of the occurrence of the danger level. Thus, the residents at Hpaan ST could have the adequate time for flood evacuation.



Source DMH

Figure 4.6 Daily Water Level of Thanlwin River Hydrograph in 2012

The information for the flood warning and the flood bulletin is once sent from the river gauging stations to the River Forecasting Section (RFS) of DPH at Naypyitaw through the Single Side Band (SSB) telecommunication system. Then, the RFS distributes the information to the relevant local authorities for the necessary flood prevention and relief actions and further disseminates them to the public for evacuation through the medium such as radio, television, newspaper, DMH's Website and the DMH's automatic answering machine.

In order to strength the existing FFW system, the various foreign aid projects are being undertaken including the following:

i) The Storm Forecasting Project (2010-2012), which aims at establishing the ground receiving system for the Multifunctional Satellite Image (MTSAT) and the related computer facilities (supported by JICA),
ii) The Project for the second radar systems which are installed at Yangon, Mandalay and Kyaukpyu in Western Rakhine State in order to upgrade the nationwide weather forecast (supported by JICA), and
iii) The Project, which aims at supplying the meteorological instruments such as the automatic weather observation system (AWOS) and thermometer (supported by China Meteorological Administration and Thailand International Cooperation Agency).

2) Flood evacuation and relieves

The Department of Relief and Settlement and the Fire Brigade Offices under the State Government keeps in stock the boat, the life jackets and other relief goods against the flood. During the flood in 2012, 5,415 persons evacuated to the 12 shelters located on elevated ground supported by the two government agencies and other various relevant agencies (Figure 4.7).

The various government agencies and NGOs also provide blankets, foods and other essential commodities, which are necessary for the evacuees to stay at the shelters.

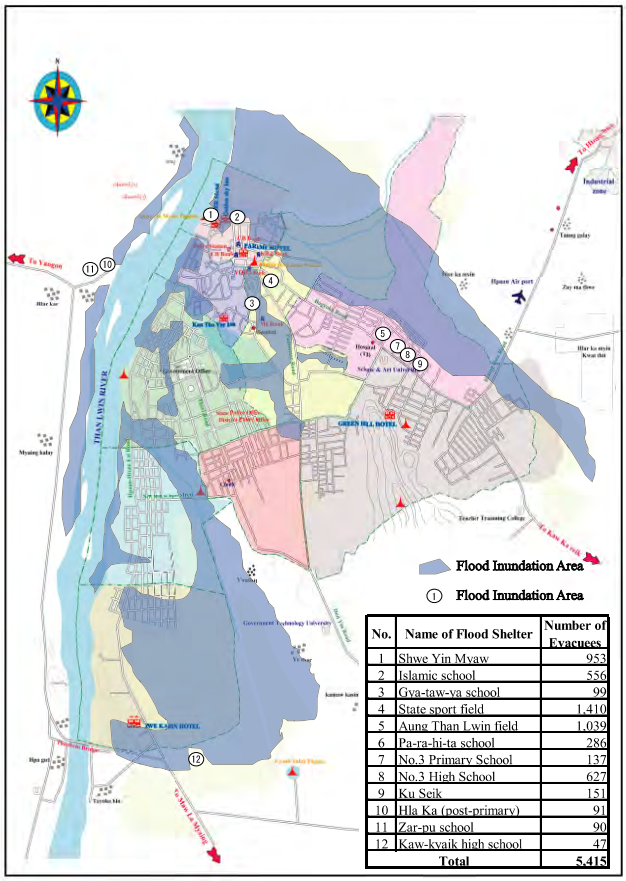
However, all the shelters are schools, temples and other public places, which are temporarily arranged and hardly accommodate all evacuees. As a result, some of the residents were forced to stay at the second floor of their own private houses. Moreover, the flood inundation often continues more than one month. Accordingly both the evacuees at the public shelters and the private houses have to spend hard time under conditions of no income and severe living conditions.

3) Structural flood mitigation works

The Department of Irrigation is the principal agency to undertake the structural works for flood mitigation. The Department has completed the numerous drainage channels for agricultural land, spreading out in the southern part of Hpaan.

One of the drainage channels runs through the urban area of Hpaan functioning as the urban drainage channel. The outlet of these drainage channels are the Thanlwin River and the Gyaing River and, the drainage gate are constructed at the outlet points. However, as the water levels of the Thanlwin River in particular tends to continue to rise from the beginning of the rainy season (the early of July) until the mid of rainy season (the mid or the end of August), the drainage from the agricultural land into the River is hardly made.

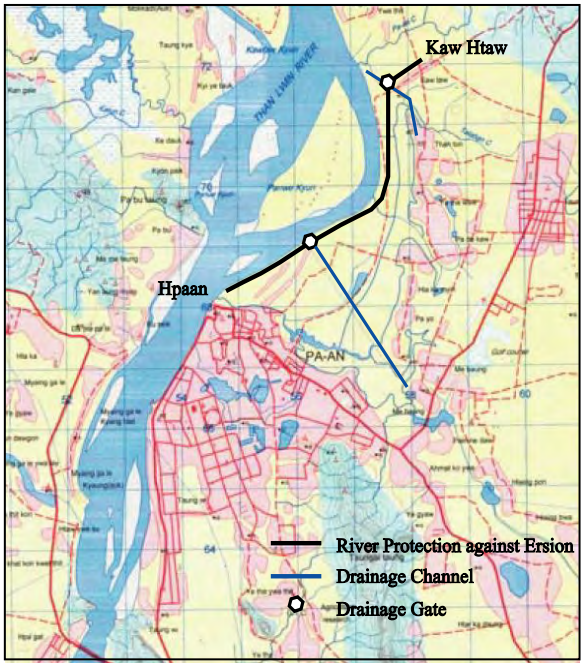
In addition to construction of the drainage channels, the Department of Irrigation further plans to construct the protection against erosion along the left bank of the Thanlwin River (Figure 4.8). The protection work is about 5 km in length stretching from Hpaan to northeast Kawtaw.



No.	Name of Flood Shelter	Number of Evacuees
1	Shwe Yin Myaw	953
2	Islamic school	556
3	Gya-taw-ya school	99
4	State sport field	1,410
5	Aung Than Lwin field	1,039
6	Pa-ra-hi-ta school	286
7	No.3 Primary School	137
8	No.3 High School	627
9	Ku Seik	151
10	Hla Ka (post-primary)	91
11	Zar-pu school	90
12	Kaw-kyaik high school	47
	Total	5,415

Source: General Administration Department of Kayin State

Figure 4.7 Extent of Flood Inundation and Location of Temporary Shelters in the 2012 Flood in the Urban Center of Hpaan TS



Source: Department of Irrigation, Kayin State

Figure 4.8 Proposed River Protection against Erosion along Thanlwin River

(3) Administration for mitigation and management of flood damage

The Central Committee for Natural Disaster Prevention and Management chaired by the Prime

Minister is now active in Myanmar. The principal objective of the central committee is to mobilize national strength for disaster preparedness, prevention, relief, resettlement and reconstruction as an implementation of total disaster risk management.

In line with the policy of the decentralization, the Kayin and Mon State Government have also established the regional committee for the natural disaster prevention and management. The regional committee is chaired by the Chief Minister and composed of 37 Ministers of the State government including the Minister for Social Welfare, Relief and Resettlement as the Vice Chairman. Under the directions by the regional committee, activities are carried out against floods, as summarized in

Table 4.22.

Table 4.22 Current Demarcation of Government Agencies for Flood Prevention and Relief Works

Work Item	Work Contents	Government Agencies in Charge
Preparedness: against Flood	To establishes the stock centers of relief goods in major towns of State.	Department of Relief and Resettlement
Capacity Development for Disaster Management	To enhance the capacity of authorities concerned, the NGO and residents for the disaster management through the multiplier training courses.	Department of Relief and Resettlement in collaboration with DMH, Fire Services Department, DOH, DOI, Police Force and Department of Water Resources and Improvement of River Systems
Flood Forecasting and Warning:	To provides early warning to the higher authorities, local government in order to reduce the disaster risk.	The Department of Meteorology and Hydrology (DMH)
Development of Structural Flood Mitigation Facilities	To develop the structures and facilities, which are effective to mitigating the flood damages	

4.1.7 Major issues for water resources development

(1) Issues related to hydropower development

1) Large scale hydropower development

As described above, while the MoAs for project implementation of Hazi and Bilin hydropower dams were completed between the Ministry of Electric Power and the investors, both projects have not been implemented and it remains uncertain whether they could be implemented in the near future. The Study Team presumes the following factors, which could hamper the project implementation.

i) The security for the project implementation has been hardly secured because of the conflicts between the Union Army and the armed ethnic groups.

ii) The armed ethnic group as well as local communities, NGOs, and others groups concerned have revealed their oppositions against the project implementation because of their apprehensions on: (a) intensified presence of the Union Army at the project sites during and after completion of the project implementation, (b) involuntary evacuation of a huge number of houses for the project implementation, (c) loss of livelihood due to submergence of the agricultural and forest land under the dam reservoir, (d) less benefits to the residents as perceived due to symbolical allocation of little return of electric power and water supply to the residents, and (e) loss of the existing biodiversity to be submerged under the dam reservoir[3].

[3] "Current Status of Dam Projects on Burma's Salween River, March 2013" by Salween Watch
"Damming at Gunpoint, November 2004" by Karen River Watch

iii) According to the officials of the Ministry of Electric Power, Hazi Dam contains the geological problems of the dam foundation and the technical solution on it has not been resolved yet.

2) Small scale hydropower development

Several small scale hydropower development projects have been planned by the Ministry of Electric Power in order especially to improve rural electrification and private investors are invited to undertake the projects. However, the investors are likely to have not been active in participation to the projects because of low profitability. The general approach of MOEP to the developing of mini-hydropower plants appears also to be rather negative due to the difficulties in maintaining the hydropower plants.

Moreover, in accordance with the policy of decentralization, the Union Government has handed over to the State Government the administration for development of small and medium-scale hydropower plants smaller than 30MW. The decentralization is still in progress and the State Government has not been empowered to execute the administration for the hydropower development alone. The MOEP would have to technically assist the development of small and medium scale hydropower plants. For these reasons, the small-scale hydropower development projects are not widely implemented in the Southeast Myanmar.

(2) Issues related to industrial water supply

The Southeast Myanmar is located along the possible economic corridors such as the east-west and southern economic corridors, and also borders on Thailand. Because of these geographical conditions, the Region is advantageous for cross-border trade, and the following three urban centers could especially have a great potential of industrial development relevant to the cross-border trade.

(a) Hpaan is the capital of Kayin State functioning as the political and economic core of the Southeast Myanmar. It is also in a strategically important position in logistics along the east-west corridor.
(b) Myawaddy is located on the border with Thailand and at the same time the starting point of the east-west corridor at the Myanmar side. For this reason, it has a potential to become the center to export the industrial products with the additional values given by the labor-intensive industry to Thailand.
(c) Hpayarthonesu has the similar functions as Myawaddy, since it is located on the border with Thailand and the starting point of the southern economic corridor.

Of these urban centers, Hpaan is expanding the industrial zone together with the bulk water supply system of 3million gallon/day as described above. In Myawaddy, development of a new industrial zone is also in progress but the definitive plan for the bulk water supply has not been formulated yet. As for Hpayarthonesu, the concept for the industrial zone has been worked out, but neither the plan for development of an industrial zone nor the plan for the bulk water supply system has been formulated yet.

(3) Issues related to domestic water supply

The present supply capacity for domestic water is quantitatively and qualitatively inadequate both in urban and rural areas as described below.

"The Salween Under Threat Damming the Longest Free River in Southeast Asia, October 2004" by Yuki Akimoto

(a) A substantial part of urban areas and all rural areas are out of the service areas of public water supply systems, and they have to individually rely on the water supply by private water suppliers and/or their own water sources such as wells, natural streams, springs and rain-fed ponds.
(b) The State Development Committee for Kayin and Mon State estimate the full per-capita domestic water demand in a rage of 20 to 25 gallon/day/person, while the present average per-capita supply capacity of public water supply systems is limited to more or less 10 gallon/day/person.
(c) Most public water supply systems adopt the sedimentation pond to reduce the turbidity of the water abstracted from rivers. However, no purification facilities other than the sedimentation pond are provided to both public and private water supply systems. The raw water is directly distributed to end users.

(4) Issues related to irrigation water

Owners of farm land tend to change their land use from the present paddy or other irrigable crops to rubber plantation, which does not require irrigation, due to higher income expected. Moreover, the farmers appear to have limited knowledge on irrigated paddy production. For these reasons, the farmers are likely to have little incentive to undertake double cropping by irrigation. Moreover, the Department of Irrigation accords higher priority to drainage projects over irrigation projects.

(5) Issues related to flood mitigation and management

As the results of the interview survey and the field reconnaissance, the following issues on the flood mitigation managements in the Southeast Myanmar are preliminarily identified:

(a) The flood forecasting and warning is judged to be effective for the lower reaches of Thanlwin River along Hpaan TS in particular because of the adequate leading time for the flood forecasting and warning. However, since the present flood forecasting is made based on the river water level gauged at Hpaan TS only, it is virtually difficult to attain the exact flood forecast for the middle reaches of the Thanlwin River, along which the rather populated town areas such as Shwegu, Myainggyingu and Kamamaung are located. From this point of view, it is recommended to increase the flood water level gauging points along the middle reaches of the Thanlwin River and/or the key points at Yunzalin River, the major tributary. The DMH of Kayin State requires installing of two new flood water level gauging stations at either Shwegu or Kamamaung along the mainstream of Thanlwin River and Hpapun at Yunzalin River.
(b) The existing schools, temples and other public buildings are used as the temporary shelters against the flood. These shelters are judged to be inadequate to accommodate the potential number of the flood evacuees as described above. Moreover, the evacuees have to occasionally stay at the shelters for more than one month, while the living environments of the shelter are not necessarily well arranged for the long stay.
(c) Development of the large-scale structure for flood mitigation in the Southeast Myanmar would hardly lead to the economic viabilities due to the low economic values of the flood damageable assets. The flood mitigation structures herein include the river/ring dike, the flood retarding basin, the flood control dam, the flood diversion channel and the inland drainage facilities. Moreover, these structures except the inland drainage facilities would be not adoptable to the Thanlwin River because of the huge flood runoff discharges of some thousand or tens of thousand cubic meter per second from the extensive catchment area of more than 300,000 km^2 and the prolong high water level for more than one month. Elevating of the river bank

elevation higher than the ground levels of the shoreline in particular has to be refrained. This is because once the river water level could exceed such elevated river bank level, which could be possibly occur in the extra-ordinary flood, a huge volume of the river discharge flushes out at once into the inland causing the disastrous damages including many of death calamities.

(d) As the regional committee for the flood management at the state level has been newly established just in 2012, its substantial activities have not been commenced yet. Under such situation of the committee, all ministers of the state government are involved as the members of the committee and. their roles have not been clearly demarcated. Moreover, the Department of Relief and Resettlement shoulders the primary role for the preparedness against flood and the capacity development for disaster management for the entire jurisdiction of the State Government. In spite of such heavy duty, only a few staffs of the Department look after the entire jurisdiction area of the State and it is virtually difficult for them to fulfill their responsibilities for flood management.

4.1.8 Preliminary identification of potential dam sites

The JICA Study Team has preliminarily identified and examined the new potential dam sites, which could help to resolve the issues as pointed out on the currently proposed projects. As the results, the three potential dams are identified as bulk water supply source for the industrial, domestic water and irrigation uses and/or the hydropower development. The features of these three potential dams are summarized in Table 4.23.

Table 4.23 Features of Potential Dam Reservoirs Preliminarily Identified

Description	Features of the Dam Reservoirs Identified								
Name of Dam	Megala			Megathat			Yunzalin		
Name of River	Moei (Tributary of Thanlwin River)			Megathat Creek (Tributary of Attran/Zami River)			Yunzalin (Tributary of Thanlwin River)		
Catchment Area at Dam Site (km^2)	690			182			1,711		
Geology of the Project Site	Metamorphic/volcanic rock			Volcanic rock			Metamorphic/volcanic rock		
Dam Type	Concrete Gravity			Concrete Gravity			Concrete Gravity		
Alternative Dam Height (m)	28	38	48	34	44	54	54	64	74
Impounding Area (km^2)	8.7	11.3	14.0	0.6	1.6	2.6	10.9	13.3	15.3
Gross Storage Volume (mil. m^3)	177.6	276.8	402.2	3.2	13.3	33.9	235.1	355.4	497.5
Firm Discharge (m^3/s)	9.1	14.2	20.7	0.2	0.7	1.7	12.1	18.3	25.6
Capacity of Hydropower (MW)	13.0	27.6	50.6	0.3	1.5	4.8	33.3	59.7	96.6
Number of House Relocation	100	100	100	Nil	Nil	Nil	Nil	Nil	Nil

Source: JICA Study Team

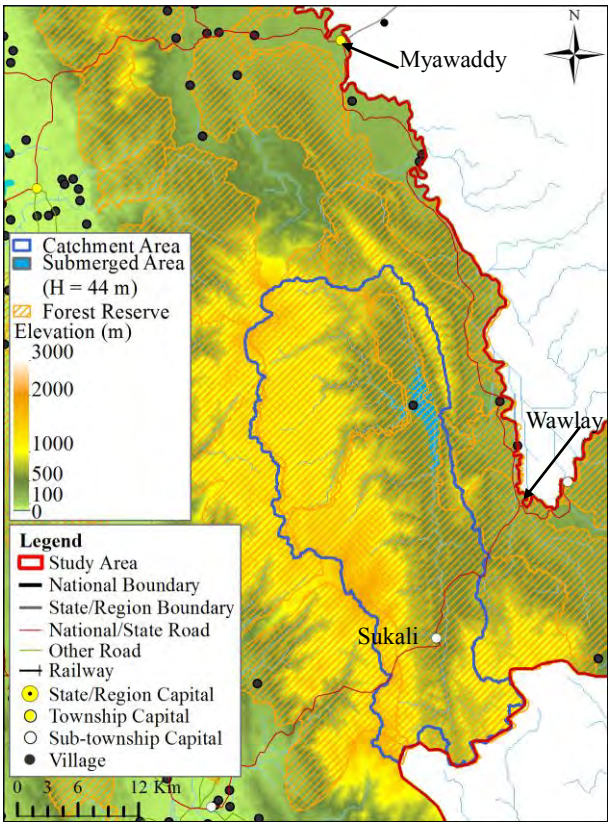
(1) Megala dam

The Megala River originates from the eastern slope of Dawna mountain range with an altitude of EL. 1000 m and flows down through the rather flat basin. Then, the River passes through the narrow gorge of the mountain range of EL. 500 to 1000 m and finally joins the Thanlwin River (called Moei River in Thailand) about 41.5 km south-east from Myawaddy urban area as shown in Figure 4.9. The dam site is just placed at the narrow gorge at the way out of the flat basin. Because of the flat basin utilized as the dam reservoir, the dam is superior in the water storage efficiency as indicated by the rather large storage volume of about 180 million m^3 obtained by the rather low dam of 28 m in height.

The dam could generate the firm discharge (the constant outflow discharge from the dam) of about 9.1

m^3/s and electric power of about 13 MW. These water and electric power could be supplied to the Myawaddy industrial zones and further for the domestic and irrigation use in Myawaddy TS as well as Wawlay and Sukali STSs. Thus, the Dam could accelerate the industrial and agricultural development in Myawaddy TS, which leads to the active cross border trade and expansion of job opportunities.

The certain distances of the upper and lower reaches of the Thanlwin River from the confluence with the Megala River are the national border between Myanmar and Thailand. Accordingly, development of the Megala dam would be difficult without consents of Thailand. However, the Dam would make a great contribution to flood mitigation along the Thanlwin River during a rainy season and the increment of the low flow discharge during a dry season. Thus, the dam could be beneficial to Thailand and therefore, difficulties in obtaining the consents of Thailand on implementation of the dam project are not foreseeable. In addition to the consents of Thailand, the following would also be required for implementation of the proposed Megala dam: (a) to restore the peace in and around the project site, (b) to improve the new access road from Myawaddy to the project site, (c) to dispose the land-mines hidden underground and (d) to conduct the environmental impact study on the dam project.



Source: JICA Study Team

Figure 4.9 Catchment Area and Submerged Area of Megala Dam

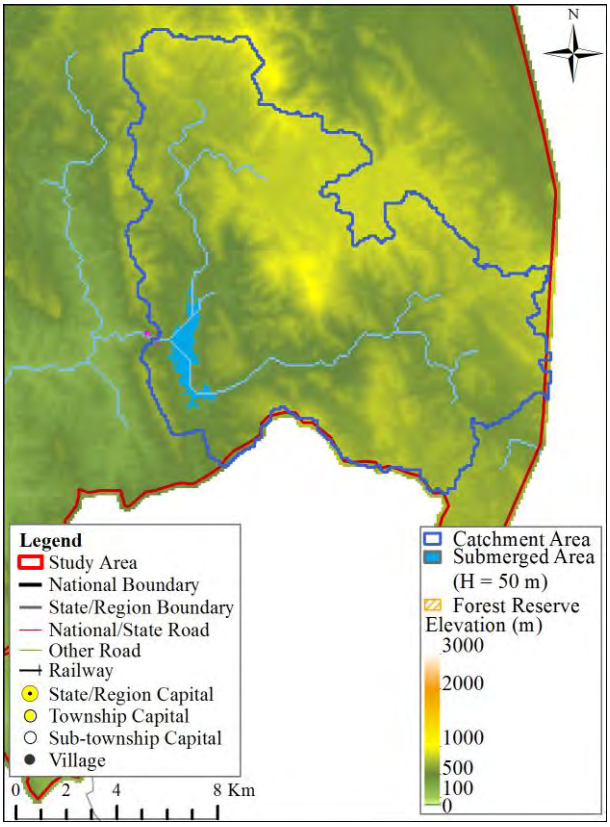
(2) Megathat dam

The Megathat dam site is located at the narrow gorge of the Megathat creek, a tributary of the Attran/Zami River (refer to Figure 4.10). The storage efficiency of the dam is low as compared with the Megala dam due to the topographic conditions at the dam site. However, it is located rather close to the Hpayarthonesu TS center (about 13.8 km away in the north-east), which allows taking advantage as the water source for the industrial and domestic water use in Hpayarthonesu. The supply capacity of the Dam is estimated at 1.7 m^3/s and 4.8 MW. These could be used for domestic and industrial uses for Hpayarthonesu provided that the project could attain the security and complete the environmental impact study as prerequisites similar to those for the above Megala Dam.

(3) Yunzalin dam

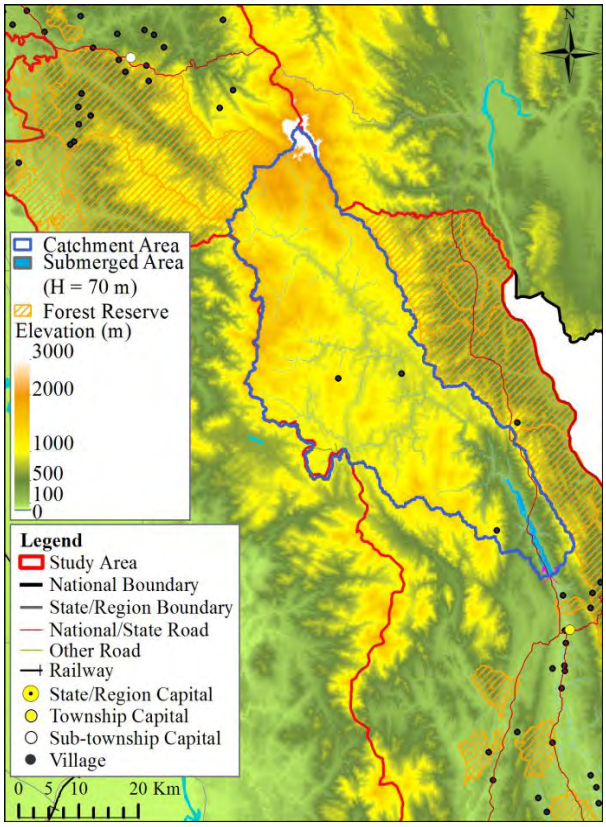
The Yunzalin dam is located along the Yunzalin River, the tributary of Thanlwin River and about 9.6 km away in the northwest from the urban area of Hpapun TS (refer to Figure 4.11). The dam with the height of dam crest of 54m could produce the firm discharge of 12.1 m^3/s and generate the electric power of 33.3 MW which could be used for the domestic use and irrigation in Hpapun TS as well as its surroundings. The power generated could be consumed within the Southeast Myanmar and further enhance the supply reliability of the national grid as a whole. However, the implementation

of the Yunzalin dam would also require the security and the environmental impact study as prerequisites similar to those of other potential dams.



Source: JICA Study Team

Figure 4.10 Catchment Area and Submerged Area of Megathat Dam



Source: JICA Study Team

Figure 4.11 Catchment Area and Submerged Area of Yunzalin Dam

4.1.9 Strategic directions of water resources development in Southeast Myanmar

(1) Integrated river basin development

Water resources development projects in the Southeast Myanmar were formulated in the past without paying adequate considerations on environmental conservation and improvement of river basins. This has often caused oppositions of the local communities against the project implementation.

Moreover, the past water resources development projects have not adequately promoted comprehensive development potentials of river basins, as they have been oriented to a single purpose either for hydropower development, domestic water supply or irrigation. This could lead to difficulties in linking the water resources development with the effective and comprehensive regional development.

In order to attain the water resources development harmonious with the environmental conservation of river basins and the comprehensive regional development, the approaches toward the integrated river basin development would be indispensable. The priority for such integrated river basin development would be given to the following projects in the Southeast Myanmar.

1) Moei and Megala integrated river basin development

The Moei and Megala River basins cover a substantial part of Myawaddy TS including Wawlay and Sukali STSs. As described above, Myawaddy TS has the great potential for industrial development. At the same time, the township could be protected from the extremely large amount of the rainfall during a rainy season by the Dawna mountain range, which is the great advantage for agricultural development. Moreover, the important settlement areas for refugees and IDPs are planned in Wawlay and Sukali STSs.

In order to support these basin potentials, the Megala multipurpose dam would function as the important water source for domestic water supply, industrial water supply, electric power supply, agricultural water supply and flood mitigation in Myawaddy TS and its vicinities. The development of the multipurpose dam should be made with linkage of: (a) improvement of road along the east-west economic corridor, (b) development of the Myawaddy industrial zone , which may have a potential to be improved as the FTZ, (c) agricultural development, (d) promotion of the settlement of refugees and IDPs at Wawlay and Sukali STS, (f) flood mitigation along Moei River and (g) environmental conservation and improvement for the areas and the persons influenced by the development projects.

2) Megathat integrated river basin development

The integrated river basin management would be realized through the development of the Megathat multipurpose dam for domestic water supply, industrial water supply and electric power supply for Hpayarthonesu STS. The development of the multipurpose dam should be made with linkage of: (a) improvement of road along the southern economic corridor, (b) development of the Hpayarthonesu industrial zone, which may have a potential to be improved as the FTZ, (c) urbanization of Hpayarthonesu STS and (d) environmental conservation and improvement for the areas and the persons influenced by the development projects.

3) Bilin integrated river basin development

Development of the Bilin dam is currently planned as the single purpose dam exclusively for hydropower generation. However, the Bilin River basin has a potential to be the major agricultural area to produce paddy for export, groundnuts and beans. In order to attain the development of the Bilin River basin as the foothold for export of the agricultural products, it is worthy to develop the Bilin dam as the multipurpose dam for agricultural water supply, domestic water supply and flood control of the Bilin River as well as the hydropower generation. The development of the multipurpose dam would be made with linkage of: (a) improvement of road along the east-west and southern economic corridors, (b) expansion of irrigation area, (c) urbanization of Bilin TS and (d) environmental conservation and improvement for the areas and the persons influenced by the development projects.

4) Yunzalin integrated river basin development and conservation

The integrated development for Yunzalin River basin would be attained through development of the Yunzalin multipurpose dam as described for domestic water supply and electric power supply for Hpapun TS and its vicinities. The development of the multipurpose dam would be made with linkage of: (a) urbanization of Hpapun and (d) environmental conservation and improvement for the areas and the persons influenced by the development projects taking the present rich biodiversity in the river basin into account.

(2) Hydropower development

1) Large-scale hydropower development

As described above, the prospect of large-scale hydropower development projects for Hazi and Bilin Dams is likely to be bleak. Of these two dams, the Bilin dam would have the potential as the multipurpose dam as described above and therefore, its development plan would need to be revised accordingly.

On the other hand, the Hazi dam has the huge potential hydropower supply capacity of 1,360 MW. A half of this supply capacity (680 MW) could contribute to the power supply in Myanmar. This is equal to about 27% of the present national total install capacity in Myanmar. Thus, the development of the Hazi dam as the hydropower dam could make a great contribution to the supply reliability of the national grid as a whole. On the other hand, the dam could make little contribution to domestic, industrial and agricultural water supply for the surrounding areas.

From these points of view, it would be worthy to pursue the implementation of the Hazi dam project exclusively for hydropower generation. In order to realize the project implementation, it would be indispensable to convince all stakeholders that the projects would bring benefits both for the regional development and the local communities. The important issues to convince the local communities would be to disclose the information on the project and to clarify various concerns of the local communities on the adverse effects associated to the dam development.

2) Improvement of rural electrification

As described above, small scale hydropower development is not well developed in the Southeast Myanmar due to low profitability for investors and difficulties in maintaining plants. These would be principal reasons why the electrification ratios are low especially in rural areas.

Nevertheless, expansion of the coverage of power supply in rural areas would be indispensable to improve the living standard of the communities in the Southeast Myanmar and in order to achieve it, the following strategic directions are provisionally proposed.

i) The step-wise development plan for the small-scale hydropower generation for rural electrification should be formulated taking the practical measures for sustainable maintenance and operation of the power plants in to account. Then, the plan should be implemented based on the public investment instead of the current private investment.
ii) The irrigation dam should be provided with a mini hydropower plant, when it is located out of the coverage of power supply services.
iii) The proposed projects for the multipurpose dams, namely Megala, Megathat and Yunzalin would be implemented in the long run. The electric power generated by these multipurpose dams, may be exclusively supplied within the Southeast Myanmar and a part of it would be distributed to rural areas.
iv) The electric power generated by the Hazi dam would be supplied to the national grid. However, a part of it should be used to the rural communities affected by the development of the Dam.

(3) Development of water supply for industrial zones

As described above, the development of industrial zones is in progress for Hpaan TS and Myawaddy TS. Hpayarthonesu STS is also considered to have a potential to develop an industrial zone once the

southern economic corridor is opened in Myanmar. Of these three TS/STSs, however, bulk water supply system has been completed only in Hpaan as stated above.

Taking the above conditions into account, the priority of bulk water supply system for the industrial zones would be given to Myawaddy followed by Hpayarthonesu. The eligible sources for the industrial water supply would be Megala multipurpose dam for Myawaddy and the Megathat dam for Hpayarthonesu STS.

(4) Development of domestic water supply

Quantitative and qualitative improvement of the present domestic water supply systems is indispensable to meet the basic human needs and to support the sustainable regional development. Hence, the strategic directions for development of the domestic water supply system for urban and rural areas are preliminarily proposed as described.

1) Domestic water supply in urban areas

The priority for improvement of the bulk water supply systems would be given to the urban centers along the east-west and/or southern economic corridors. The bulk water supply should be basically made by pumping from rivers and/or by dam reservoirs and, water purification facilities should be introduced to theses bulk water supply systems. The objective urban centers for improving of bulk water supply systems would include Hpaan, Myawaddy and Hpayarthonesu in Kayin State and Mawlamyine and Bilin in Mon State. These urban areas would make progress of urbanization in parallel with the growth of economic corridors.

The domestic water for urban areas other than the above urban centers should give priority to expansion of existing public water systems with piped water distribution or establishment of a new public water supply system in order to reinforce their functions as the core of each township. The water sources would have to rely on development of tube-wells and/or small-scale dams. The objective urban areas are as below:

i) Expansion of the existing public water supply system: Thandaunggyi, Kyainseikgyi, Hpapun in Kayin State and Thaton, Paung and Chaungzon in Mon State
ii) Establishment of a new public water supply system: Hlaingbwe and Kawkareik in Kayin State and Kyaikto, Kyaikmaraw, Thanbyuzayat and Ye in Mon State

2) Domestic water supply in rural areas

Village tracts are widely scattered in the Southeast Myanmar, and it is virtually impossible to cover the entire rural areas with public water supply systems. Therefore, rural areas would have to continue relaying on present water sources for the foreseeable future. Nevertheless, the present water supply capacity in rural areas would have to be expanded by increasing of the number of wells possibly combining dug-wells, shallow wells and/or tube wells as the principal sources.

A principal issue on the improvement of wells is inadequate knowledge and devices for exploring/developing groundwater sources. The pollution of the water sources would be another issue for the water supply system in the present water supply system in rural areas. In order to expand the supply capacity of the water sources in rural areas, it would be necessary to introduce the knowledge on exploring groundwater sources and build up adequate drilling capacity for development of groundwater. At the same time, simple purifier and test kits for water quality of groundwater would need to be introduced to maintain the clean water safe for drinking.

(5) Irrigation development

The priority for irrigation development would be given to Megala Multipurpose Dam for Myawaddy TS and Bilin Multipurpose Dam for Bilin TS as both TSs have the large potential for the agricultural development as described above.

Apart from these two multipurpose dams preliminarily proposed, the Department of Irrigation projects to develop the small/medium-scale 20 irrigation dams in the Southeast Myanmar are planned as stated above. These irrigation dams could expand the irrigable area by 137,600 acres, which corresponds to about 6.6 times of the present irrigable areas and would make a great contribution to increasing agricultural production. At the same time, the dams could be the precious water sources of the domestic water supply for Thanbyuzayat, Mudon, Bilin, Thaton and Kyaikto in particular. As these townships are located along the arterial roads which extend from the east-west and southern economic corridors, the economic activities in these townships would be promoted upon completion of the linkage of the economic corridors. For these reasons, the irrigation dam projects planned by the Department of Irrigation would also take a priority.

(6) Flood management

It would be difficult to introduce the projects for development of the large-scale flood mitigation structures to the Southeast Myanmar judging from the economic viabilities of the projects and the hydrological conditions of the river basins as described in the foregoing subsection. From this point of view, the non-structural flood mitigation projects would be given priority. Taking the present flood damage conditions into account, the primary target of the non-structural measures should be oriented to improvement of the flood forecasting and warning system, establishment/expansion of the flood shelters and the strengthening of the existing organization setup related to flood management.

4.1.10 Tentative list of possible programs and projects

The programs and projects for water resources development in the Southeast Myanmar are tentatively proposed as listed below. The list is still not comprehensive, and the inclusion in the list does not imply priority.

(1) Integrated river basin development and conservation program

As the first step to pursue the integrated river basin approach to water resources development and management in the Southeast Myanmar, the plans for the following river basins should be prepared and the priority of implementation established.

(a) Moei and Megala integrated river basin development and conservation including development of the Megala multipurpose dam,
(b) Megathat integrated river basin development and conservation including development of the Megathat multipurpose dam,
(c) Bilin integrated river basin development and conservation including development of the Bilin multipurpose dam and
(d) Yunzalin integrated river basin development and conservation including development of the Yunzalin multipurpose dam.

(2) Development for hydropower generation

The following projects for hydropower generation would be further examined for conditions to

implement, and may be implemented if an agreement is reached by all the stakeholders:

(a) JICA-Assistance-Projects for rehabilitation of the existing Hpapun mini-hydropower plant with the install capacity of 50 kW and Zinkyaik mini-hydropower plant with 64 kW
(b) The hydropower development projects for the Hazi dam with 1,360 MW on the Thanlwin River
(c) Development of the small scale hydropower generation for the rural electrification should be stage-wisely implemented including introduction of the pilot project supported by foreign aid, which may demonstrate the practical measure for the sustainable maintenance and operation of the power plants.

(3) Development of domestic water supply system in urban areas

The following short-term and the long-term projects would be implemented.

(a) The short-term project for expansion of the existing domestic water supply system in the urban centers as proposed as the JICA-assistance projects, and
(b) The long-term project for strengthening of the domestic water supply system to attain the 100% of coverage of the piped water distribution system and the clean water supply safe for drinking for all urban areas in Kayin and Mon States.

(4) Development of water supply system in rural areas

The plan formulation and implementation of the following projects would be undertaken for expansion of domestic and irrigation water supply in rural area as described.

(a) The stage-wise development projects for expansion of water sources such as tube-wells, shallow-wells and hand-dug wells, channel lining system for the source of spring water and the rain-fed pond for the rural areas in accordance with the mid-range strategy (2011/12 – 2015/16) and the long-term strategy (2016/17 – 2030/31),
(b) The projects for development of small-scale irrigation dams projected by the Ministry of Agriculture and Irrigation consisting of two dams in Kayin State and 18 dams in Mon State: some of the dams would be developed as multipurpose dams not only for irrigation but also for domestic water supply and mini-hydropower generation.
(c) The projects for diffusing of the simple filters for purifying of the raw water and the kits for water quality test for the domestic water supply.

(5) Program for capacity development on exploring of groundwater and construction of wells

A pilot project for capacity development on exploring of the groundwater and construction of dug wells and/or tube wells would need to be undertaken through the foreign technical/financial aid. The objective areas of the pilot project are provisionally proposed to be Paingkyon and Shanywarthit STSs taking the easy accessibility and the typical issues on the domestic water supply for the STSs into account, although they have to be finally selected based on the results of the detailed social survey.

The most likely counterpart for the pilot project by the foreign aid would be DRD. However, DRD has been just established in 2012 and therefore, it would be necessary to confirm whether or not DRD would possess the adequate human resources as the counterpart agency.

The pilot project would include the following major components.

(a) Procurement of drilling machines and their accessories together with guidance for operation and maintenance for them and,
(b) Model construction of the tube wells and the dug wells with covers together with technical transfer of knowledge on the maintenance and repair of the pumps.

(6) Projects for non-structural flood mitigation

The plan formulation and implementation of the following projects for the flood management would be undertaken for improvement for non-structural flood mitigation.

(a) Expansion of the key water level gauging stations for the FFW along the Thanlwin River and establishment of the new key water level gauging stations for the FFW along other major rivers including Gyaing River, Attran River and Bilin Rive,

(b) Establishment of new permanent flood shelters, which could be adapted to other public uses during the non-flood time and

(c) Institutional set up for the flood mitigation management with the primary concerns given to: (i) clarification of the roles and authorities for the members of the new regional committee for the flood management and (ii) strengthening of the man power for the Department of Relief and Resettlement.

4.2 Power Development

4.2.1 Overview of power development in Myanmar and Southeast Myanmar

(1) Power development in Myanmar

Power supply capacity in Myanmar increased rapidly even during the economic sanction by western countries from 1,171 MW in 2000/01 to 2,544 MW in 2009/10 at the average annual rate of 9.0% (Table 4.24). This is due mainly to the development of large scale hydropower plants supported by China. The share of hydropower in generating capacity increased from 30.7% with 360 MW to 65.0% with 1,654 MW during this period.

The total power generation in Myanmar increased from 5,117.6 million kWh in 2000/01 to 6,964.3 million kWh in 2009/10 at the annual average rate of 3.48% (Table 4.25). The increase rate is much lower for the total power generation than the generating capacity as the hydropower generation varies widely due to changes in flow rates of rivers. The share of hydropower in generated power increased from 37.0% with 1,891.9 million kWh in 2000/01 to 75.5% with 5,256.4 million kWh in 2009/10.

Major hydropower plants are located in upper streams of major rivers such as the Ayeyarwady and the Sittaung Rivers and their tributaries as well as the tributary of the Thanlwin River where the first hydropower plant in Myanmar was developed on Baruchan. Most thermal power plants are gas thermal developed during 1990's, while large scale hydropower plants were constructed. As natural gas has been diverted for export, gas thermal generating capacity has not increased much during 2000's, and generated energy by gas thermal has decreased steadily during this period.

To supply power from hydropower plants in the north to main demand centers along the southern coast including the Yangon metropolitan area, extensive power transmission networks have been developed. Supply reliability, however, is still low and frequent power blackouts are observed even in the Yangon metropolitan area. Power supply in remote periphery areas is much poorer than the coastal and central areas, and some border areas are often supplied with power from respective neighboring countries.

Table 4.24 Installed Capacity by Type of Power Generation in Myanmar, 2000/01-2009/10

(Unit: MW)

Year	Installed Power Generating Capacity by Type				Total Installed Capacity
	Thermal	Diesel	Hydro	Gas	
2000/01	216	65	360	530	1,171
2003/04	216	61	391	523	1,191
2004/05	195	60	746	561	1,562
2005/06	315	68	746	561	1,690
2006/07	285	70	771	558	1,684
2007/08	285	57	803	559	1,717
2008/09	285	55	947	559	1,848
2009/2010	285	55	1,654	550	2,544

Source: Statistical Yearbook 2010, Central Statistics Office

Table 4.25 Total Power Generation by Type in Myanmar, 2000/01- 2009/2010

(Unit: Million kWh)

Year	Electric Power Generated by Type				Total Electricity Generated
	Thermal	Diesel	Hydro	Gas	
2000/01	661.6	36.2	1,891.9	2,527.9	5,117.6
2003/04	634.3	31.5	2,074.8	2,685.3	5,425.9
2004/05	183.9	33.2	2,407.8	2,983.4	5.608.2
2005/06	631.9	33.4	3,000.8	2,398.1	6,064.2
2006/07	786.4	28.1	3,324.6	2,025.0	6,164.2
2007/08	854.7	33.6	3,618.5	1,891.2	6,398.0
2008/09	614.2	40.0	4,071.1	1,896.5	6,621.8
2009/10	473.4	29.6	5,256.4	1,205.0	6,964.3

Source: Statistical Yearbook 2010, Central Statistics Office

(2) Power development in Southeast Myanmar

Power supply in the Southeast Myanmar depends almost exclusively on power plants located outside the Southeast Myanmar. There exist 19 hydropower plants with the total installed capacity of 2,660 MW and 11 gas thermal plants with 715 MW in Myanmar as of April 2012 as shown in Table 4.26. Of these plants, only the Thaton gas thermal plant (51 MW) and the Mawlamyine gas thermal plant (12 MW) are located in the Southeast Myanmar. Hydropower plants located close to the Southeast Myanmar are Baruchan No. 1 and No. 2 in Kayah State, Paunglaung in Shan State, and Yanwe and Shwekyin in Bago Region. The Hlawga, Thaketa and Ahlone gas thermal plants are also relatively close to the Southeast Myanmar.

Electrification ratios are higher in rural areas of Kayin and Mon States than the national average, reflecting their location closer to the Baruchan hydropower plants in Kayah State. The overall electrification ratio, however, is about 26% in the Southeast Myanmar lower than the national average of 31%. Based on the electrified population, the total power demand in the Southeast Myanmar is roughly estimated to be 120 MW, corresponding only to less than 5% of the total power demand of 2,544 MW in Myanmar in 2009/10 (Box 4.1).

Table 4.26 Existing Power Plants in Myanmar (as of April 2012)

No.	Name of Plant	Type	Installed Capacity (MW)	No.	Name of Plant	Type	Installed Capacity (MW)
1	Tapein (1)	Hydro	240	16	Shwekyin	Hydro	75
2	Shweli	Hydro	600	17	Zaungtu	Hydro	20
3	Thapenzeik	Hydro	30	18	Kun	Hydro	60
4	Sedawgyi	Hydro	25	19	Kyee Own Kyee Wa	Hydro	74
5	Yeywa	Hydro	790	20	Tikyit	Coal	120
6	Zaw Gyi (2)	Hydro	12	21	Kyunvhaung	Gas	54.3
7	Zaw Gyi (1)	Hydro	18	22	Mann	Gas	36.9
8	Kinda	Hydro	56	23	Shwedaung	Gas	55.4
9	Keng Tang	Hydro	54	24	Myan Aung	Gas	34.7
10	Mone	Hydro	75	25	Hlawga	Gas	154.2
11	Baluchaung (1)	Hydro	28	26	Thaketa	Gas	92
12	Baluchaung (2)	Hydro	168	27	Ywama	Gas	70.3
13	Paunglaung	Hydro	280	28	Ahlone	Gas	154.2
14	Khapaung	Hydro	30	29	Thaton	Gas	51.1
15	Yenwe	Hydro	25	30	Mawlamyine	Gas	12

Source: Data provided by MOEP (2) and hearing from MOEP (1)

Box 4.1: Crude Estimate of Peak Power Demand in Southeast Myanmar and Myanmar

To clarify the position of the Southeast Myanmar in power supply and consumption as compared with the average in Myanmar, peak power demand is roughly estimated for the Southeast Myanmar and Myanmar based on the population data and electrification ratios in urban and rural areas. Data and calculation are summarized in Table 4.25.

Table 4.27 Crude Estimate of Peak Power Demand in Southeast Myanmar and Myanmar, 2009

		Myanmar	Kayin	Mon
Population	Urban	11,870,414	220,342	484,613
	Rural	35,864,866	1,167,804	1,595,251
	Total	47,735,280	1,388,146	2,079,864
Electrification ratio (%)	Urban	71.6	57.6	28.8
	Rural	17.7	20.1	25.2
Population with access to power	Urban	8,499,000	126,900	139,600
	Rural	6,348,000	234,700	402,000
Calculated peak power demand (MW)		2,547	48.9	68.1
Total installed power generating capacity (MW)		2,544		

Source: JICA Study Team

In Table 4.27, the population having access to electricity was multiplied by unit power demand of 200W per capita in urban area (225 W per capita in Yangon urban area) and 100 W per capita in rural area to calculate the crude estimates of power demand. As calculated, the total peak demand of electricity in the Southeast Myanmar is 117 MW, corresponding to 4.6% of the total installed generating capacity in Myanmar. This ratio is much smaller than the population share of the Southeast Myanmar, indicating deprived power supply situation in the Southeast Myanmar.

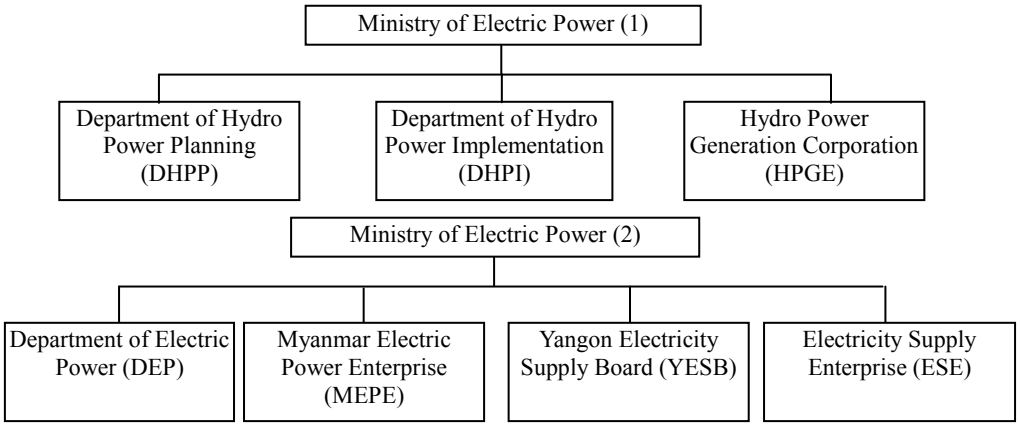
4.2.2 Administration for power development and management

(1) Myanmar administration for power development and management

To administer the power and energy sector in Myanmar, the Union Government had the Ministry of Energy (MOE), Ministry of Electric Power No. 1 (MOEP (1)), and Ministry of Electric Power No. 2 (MOEP (2)). The latter two ministries unified in September 2012 into a new Ministry of Electric Power. Former organizational structure of MOEP (1) and MOEP (2) are shown in Figure 4.12. MOE is in charge of development, export and import, and domestic supply of petroleum and natural gas resources.

As shown in Figure 4.12, hydropower development is planned by DHPP and implemented by DHPI formally of MOEP (1). Hydro Power Generation Corporation (HPGC) formally under MOEP (1) is responsible for operation of hydropower and coal thermal power plants. Under MOEP (2), Yangon Electricity Supply Board (YESB) is in charge of power distribution in the Yangon region, and Electricity Supply Enterprise (ESE) is responsible for power supply in other areas. Myanmar Electric Power Enterprise (MEPE) formally under MOEP (2) is responsible only for operation of thermal power plants and transmission system of the national grid.

Electricity tariff in Myanmar was revised in 2012. Unit electricity rate is now 35 kyat/kWh for household uses, and 75 kyat/kWh for industrial and commercial uses. For electricity imported from Thailand, ESE cannot administer the Myanmar tariff and the Thai tariff is applied at 6 Thai baht/kWh, considerably higher than the rates in Myanmar.



Source: Ministry of Electric Power

Figure 4.12 Organizational Structure of Former Ministry of Electric Power (1) and (2)

(2) Organizational structure of ESE in Southeast Myanmar

Kayin and Mon States have respective ESE offices at the state level administered by the ESE head office in Naypyitaw under MOEP. Under each ESE state office, district ESE and township ESE exist for power supply operation at each administrative level.

4.2.3 Existing power supply system in Southeast Myanmar

(1) Grid power supply

As described above, there exist no major power plants operating in the Southeast Myanmar. Power supply in the Region relies mainly on the single circuit power transmission line of 230 kV from the Kamarnat substation in Bago State to the Thaton substation in Mon State. From the Thaton substation, a 66 kV transmission line extends to Hpaan as the only supply line from the national grid serving Kayin State. The only major substation in Kayin State is in Hpaan with 66/11 kV capacity.

From Hpaan, a 66 kV transmission line extends to Mawlamyine. In parallel with this transmission line, a distribution line extends to the border with Mon State. A new 230 kV transmission line has been completed recently from Thaton to Mawlamyine by Hpaan together with a new 230/66 kV substation in Mawlamyine.

(2) Power supply in Kayin State

From the grid power supply system linked to the Kamarnat substation through Thaton, only areas around Hpaan are served with electricity. Hlaingbwe is served by an 11 kV distribution line from Hpaan. Also from Hpaan, distribution lines extend to Myaingkalay on the opposite side of the Thanlwin River, and two cement plants. A new 66 kV transmission line has been completed from the Hpaan substation to serve the Hpaan industrial estate.

In the northern part on Kayin State, the Taungoo substation in Bago State on the 230 kV trunk transmission line extends distribution lines to serve Thandaung and Thandaunggyi. In addition, 10 townships in Kayin State have been electrified by independent diesel generators; i.e. Leiktho, Bawgali, Hpapun, Kyaikdon, Kyainseikgyi, Kamamaung, Myainggyingu, Paingkyon, Kyundo and Kawkareik.

(3) Power supply in Mon State

Power supply system in Mon State had been supported mostly by the Thaton 230 kV substation and

the Mawlamyine 66 kV substation with transmission and distribution lines. A new 230 kV transmission line from Thaton to Mawlamyine has been just completed together with a new 230/66 kV substation at Mawlamyine. A 33 kV transmission line extends from Mawlamyine to serve Mudon and Thanbyuzayat. In addition, six townships have been electrified by independent diesel generators; i.e. Chaungzon, Ye, Zeehphuthaung, Lamaing, Khawzar and Katoe. Chaungzon on the Bilu island located at the mouth of Thanlwin River is served by three diesel generating units with the total capacity of 1,458 kVA.

4.2.4 Power development plans and projects in Southeast Myanmar

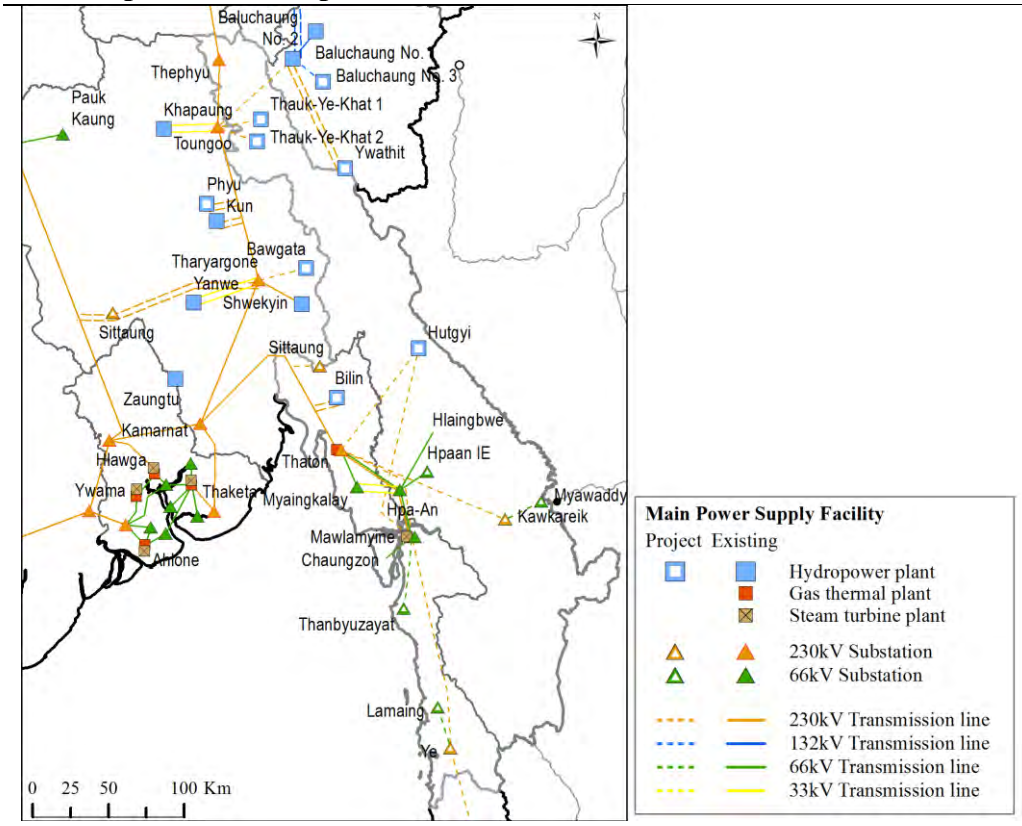
A new 66kV transmission line from Mawlamyine to Thanbyuzayat is expected to be constructed in the near future. Also, a 230 kV transmission line from Mawlamyine to Ye is planned to be constructed during 2014-15 together with a new 23 0kV substation. Further extension of transmission line from Ye to Lamaing is planned to follow, but no definite schedule has been set. Another 66 kV transmission line is planned from Mawlamyine to serve Chaungzon.

In Kayin State, a new 230 kV transmission line is planned from Thaton to Kawkareik, and another 66kV transmission line is planned from Kawkareik to Myawaddy. These transmission lines and associated substations are not included in the list of ongoing and planned transmission lines and substations prepared by former MOEP (2), and thus no definite schedule has been determined for these lines.

Possibilities are discussed to extend a 66 kV transmission line from Mawlamyine to Kawkareik and a 33 kV distribution line from Kawkareik to Myawaddy to serve neighboring areas with 11 kV distribution lines, but no definite plan exists for these.

Kayin State has high hydropower potentials on the Thanlwin River and its tributaries, and the Hazi hydropower plant (1,200 MW) and the Bilin hydropower plant (200 MW) have been planned. The Hazi hydropower is planned to be transmitted to Mawlamyine and Kawkareik by a 230 kV transmission line to be newly constructed. These major hydropower plants are planned to be integrated into the national grid, and therefore planned and implemented by DHPP and DHPI former of MOEP (1). For the Hazi hydropower, joint development by former MOEP (1) and EGAT of Thailand was discussed, and the generated power may be mostly exported to Thailand.

The power development plans and major projects are shown in Figure 4.13.



Source: JICA Study Team

Figure 4.13 Power Development Plans and Major Projects in the Southeast Myanmar

4.2.5 Planning for power supply in Southeast Myanmar

(1) Zoning for power supply planning

Development of power supply system in Kayin State may be effectively planned by supply zone as follows:

(a) Northern zone served from the 230/33 kV Taungoo substation to cover Thandaunggyi, Thandaung, Leiktho, Bawgali and neighboring areas,
(b) North central zone centering around Hpapun served by an independent system initially and by a transmission line from the Hazi hydropower in the future;
(c) Central zone to be served from the Hlaingbwe substation after the strengthening of the Hpaan – Hlaingbwe power supply link covering Kamamaung, Myainggyingu, Paingkyon, Shanywarthit and neighboring areas;
(d) East-west economic corridor zone covering Myawaddy, Kawkareik, Hpaan and other towns and neighboring areas;
(e) Southern zone to be served from the substation at Mudon or Thanbyuzayat in Mon State after the strengthening of the power supply system for southern part of the State; and
(f) Southern border zone to be served in association with the major artery road development linking Thailand through Hpayarthonesu to Thanbyuzayat.

Development of power supply system in Mon State may be effectively planned by supply zone as follows:

(a) Northern zone up to the mouth of the Thanlwin River served by the 230 kV Thaton substation linked from the Kamarnat substation in Bago Region;

(b) Central zone served from the 66/33/11 kV substation linked from the 230/66 kV substation both at Mawlamyine by 33 kV and 11 kV distribution lines and to be served also from the 66/33 kV substation at Thanbyuzayat in the future;
(c) Chaungzon zone to be served by the 66 kV transmission line from the Mawlamyine 230/66 kV substation with 33 kV and 11 kV distribution lines; and
(d) Southern zone to be served from the 230 kV substation to be newly established at Ye linked from the Mawlamyine 230/66 kV substation with 33 kV and 11 kV distribution lines.

(2) Issues for power supply development in the Southeast Myanmar

Main issues identified for power supply development in the Southeast Myanmar are described.

1) Strengthening power supply along artery roads to improve conditions for industrial location

The Southeast Myanmar has a potential advantage for industrial location as it is located along the east-west economic corridor in the Southeast Asia identified by ADB. As a prerequisite to realizing the potential, infrastructure along the corridor needs to be much improved. Power supply is to be much improved together with roads, water supply, telecommunications and other infrastructure facilities.

Infrastructure along other artery roads should also be improved including a proposed alternative to the southern economic corridor linking Hpayarthonesu and Thanbyuzayat. In view of very limited coverage at present by the national grid power supply, realistic phasing should be planned for stage-wise improvement of power supply to serve different areas along the corridors and other artery roads. Priority may be placed on the ongoing industrial estates in Hpaan and Myawaddy, followed by other selected areas.

2) Improving power supply associated with grid extension

The grid extension of power supply to major development areas including industrial estates should be effectively utilized to improve the power supply in small towns and rural areas along the corridors and other artery roads. Service areas for power supply should be defined in consideration of economic relationships between major demand centers and their respective catchment areas.

An example is to cover such an area supplying primary raw materials such as agricultural products for processing industries in a major demand center through distribution centers in small towns. This would help to strengthen the economic linkages between the major demand center and its hinterland, and facilitate the establishment of an industrial cluster encompassing all the related economic activities in a major urban center, small towns and rural areas.

3) Establishing generating capacity within the Region and interlinking transmission lines

The national grid of power supply in Myanmar is supported mainly by hydropower and gas turbine generators interlinked by transmission lines network. Most generating plants are located in the northern part of the Country and along the coastal areas around the Yangon metropolitan area, and there exists no major power plants operating in the Southeast Myanmar. It is desirable that generating capacity is increased in the Southeast Myanmar not only to improve the power supply within the Region but also to enhance the supply reliability of the national grid as a whole.

Other than the major hydropower development, i.e. Hazi hydropower plant (1,200 MW) and the Bilin hydropower plant (200 MW), opportunities for hydropower generation in the Southeast Myanmar are limited. Small scale hydropower development may be pursued for household electrification in rural areas and small towns. Installation of a power generating barge as proposed may deserve serious consideration. Possibilities for renewable energy development such as solar and wind power are also suggested, but local conditions should be carefully examined.

4) Rural electrification

Electrification ratios are low in Kayin and Mon States particularly in rural areas and small towns. Larger towns are served by independent diesel generating units respectively. Most rural areas and small towns will have to continue relying on independent power supply systems in the foreseeable future. Supply capacities, however, will have to be expanded and existing generating facilities renewed once in a while. When the new facilities are installed in small towns, provision should be made for increasing service population covering respective hinterland rural areas.

5) Promotion of renewable energy

Renewable energy sources may offer options for electrification of remote rural areas. It is reported that ESE has a plan to install wind power generators in the area between Myawaddy and Kawkareik with the total generating capacity of 1,000 MW. This implies that some 500 generating units may be installed each having the maximum generating capacity of 1.7 MW. The viability of such a large scale wind power generation should be examined carefully not only from technical but also from environmental points of view.

Introduction of solar power generation in the Southeast Myanmar may be constrained by the long rainy season with very limited sunshine period. Seasonal use of solar power may be possible for pumping water for irrigation during the dry season. Opportunities for small and mini hydropower should be investigated in remote areas. Also, complementary development of small hydropower and renewable energy in combination with independent diesel generators may be examined to expand the service coverage effectively in remote rural areas.

(3) Power supply planning for settlement areas

1) Existing situations and plans

- Wawlay

Wawlay STS has not been electrified, but a plan exists to extend a distribution line from Myawaddy or Thailand. The latter may be realized in the near future through negotiation with the Thai side. Alternatively, Wawlay may be served by an independent diesel generator to be installed by ESE. In the latter case, a unit of 100 kVA would be commonly established.

- Sukali

Sukali STS is also an un-electrified STS, although a small diesel generator exists in the STS. It will be electrified with a 100 kVA diesel generator initially.

➢ Paingkyon

The town center of Paingkyon township (TS) has been electrified with a 80 kVA diesel generator. Power supply, however, is limited only to 2.5 hours supply daily. Renewal of diesel generator is proposed, and the supply capacity may be increased to serve neighboring areas as well. Extension of distribution line from Hlaingbwe is conceived in the near future. Also, potential exists for 25 MW hydropower development utilizing falls, which may be examined by MOEP (1). The Paingkyon hospital with 16 beds is powered by a solar system.

➢ Shanywarthit

Shanywarthit STS has not been electrified, except very small generating units, including micro-hydro with smaller than 5 kW, mainly for lighting. Extension of distribution line from Hlaingbwe is conceived in the near future. Alternatively, an independent diesel generating unit may be installed to serve the existing residents and returnees.

➢ Leiktho

The town center of Leiktho township (TS) is served by ESE with an independent diesel unit. Power supply, however, is limited to 2.5 hours a day during evening. Planned settlement areas are located far from the TS center, and no plan has been prepared to supply electricity there. When extension of 33 kV distribution line as planned by ESE is implemented, service area should be expanded to cover the planned settlement areas.

➢ Bawgali

The town center of the Bawgali TS is supplied with power by a 100 kVA diesel generator, covering about 100 households or about one-third of all the households. The supply is only from 6:00 to 9:30 in the evening. The new hydropower plant on the Thaukyegat river supplies to the national grid through a 11 kV sub-station. The Bawgali STS is expected to be connected to the grid in the future. There exist a hydropower potential of 25 kW between Bawgali and the Pyaungtho village.

2) Planning for power supply in settlement areas

Of the six areas designated for settlement of returned refugees and IDPs, only Wawlay has a definite plan to extend power supply from the existing supply system. Power line extension from the Thai supply system will be undertaken by the private supplier through negotiation, and thus ESE will not administer this supply. To ensure supply reliability, installation of an independent diesel generator or power line extension from Myawaddy may be preferable. The latter option should make provision for further extension of supply line to Sukali and its surrounding settlement areas in the future.

For the other five settlement areas, installation or renewal of diesel generating units are planned by ESE. In planning for the installation of new generating units at Sukali and Shanywarthit and the renewal of generating units for Leiktho, Bawgali and Paingkyon, provision should be made for power supply to the planned settlement areas respectively, depending on the expected progress of returns of refugees and IDPs.

For Leiktho, an alternative is to extend a distribution line from Taungoo as planned by ESE, which will facilitate the power supply to the planned settlement area. This extension should be planned to accommodate a 11 kV distribution line, 11 kV/400 V transformer and 400 V distribution lines for the settlement. For Paingkyon and Shanywarthit, the extension of 66 kV distribution line from

Hpaan will facilitate the 33 kV distribution lines extension to these STSs to serve the respective settlement areas in the future.

An important option to consider for power supply in the remote settlement areas is to combine diesel generation with renewable energy. In particular, mini hydro power and solar energy may be effectively used in combination with diesel generation for different purposes, respectively. As the installation of such hybrid systems usually results in higher construction costs, distribution of demand should be carefully examined in planning for such systems. Mini hydro may be easily utilized for household electrification, while the use of solar energy may be limited to seasonal irrigation and other supplemental uses. In case where multiple power sources are linked into a supply system, operation and management should also be examined carefully.

4.2.6 Tentative list of possible programs and projects

Possible programs and projects for power development in the Southeast Myanmar are tentatively listed below. The list is not comprehensive, and the inclusion in the list does not imply priority.

(1) National grid extension program

Extension of the following transmission lines are planned or conceived together with associated installation of sub-stations.

1.1 Mawlamyine – Thanbyuzayat transmission line extension (66 kV)
1.2 Mawlamyine – Ye transmission line extension (230 kV)
1.3 Mawlamyine – Chaungzon transmission line extension (66 kV)
1.4 Thaton – Kawkareik transmission line extension (230 kV)
1.5 Kawkareik – Myawaddy transmission line extension (66 kV)
1.6 Hpaan – Hlaingbwe transmission line extension (66 kV)

(2) Rural electrification program

The following projects have been proposed by implementing agencies to expand power supply to rural areas and small towns.

2.1 Installation/renewal of diesel generators in Kayin State
2.2 Taungoo – Leiktho distribution line extension (33 kV)
2.3 Distribution lines (33 kV) extension from Hlaingbwe (Myainggyingu etc.)
2.4 Distribution lines (33 kV) extension from Ye (Lamie etc.)
2.5 Installation/renewal of diesel generators in Mon State
2.6 Mudon – Kyainseikgyi distribution line extension (33 kV)

(3) Power generating capacity expansion program

The following projects have been planned for implementation in the short, medium and long terms.

3.1 Hazi hydropower development (1,200 MW)
3.2 Bilin hydropower development (200 MW)
3.3 Hpapun small hydro power renovation
3.4 Power barge installation on Thanlwin River
3.5 Megala River small hydro power development

(4) Renewable energy program

4.1 Hybrid power supply system development with renewable energy
4.2 Mini hydro power development
4.3 Solar energy development

4.3 Roads and Bridges

4.3.1 Road sector overview

(1) Road network in Myanmar

In respect to the importance of road network development for national integration and socio-economic development, the Ministry of Construction of the Union Government extended the road length from 22,725 km in 1998 to 29,788 km in 2000. As Myanmar joined ASEAN in 1997, the Union Government formulated a 30 year plan to adapt existing roads and bridges for the ASEAN standards and made budget allocation accordingly from the fiscal year 2001.

Of the 30 year plan from 2001, the first five year plan completed in 2005 and the second five year plan in 2010. The length of asphalt pavement exceeded the planned target during the second five year plan period. This owes much to introduction of the build, operate and transfer (BOT) scheme.

After the completion of the second five year plan, the Union Government reviewed targets for the third five year plan starting in 2011. The Union Government set the objectives to be achieved by the end of the sixth five year plan that will be the final phase of the 30 year plan, as follows:

(a) To develop international artery roads linking to other ASEAN countries by applying the ASEAN standards, and
(b) To improve the network of Union highways to connect between States and Regions.

Sections of the Union highways that will be widened from 12 feet for one lane to 24 feet for two lanes with asphalt pavement were specified in the third five year plan as listed in Table 4.28.

Table 4.28 Sections of Union Highways to Be Improved by 2015

Name of Highway	Length (km)	Budged Needed (million kyat)
1. AH-1. Myawaddy - Hpaan - Taungoo - Mandalay – Tamu	1,475	1,834,893
2. AH-2. Tachileik - Kyaingtong - Taunggyi – Meiktila	800	76,114
3. AH-14. Mandalay - Lashio - Hseni - Kutkai – Muse	474	11,417
4. AH-111. Loilen - Lelcher - Pankaytu – Thibaw	240	28,383
5. AH-112. Thaton - Mawlamyine - Ye - Dawei - Myeik - Kawthoung	1,115	124,867
6. Laynyar - Thai border (Princess Valley)	141	19,748
Total	4,245	2,095,422

Source: Public Works Department

(2) Road network in Southeast Myanmar

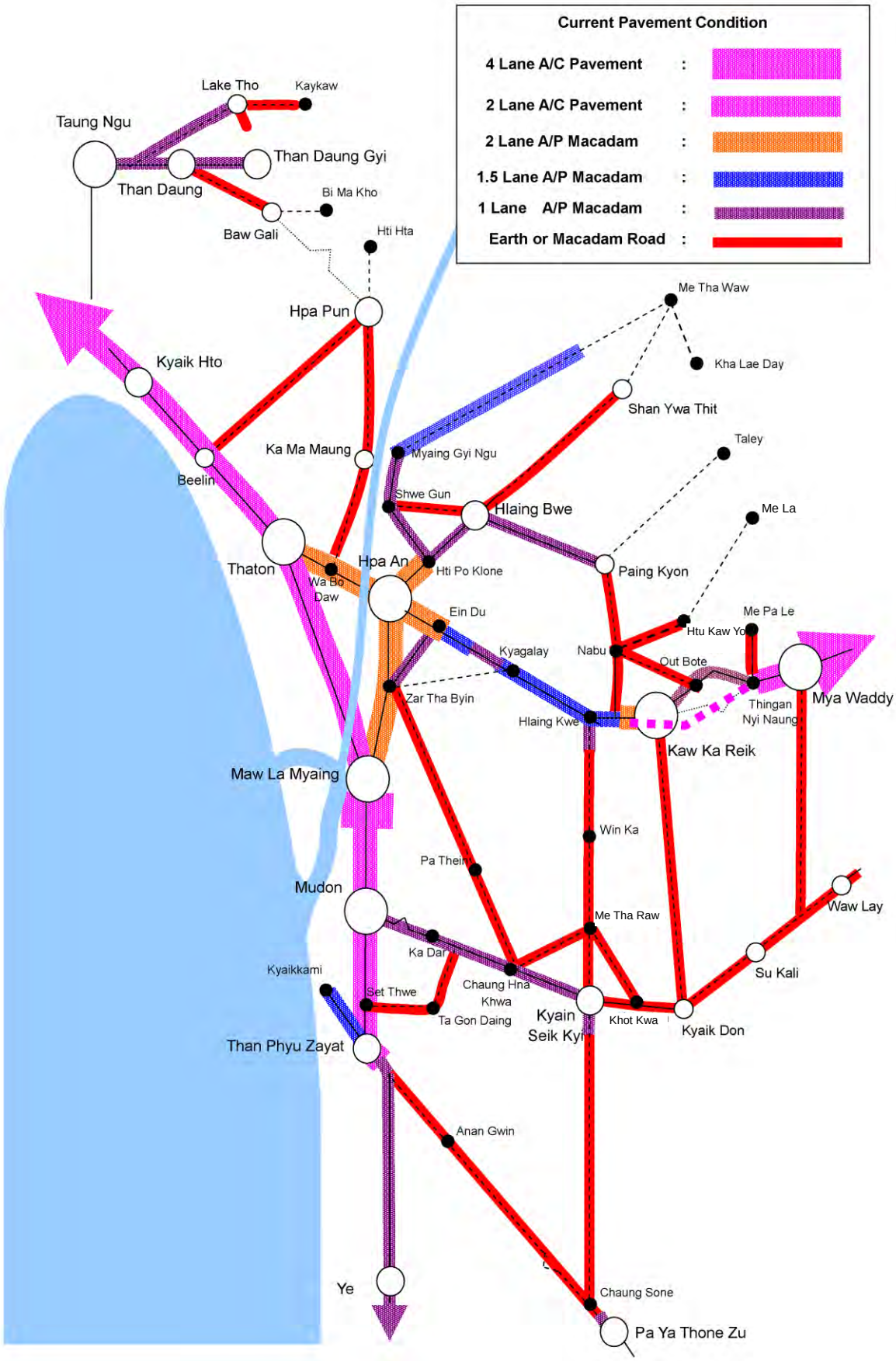
Road network in Kayin and Mon States will be improved as part of the Union highways improvement as described above. The third five year specified the sections of the Union highways to be improved from 12 feet for one lane to 24 feet for two lanes in the two states until 2015 as listed in Table 4.29.

Table 4.29 Sections of Union Highways in Kayin and Mon States to Be Improved by 2015

Name of Highway	Length (km)	Budged Needed (million kyat)
1) Thaton（Mon State） - Hpaan - Kawkareik - Myawaddy	218	15,014
2) Hpaan - Kamamaung	93	7,524
3) Mudon（Mon State） - Myawaddy	95	5,905
4) Kawkareik - Metharaw - Khotkwa	24	3,919

Source: Public Works Department

Existing road network in the Southeast Myanmar and its pavement conditions are illustrated in Figure 4.14.



Source: JICA Study Team

Figure 4.14 Existing Road Network and Pavement Conditions in Southeast Myanmar

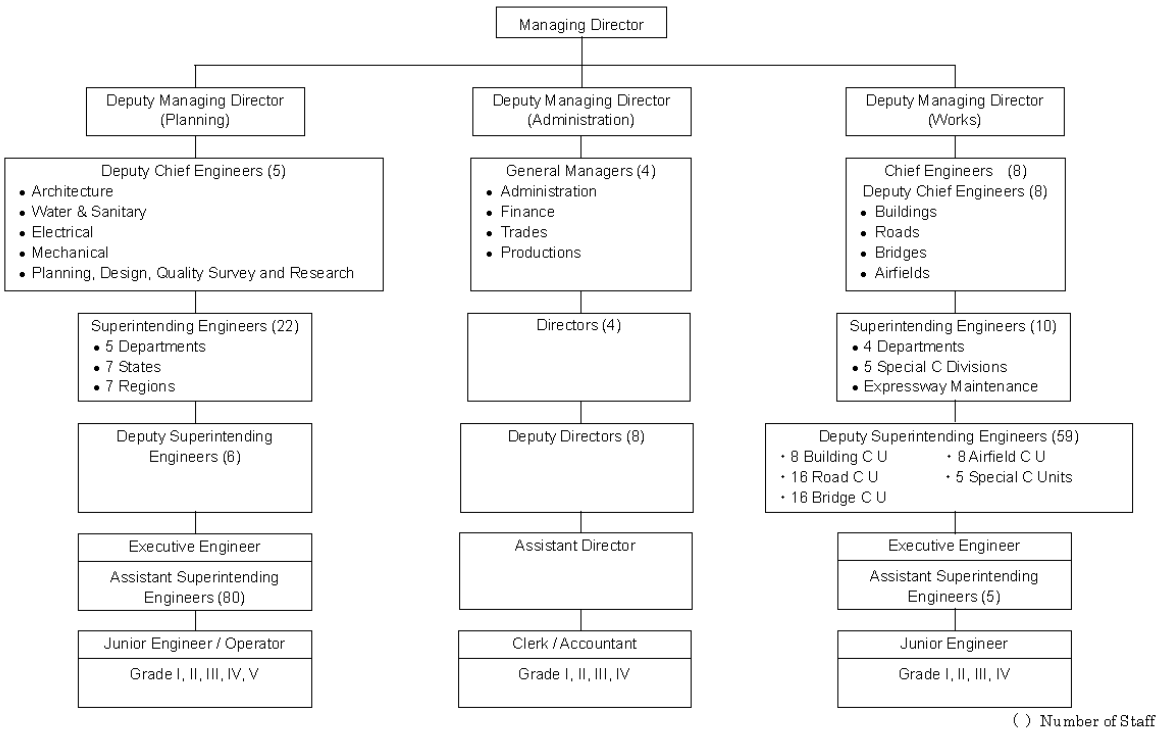
4.3.2 Administration for road development and management

(1) Road administration in Myanmar

The Public Works Department (PWD) under the Ministry of Construction is in charge of development, maintenance and management of main roads in Myanmar. Road development in border areas and areas where security conditions are unstable is undertaken by the Union Army Corp of Engineers and NATALA of the Ministry of Border Areas. City roads in large cities such as Yangon are responsibilities to respective City Development Committee, and access roads in rural areas are under the jurisdiction of the Department of Rural Development (DRD) of the Ministry of Border Areas.

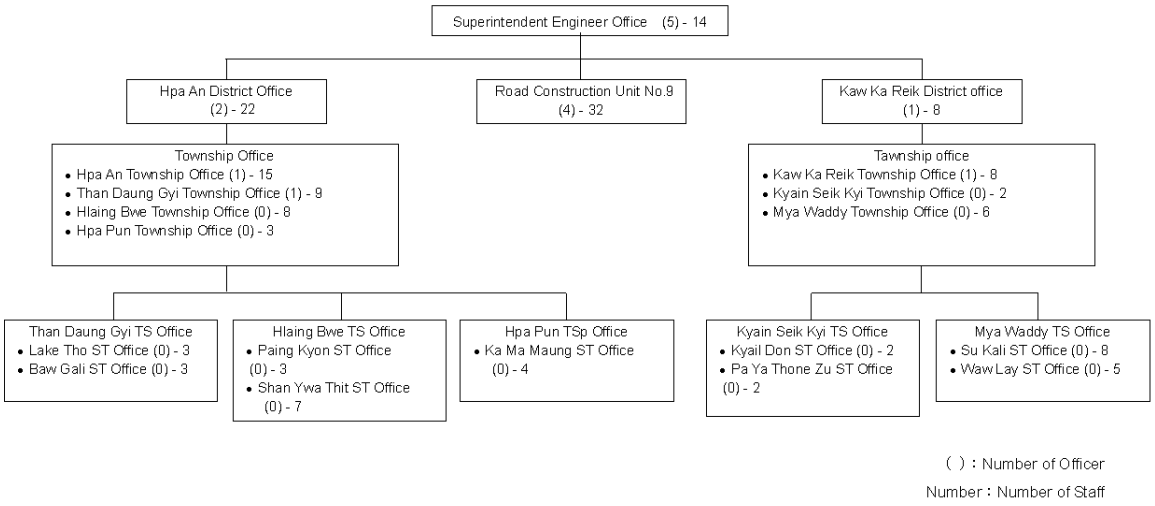
(2) Organization of Public Works Department

Planning and design of roads and bridges are undertaken by the PWD in Naypyitaw, and construction works are responsibilities to the PWDs of the local governments in respective states and regions. An organization chart of the PWD in Naypyitaw is shown in Figure 4.15. Organization charts of the PWD in Kayin and Mon States are shown in Figure 4.16 and Figure 4.17, respectively.



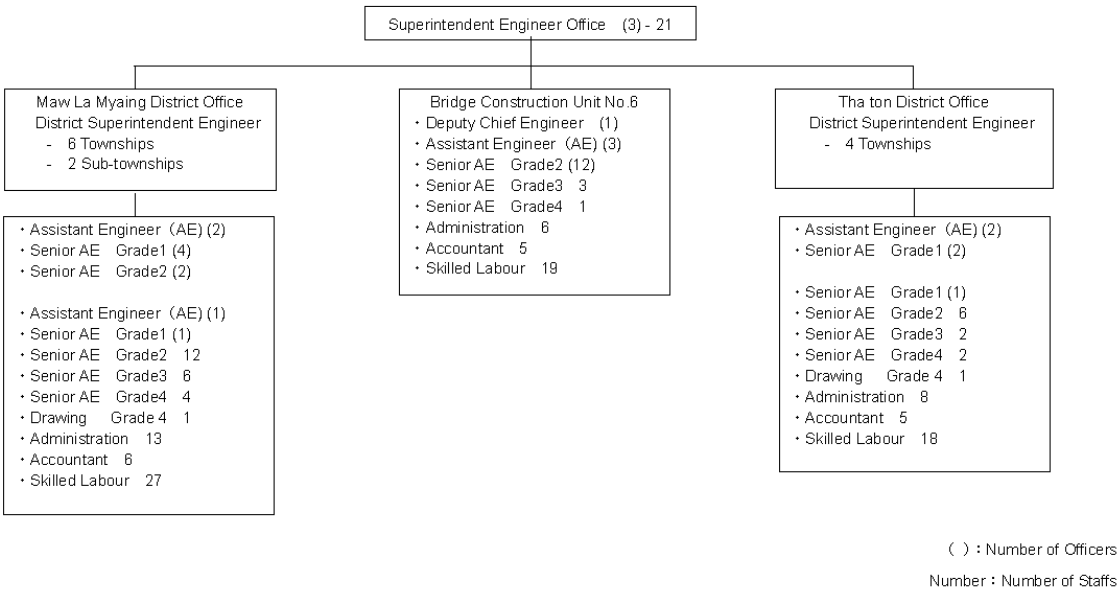
Source: Public Works Department

Figure 4.15 Organization Chart of Public Works Department in Naypyitaw



Source: Public Works Department

Figure 4.16 Organization Chart of Public Works Department in Kayin State



Source: Public Works Department

Figure 4.17 Organization Chart of Public Works Department in Mon State

4.3.3 Issues in the road sector of Southeast Myanmar

(1) Issues related to road network

The road network in the Southeast Myanmar has been developed centering on the roads linking urban centers along the coast in Mon State, and the roads passing through Kayin State to link to the border with Thailand. As shown in Figure 4.14, main roads in the Region are the Kyaikto – Mawlamyine – Thanbyuzayat road developed as a paved road with two or more lanes, and the Thaton – Hpaan – Myawaddy road developed as a paved road with 1.5-2 lanes.

Other roads are currently mostly earth roads, most of which are not passable during the five month long rainy season. Delay in improvement of these roads is due to the fact that security conditions were not stable in this ethnic peoples' region as well as the lack of budget by the PWD. As security

conditions are improved, acceleration of road improvement is expected in the Region.

Another important issue related to the road network in the Southeast Myanmar is lack of effective road links between the northern part and the central areas of the Region. For integrated development of Kayin State and the Southeast Myanmar as a whole, these two areas should be connected by roads passable by cars for all the seasons. Since the area linking these two areas, however, used to be severe fighting ground and the security is still unstable. Therefore, careful approach is required for road projects in this area.

(2) Issues related to road structure

Bridges along the artery roads have small load allowance, and become bottlenecks of traffic. The load capacity of bridges along artery roads recently constructed has been set at 60 ton, but many existing bridges have capacity smaller than this standard. The Naunglong bridge along the Hpaan – Myawaddy roads constructed during 1970s has the load capacity of 13 ton, and its piers have subsided, causing dangerous situation. Most state roads have temporary Bailey bridges, which have usually load capacity of 13 ton to prevent safe passage of heavy vehicles.

Other bottlenecks include inadequate drainage structures crossing roads. In areas where pipe or box culverts are not installed, river crossing becomes impossible during the rainy season, while during the dry season, level crossing on river beds may be possible for small rivers and creeks.

(3) Issue related to public transport

Due to the problems with road structure mentioned above, public transport has not been developed in the Southeast Myanmar except on the main roads such as the Kyaikto – Mawlamyine – Thanbyuzayat road and the Thaton – Myawaddy road. People making access to the central part of the Region from areas along the main roads utilize joint passenger vehicles such as pick-up trucks during the dry season. During the rainy season, when those roads become impassable, river navigation by small boats is used for transportation. Transport between villages is mostly by taxis using motorbikes.

4.3.4 Road development plan for Southeast Myanmar

(1) Functional classification of roads

There exist different ways of road classification as follows:

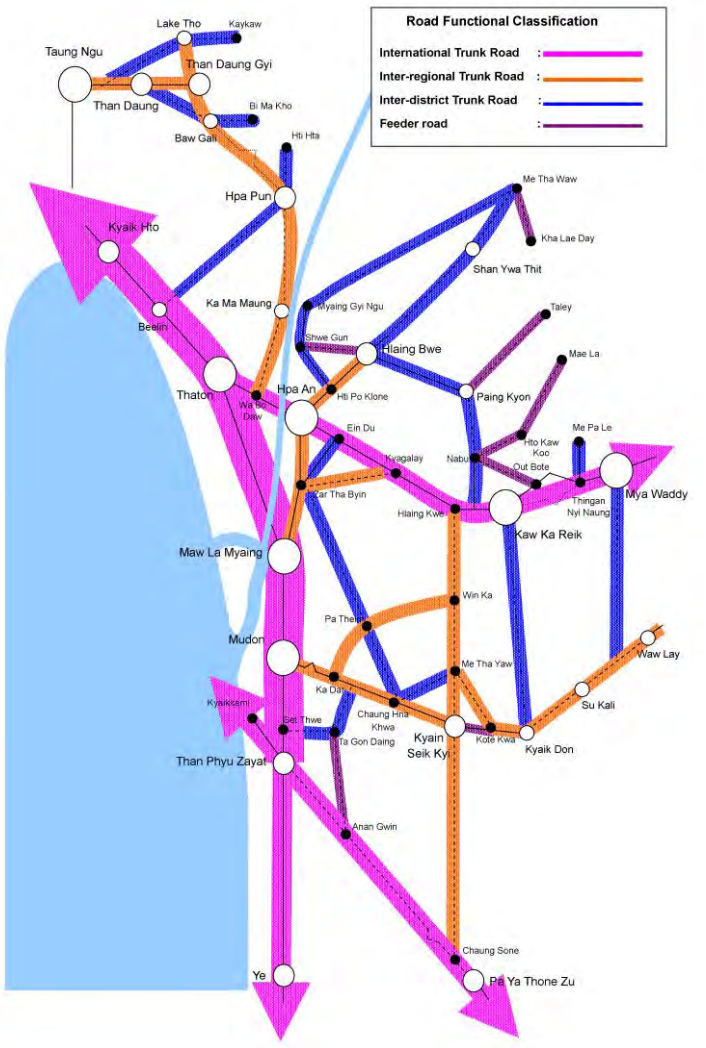
(a) Classification by administration such as national, state and private roads,
(b) Classification by road structure and conditions such as paved, gravel and earth roads, and
(c) Classification by road functions such as artery, feeder and access roads.

Of these, most important in road network planning is functional classification of roads. Functional road classification indicates not only hierarchical structure of roads but also roles and importance of roads having different functions. In planning for road network development and road maintenance and management, functional classification of roads needs to be conducted. Table 4.30 summarizes the functional classification of roads in Myanmar to be used in the present study. Results of the road classification applied to roads in the Southeast Myanmar are shown in Figure 4.18.

Table 4.30 Functional Classification of Roads in Myanmar

	Functional Classification	General Functional Assignment	Classification by MOC
1	International Trunk Road	Road that links major international cities and caters to international cargos and passengers	International Union Highway
2	Inter-Region Trunk Road	Road that links major regional centers and caters to domestic cargo and passengers.	Main Union Highway (Roads among States and Regions)
3	Inter-District Road	Road that links district centers and caters to regional cargos and passengers	Other Union Highway (Roads among Districts)
4	Feeder Road	Roads that link villages and district centers and connect to upper class roads	Roads among Townships Roads for Connecting Villages

Source: JICA Study Team



Source: JICA Study Team

Figure 4.18 Functional Classification of Roads in Southeast Myanmar

(2) Proposed road network in Southeast Myanmar

In planning for road development in Kayin and Mon States, consistency must be ensured with the regional development plan in the present study and the 30 year plan by the Ministry of Construction. The regional development plan aims at the year 2030, but a road network in the short and medium terms is also conceived to clarify staged development of the network.

The Ministry of Construction clarified to the JICA Study Team ideas built in the 30 year plan as summarized in Box 4.2. This will be reflected in the planning for the road network development in the Southeast Myanmar.

Box 4.2

The Ministry of Construction clarified in the 30 year plan the need for development of roads and bridges for the long term development of Myanmar. When the 30 year plan will be completed, all the international artery roads will be AC paved, having four lanes with 48 feet width, and major Union highways will be AC paved, having two lanes with 24 feet width. Other Union highways will be macadam paved, having single lane with 12 feet width. All the bridges on respective roads will be widened and improved along with the roads.

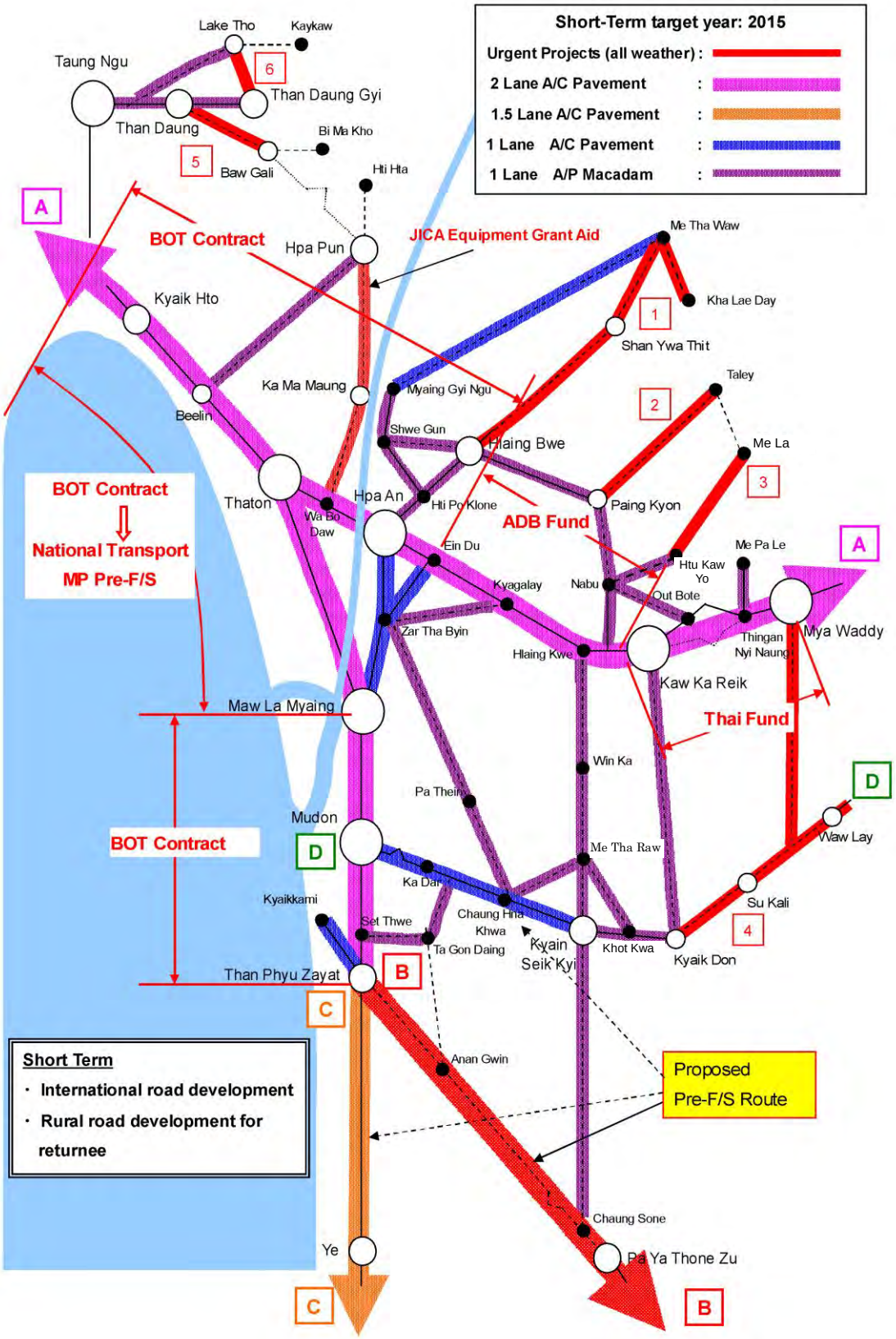
Figure 4.19 shows the proposed road network in the long term until 2035, though the road network in the medium and short terms is shown in Figure 4.20 and Figure 4.21, respectively. The short term network includes on-going projects and projects to be implemented in the near future. The medium term network covers the routes to be established, when the Kyaikkhami regional port will start operation.

Source: JICA Study Team

Figure 4.19 Long Term Development of Road Network in Southeast Myanmar (2035)

Source: JICA Study Team

Figure 4.20 Medium Term Development of Road Network in Southeast Myanmar (2025)



Source: JICA Study Team

Figure 4.21 Short Term Development of Road Network in Southeast Myanmar with On-going and Planned Projects (2015)

4.3.5 Tentative list of possible projects

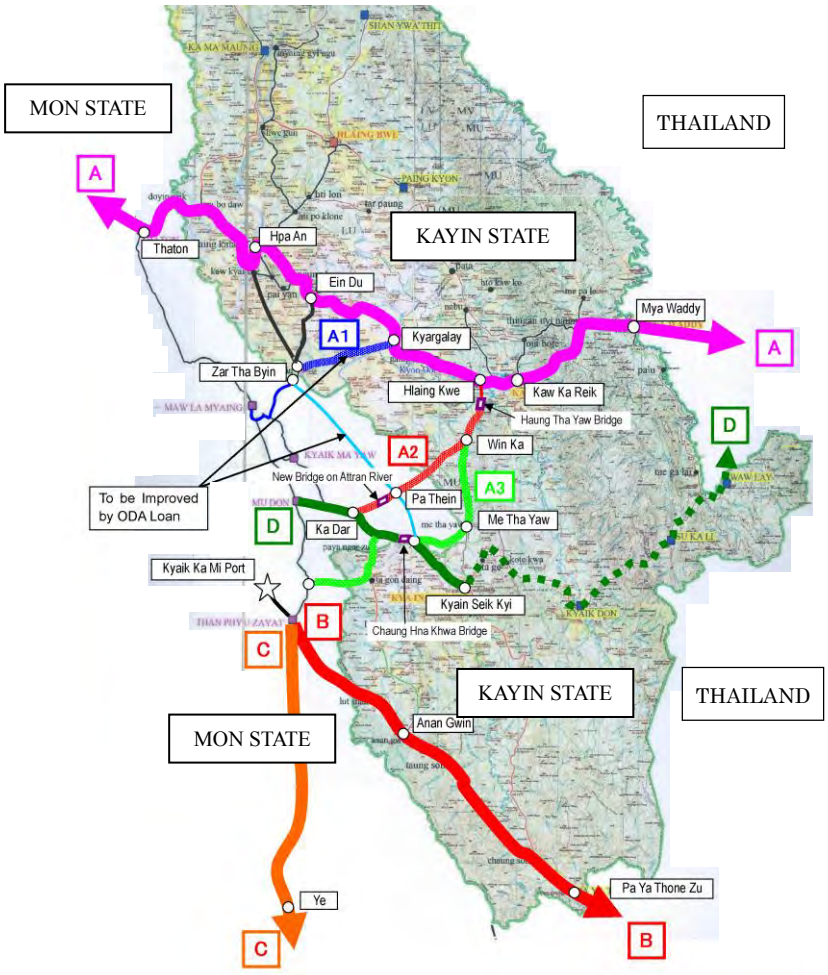
Based on the field survey and in line with the road development planning, possible projects to be implemented in the Southeast Myanmar are listed below. The list is still tentative and not comprehensive, and the inclusion in the list does not imply priority.

(1) International artery roads improvement project

The international artery roads will establish four routes in the Southeast Myanmar as follows.

(a) Thaton – Hpaan – Eindu – Kawkareik – Myawaddy (A-A alignment)
(b) Thanbyuzayat – Hpayarthonesu (B-B)
(c) Thanbyuzayat – Ye – Tanintharyi border (C-C)
(d) Mudon – Kyainseikgyi – Sukali – Wawlay (D-D)

Figure 4.22 shows the international artery roads and alternative alignments. The alternative alignments of A1, A2 and A3 connect the international artery A-A to three coastal cities of Mawlamyine, Mudon and Thanbyuzayat. It is expected that these alternatives roads would be developed together with the upgrading of the international artery A-A to promote the regional development.



Source: JICA Study Team

Figure 4.22 International Artery Roads to Be Improved in Southeast Myanmar

(2) Access improvement to settlement areas

To ensure access to the planned settlement areas, the six road sections were recommended as priority by the State Government as follows. The location of these road sections is shown in Figure 4.21.

(a) Hlaingbwe – Shanywarthit – Methawaw – Khalawday
(b) Paingkyon – Tarle
(c) Htokawyo – Mela
(d) Kyaikdon – Sukali – Wawlay – Myawaddy
(e) Thandaung – Bawgali
(f) Leiktho – Thandaunggyi and Leiktho – Yardo (Kyakaw)

Some road sections of these roads pass through areas of uncertain or unstable security, and therefore the improvement of these road sections should be planned carefully. The improvement of access from the western side of the Dawna mountain range to settlements on the eastern side needs to be discussed with ethnic groups.

The Hpapun – Kamamaung – Wabodo road section is not included in the list above, as its improvement is likely to be implemented with construction equipment that will be procured in the grant-in-aid assistance by Japan.

(3) Procurement of equipment for ethnic peoples

To improve access of ethnic peoples in Kayin State, the following equipment and materials were recommended by the State Government,

(a) Macadam rollers (nine units)
(b) Materials for three pedestrian suspension bridges passable by bikes in the northern part

Each macadam roller will be assigned to each township for continuous road maintenance and management. The three suspension bridges aim to improve access by residents from the eastern side of the river to the government offices on the western side in Thandaunggyi. Construction works for the bridges can be undertaken by local people.

Another set of road construction equipment is required for each township in Mon State. The access to the remote areas in the Bilin river basin and the Ye river basin needs to be improved urgently. As security conditions are stable in these areas, the State Government can work closely with ethnic groups such as NMSP and KNU.

(4) New bridges construction on artery roads

The PWD plans to construct new bridges on the following artery roads.

(a) Chaunghnitkhwa bridge on the Mudon – Kyainseikgyi road
(b) Haungtharaw bridge on the Hlaingkwe – Kyainseikgyi road

The Chaunghnitkhwa bridge is also located on the D-D alignment of the international artery routes in the Southeast Myanmar as shown in Figure 4.22. This bridge has the length of about 2,000 feet (600 m). The Haungtharaw bridge serves the alternative international artery routes of A2 and A3. This bridge has the length of about 700 feet (210 m).

4.3.6 Outline of pre-feasibility study for international artery road

(1) Alternative and selection of target road for pre-feasibility study

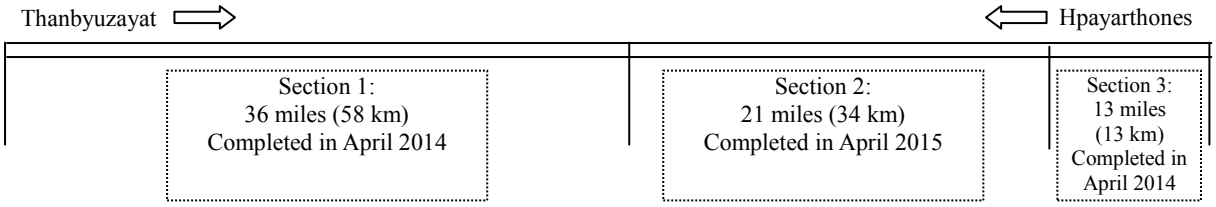
Four alternative routes were selected as candidate routes for the preliminary feasibility study (pre-F/S) to be conducted in the present study. The alternative routes cover the international artery roads (Figure 4.22) as listed below.

(a) Thaton – Hpaan – Eindu – Kawkareik – Myawaddy road (A-A route)
(b) Thanbyuzayat – Hpayarthonesu road (B-B route)
(c) Thanbyuzayat – Ye – Tanintharyi border road (C-C route)
(d) Mudon – Kyainseikgyi – Sukali – Wawlay road (D-D route)

The B-B route was given the highest priority through a comparative study. Result of the comparative study is expressed in the supplemental report, "Pre-Feasibility Study for Thanbyuzayat – Hpayarthonesu Road".

(2) Outline of Thanbyuzayat – Hpayarthonesu road (B-B Route)

The length of Thanbyuzayat – Hpayarthonesu road (B-B route) is estimated at approximately 65 miles (105 km). PWD started the land acquisition and earth works including drainage works on the Thanbyuzayat – Hpayarthonesu road. The earth work was commenced at both ends of the road, and it will be completed by April 2015 as shown in Figure 4.23. As the PWD carries out the earth works, the necessary assistance by a foreign donor will be limited to pavement works and bridge works.



Source: Public Works Department

Figure 4.23 Schedule of Earth Work for Thanbyuzayat – Hpayarthonesu Road by PWD

PWD prepared the road design of the Thanbyuzayat – Hpayarthonesu road to comply with the technical requirements specified in the national geometric standard in Myanmar. The road class was classified in Divisional Road D-III of the national standard. As this route is expected to be the international artery road, the geometric design will need to meet the technical specification in ASEAN Highway Class II.

4.4 Logistic Infrastructure

4.4.1 International and national contexts of spatial and logistic development

(1) Marine transportation

1) Trends of international marine transportation

In order to trade goods efficiently and economically between Asian countries (including Indochina countries) and Europe or America, two main marine transport routes are established for vessel traffic: (i) Europe route (between Europe and Asia) and Pacific Ocean route (between Asia and America). Along the routes, large container vessels are deployed, and container terminals have been modernized to accommodate large container vessels. As of 2010, Asian ports dominate top 1 to 8 in terms of container cargo handling volume by port. As the development of Asia is expected to continue, this trend will continue. For the Indochina countries such as Thai, Cambodia, and Vietnam to keep up with the world container logistic trend, developments of deep seaports having depth over 14m are underway.

In Myanmar, it is also recognized that development of deep seaports is an important issue. Currently there are deep seaport development projects in Kyaukpyu and Dawei. Under the military administration, it was considered to deepen the access channel to 13.5 m depth so that 35,000 DWT vessels could call at the Yangon port. Currently, water depth of the Yangon port is only 9m, and the national container handling volume is merely 420,000 TEU, mainly from Singapore by feeder service). However, in the near future rapid containerization in Myanmar is expected, and thus regional hub ports, as well as the Yangon port, shall be constructed or modernized as international ports, which can also handle container cargos.

2) Cargo handling volume by ports in Myanmar

The total cargo handling volume by ports in Myanmar has doubled in five years from 12 million ton in 2006 to 26 million ton in 2011. This is mainly attributable to the increase of the international cargo. The percentage of coastal shipping is not high. For example, in 2011 the ratio of the international cargo to the coastal cargo is 9 to 1 as shown in Table 4.31. Coastal shipping cargo has increased merely 20% during the same five year period.

Table 4.31 Cargo Handling Volume by Ports in Myanmar

(Unit: ton)

		2006	2007	2008	2009	2010	2011
International	Import	5,168,750	5,812,793	5,735,245	9,172,538	11,908,660	14,225,240
	Export	5,146,594	5,541,104	8,122,714	11,146,486	7,146,366	9,059,520
	Total	10,315,344	11,353,897	13,857,959	20,319,024	19,055,026	23,284,760
Coastal	Unload	937,622	929,259	814,511	760,640	1,027,881	1,101,651
	Load	1,115,308	1,134,394	1,114,189	1,140,100	1,372,667	1,309,746
	Total	2,052,930	2,063,653	1,928,700	1,900,740	2,400,548	2,411,397
Total		12,368,274	13,417,550	15,786,659	22,219,764	21,455,574	25,696,157

Source: Myanma Port Authority

(2) Land transportation with corridor development

1) Myanmar as gateway to economic corridors

The ASEAN nations envisage forming an economic community to liberalize tariffs by 2015. Myanmar is part of the Great Mekong Sub-Region (GMS), and the economic cooperation in GMS includes formation of economic corridors, along which economic developments are expected. Myanmar is the gateways of the southern economic corridor from Bangkok to Dawei and the east-west economic corridor from Vietnam, through Laos and the northern Thailand, to Myanmar. Ports in Myanmar, as the gateway ports located at the west side of the Indochina peninsula, have high potentials to become the important logistic hubs in the ASEAN region.

2) ASEAN integration

The ASEAN integration program also pushes the cross border transport development. Following situations are observed in the ASEAN countries.

- Malaysia/Thailand

Land transportation can reduce the transit time to three days between Bangkok/Kuala Lumpur from seven days on ocean transport (door-to-door basis), while keeping cost competitiveness that attracts high valued manufactures to shift their logistics chain from ocean transport such as automobile manufactures. Now, feasibility for rail transportation is taking it into account.

- Cambodia

Cross border development takes the form not only of bilateral border transport between Thailand and Vietnam, but also of transit transportation connecting Thailand and Vietnam through Cambodia. Along this corridor, a FTZ program becomes active not only in the Phone Penh area but also in border areas with Vietnam.

- Laos

Laos is also eager on transit transport development, connecting Bangkok and Hanoi, which can reduce the transit time from 12 days (door to door by ocean) to five days by road. It is announced that Japanese manufacture "Nikon" has set up its factory at the Thailand/Laos border along Bangkok/Hanoi corridor in April 2013. This is the result of assessing the accessibility between Thailand and Vietnam (mainly Thailand).

3) National spatial and logistic development in Myanmar

In order to achieve effective national development, developing two axes is considered critical. One is the north-south axis connecting Yangon and Mandalay, and the other is the east-west axis connecting Yangon and Myawaddy. These two axes will form the backbone for the national land. With this view, the "National Logistics Master Plan" supported by JICA is now focusing on developing economic corridors along these two axes.

The east-west corridor is to secure accessibility from/to Thailand, in view of the current situations as follows.

i) Major retailers such as supermarkets in Yangon highly depend their sales commodities on border transport from Thailand, particularly food and beverage products including processed food products. Shortages of commodities easily take place when the border situation becomes unstable and border gates are closed.

ii) Manufactures along the border areas are likely to depend their raw materials and intermediate goods on border transport from Thailand, the lead time of which is shorter than ocean transport from Yangon.

iii) Thailand investors are now enthusiastic on shifting their factories to border areas, by evaluating the accessibility from/to Thailand as well as rich/inexpensive local labor forces on the Myanmar side.

The Southeast Myanmar should take consideration of such success lessens in the ASEAN region. Based on such "successful trails", the business sector has already started to develop corridor transport facilities and services along the Yangon-Bangkok route. An international logistics company has already started a feasibility study, aiming at providing services in 2015 for container transportation instead of truck services (Figure 4.24).

In short to medium terms, Myanmar continues to depend on Thailand for procurement of goods. Taking a look at outbound cargo, it is unfortunate that the ocean liner service in Myanmar is inferior to Thailand due to less frequency services, long lead time and small sized vessel calling. Shippers at border areas should have an option to use the Laem Chabang port in Thailand for their export if border transportation is feasible and their commodities can bear land transportation cost.

This company are preparing Yangon/Thailand cross border transport, targeting at 2015.

Transit time is scheduled 4-5 day by using 40' container-sized vehicle and will be transshipped at Myawadi Trade Zone

Source: Nippon express

Figure 4.24 Notice of Starting Yangon/Bangkok Cross Border Services

4.4.2 Existing domestic logistics in Myanmar and Southeast Myanmar

(1) Inland waterway transport

Myanmar has land area 1.8 times that of Japan, and population of about 60 million. The Ayeyarwady River runs from north to south, and about 60% of the population resides along the rivers. Due to this characteristic, the ratio of waterway transportation is rather high with waterway having a share of 40%, closely following railway with 42%, and road with 18%, in comparison to other Asian countries, where the road transportation ratio is over 70%.

Since there are no reliable data prepared by private companies for the inland waterway transportation,

the data of IWT, major operator of inland waterway, are shown here. Table 4.32 shows the transportation volume by commodities. As seen in Table 4.32, major commodities are rice, cement, and miscellaneous goods. Miscellaneous goods transportation is increasing, and the rice transportation has decreased.

Next for the total cargo transport volume, it reached about 4.79 million ton in 2010- 2011 and shows increasing tendency annually and the cargo volume in 2010- 2011 reached 1.9 times that of 1990-1991. However, cargo volume shows sharp decrease in 2011-2012 with about 3.3 million and then about 2.1 million in 2012- 2013 because of the increase of road construction and rapid increase of private water transportation sector. However, water transportation has an advantage for long distance mass transportation and so its share is 40 % also in Japan where road transportation has been developed. Therefore, increase of water transportation is expected in Myanmar with containerization in future.

Table 4.32 Cargo Transportation by Commodities (IWT)

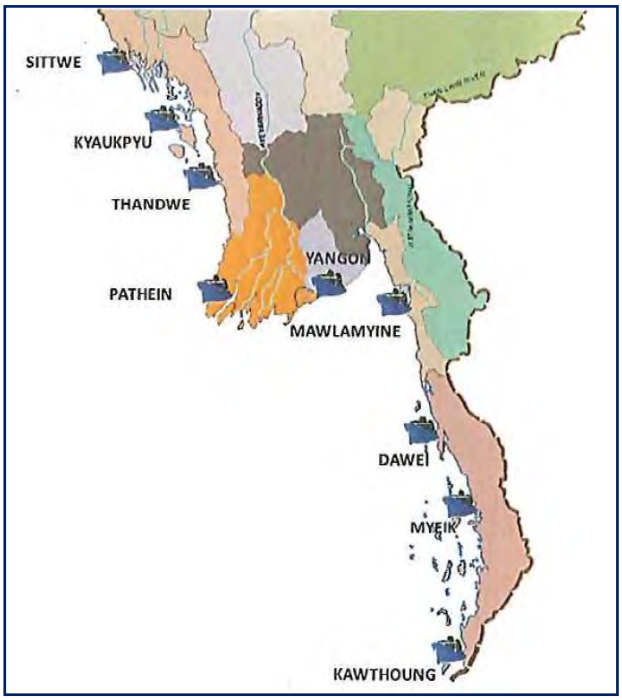
Commodity	Unit	1990-1991	1995-1996	2000-2001	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Rice	thousands ton	181	132	45	18	9	2	10	7	1		-
	ton-miles	27,343	22,218	7,079	4,288	1,912	224	5,273	3,516	537		-
Cement	thousands ton	108	28	29	20	11	1	3	9	1		6
	ton-miles	24,879	6,317	10,089	6,217	3,083	155	1,828	5,216	518	1,153	2,267
Petroleum Coke	thousands ton	*	-	2	4	4	4	1	3	-		-
	ton-miles	n.a.	-	754	1,613	1,237	1,637	629	1,195	-		-
Fertilizer	thousands ton	*	-	-	-	-	-	-	7	1		-
	ton-miles	n.a.	-	-	-	-	-	-	3,124	396		-
Miscellaneous	thousands ton	2,200	3,017	3,787	4,150	4,251	4,210	4,211	4,412	4,630	4,667	4,763
	ton-miles	273,421	294,066	326,459	415,007	428,471	425,579	474,765	541,062	623,691	677,714	740,632
Timber	thousands ton	n.a.	n.a.	n.a.	n.a.	32	45	59	42	25	15	17
	ton-miles	n.a.	n.a.	n.a.	n.a.	18,656	27,580	37,488	27,727	14,502	8,340	10,790
Total	thousands ton	2,489	3,177	3,863	4,192	4,307	4,262	4,284	4,479	4,658	4,685	4,786
	ton-miles	325,643	322,601	344,381	427,125	453,359	455,175	519,983	581,840	639,444	687,207	753,689

Source: Central Statistics Office

(2) Coastal transportation

Myanma Port Authority manages and operates the Sittwe port, Kyaukpyu port, Thandwe port, Pathein port, Mawlamyine port, Dawei port, Myeik port, and Kawthoung port, other than the Yangon port (Figure 4.25). Except for the Kyaukpyu port, domestic coastal cargo volume is larger than international cargo volume (Table 4.33). The Mawlamyine port handles almost only the coastal cargos, and the volume rapidly increased from 40,000 ton in 2010 to 120,000 ton in 2011. This is due to the fact that the stone supply to China's Kyaukpyu development has increased.

From the local ports to the Yangon port, agriculture products, fishery products, and rubbers are transported. Transported from the



Source: MPA

Figure 4.25 Port Locations in Myanmar

Yangon port to the local ports are daily commodities and durable goods. The cargo handling volumes at the Sittwe port, Myeik port, and Kawthoung port located far away from Yangon are larger. In the remote regions, the road network is not established, and the coastal transportation, which is suitable for long-distance mass transportation, supports the lives of the locals.

Table 4.33 Cargo Volume Handled at Local Ports

(Unit: ton)

		2006	2007	2008	2009	2010	2011
Sittwe	International	30,274	32,996	31,127	28,248	26,363	23,565
	Coastal	77,668	94,035	128,423	164,497	190,847	157,698
	Total	107,942	127,031	159,550	192,745	217,210	181,263
Kyaukpyu	International	-	-	-	3,332	167	164,157
	Coastal	12,074	18,162	21,627	29,700	79,022	129,937
	Total	12,074	18,162	21,627	33,032	79,189	294,094
Thandwe	International	5,958	6,126	8,539	9,633	11,402	6,185
	Coastal	23,364	39,593	46,436	49,449	47,491	27,106
	Total	29,322	45,719	54,975	59,082	58,893	33,291
Pathein	International	16,767	20,560	36,122	17,136	25,661	35,370
	Coastal	41,335	50,020	36,669	32,535	35,175	12,580
	Total	58,102	70,580	72,791	49,671	60,836	47,950
Mawlamyine	International	-	23,079	-	-	-	2,643
	Coastal	62,024	51,604	41,930	28,575	75,674	145,940
	Total	62,024	74,683	41,930	28,575	75,674	148,583
Dawei	International	106,467	130,958	44,534	85,310	4,246	35,201
	Coastal	439,609	423,765	426,727	379,749	514,174	496,685
	Total	546,076	554,723	471,261	465,059	518,420	531,886
Myeik	International	65,949	129,326	807,784	2,202,526	196,256	980,668
	Coastal	164,884	157,131	122,649	92,357	160,929	159,412
	Total	230,833	286,457	930,433	2,294,883	357,185	1,140,080
Kawthaung	International	150,320	159,386	1,526,576	2,733,754	1,418,962	1,363,081
	Coastal	216,549	221,323	191,568	215,514	230,564	233,586
	Total	366,869	380,709	1,718,144	2,949,268	1,649,526	1,596,667

Source: MPA

(3) Land transport in Southeast Myanmar

The most serious bottleneck along the Yangon - Myawaddy road is the Kawkareik - Myawaddy section. A new road is now under construction supported by Thailand finance, targeting at completion in 2015. It is fortunate that this road will equip with two lanes, enabling 40' container can pass through each other. This new road will provide a short cut from the current road so that driving time will be reduced to three hours for trucks. It remains uncertain, however, whether the Yangon – Myawaddy road as a whole is transportable by 40' size trucks without problems. Besides the Myawaddy - Kawkareik road development, following constraints are pointed out from logistics providers.

1) Kawkareik - Eindu

Although it is announced that ADB will finance for road infrastructure development, some bridges are not adequate for passing full loaded 40' containers. Unfortunately, the rehabilitation of bridges is not planned to be financed by ADB.

2) Eindu - Yangon

This road section will be developed by BOT and JICA. Even if two lanes are equipped in Mon State, narrow road width and insufficient shoulders are likely to make it dangerous for larger sized trucks to pass through each other. In addition, night time driving seems dangerous so that fluorescent painted sigh boards, center lines and boundary lines should be installed.

3) Toll gates

The toll gates do not have sufficient number of gates with only one gate for trucks with weighbridge. The increasing number of toll gates will enhance the risk of overlapped weight checks. It is also worried that BOT road construction sets up numerous toll gates.

4) Truck fleet development

The Yangon - Myawaddy road is planned to set up maximum gross vehicle weight at 33 ton for 4 axle/14 wheel trailers, which cannot transport full loaded 40' containers (Table 4.34). Replacement into 5/6 axle trailer is necessary for container transportation. This would be serious financial obstacle for local transporters so that it is necessary to take it into account some kind of supportive programs. Even in Japan, replacement program from 4 axle trailer to 5/6 axle trailer took long time because of heavy financial burden for transporters.

Table 4.34 Weight Limitation by Type of Car and Season

Type of Car	Nos. of Axle (axle)	Nos. of Tire (tire)	Current (ton)		2015 (ton)
			Dry season	Rainy season	
Truck	6 (wheels)		10	16	15
	4	12	25	27	25
	4	14	25	30	29
Trailer	4	14	34	33	33
	5	18	46	41	41
	6	22	50.5	48	48

Source: Notice at toll gate at boundary between Bago and Mon

4.4.3 Organizations and institutions related to logistics

(1) Ministry of Transport

At the independence of Myanmar, two ministries were established to take charge of nation's transport administration: the Ministry of Waterways and Civil Aviation, and the Ministry of Transport, Posts and Telecommunications. In 1961, they were merged into the Ministry of Transport and Communications consisting of 11 organizations. In 1972, the number of organization increased to 19. In 1992, the Ministry became separated into three: the Ministry of Transport, Ministry of Rail Transportation, and Ministry of Communications, Posts and Telegraphs.

In August 1999, the Department of Meteorology and Hydrology joined, and currently there are five

departments, four enterprises, two universities, totaling 11 organizations under the Ministry of Transport as listed below. Myanmar Five Star Line, former MOT enterprise, was privatized in April 2010, and is now affiliated with Myanmar Economic Holding Limited.

(a) Department of Transport
(b) Department of Civil Aviation
(c) Department of Marine Administration
(d) Department of Meteorology and Hydrology
(e) Directorate of Water Resources and Improvement of River Systems
(f) Inland Water Transport
(g) Myanma Airways
(h) Myanma Port Authority
(i) Myanma Shipyards
(j) Myanmar Maritime University
(k) Myanmar Mercantile Marine Collage

(2) Transport policy

The policy of the Union Government for transportation is summarized below.

(a) To develop and fully utilize transport capacities to contribute towards the realization of an economically strong, modern and developed nation.
(b) To fulfill transport requirements, and to extend and maintain the transport infrastructure to be able to fully support increased production from other economic sectors and meet growing public and social demands.
(c) To ensure smooth and secure domestic and international transport system as well as contribute towards the development of border areas and national races and the development of tourism.
(d) To enable all-weather river transportation by maintenance and preservation of natural resources.
(e) To develop air and maritime transport infrastructures in line with international standards for environmental protection.
(f) To enhance the transport sector through human resources development and upgrade expertise in management and advancing modern technology.
(g) To abide by international conventions, acts, laws, rules and regulations with respect to the transport sector.
(h) To develop domestic and international transportation and actively take a key role in the implementation of a national multi-modal transport system.
(i) To plan for implementation of implement national, sub-regional and international transport networks.

(3) Transport strategy

The national transport strategy consists of the following components:

(a) Efficient handling of services in air ports and sea ports,
(b) Promoting port activities by loading/unloading cargoes such as transit cargo, trans-shipment cargo,
(c) Supervising to ensure strength, safety and security of maritime and aviation sectors,
(d) Enhancing human resources development for the transport sector,
(e) Saving natural environment seriously in ways of extension in transport operation,

(f) Intensive and serious planning in the development of secure and smooth transportation for rural areas, and
(g) Planning of preventive measures for natural disasters.

(4) Trade related policy and institution

Until recently, Myanmar international trade was strongly restricted mainly due to the currency control and license system. As Myanmar adopted the "export first policy", import was allowed within the budget being earned by export. Export payment was allowable just for advanced payment, avoiding standard international payment system; L/C, D/P, D/A. This made it difficult to do export business internationally. Previously, remitting foreign currency earned in kyats was difficult. Deregulation now allows remittance to overseas as far as some conditions are observed. While deregulation has been promoted, "export first policy" still nominally continues.

The other serious obstacle "license system" had been making export/import business difficult. Every export/import needed to get license on purchase order (P/O) basis. Export/import shipment was not allowed to start before the date when license was issued. This made business persons to do business difficult, because quick cargo receipt was impossible as well as it is impossible to meet customer's demand. The quota system was also serious obstacles for business persons. Since quota volume was determined by the past performance, it was difficult to obtain sufficient volume for business expansion. Quota could be purchased and sold between quota-holder and non-quota-holder. This resulted in high transaction cost and non-transparent business circumstances. Facilitating license system has been a key factor for developing trade, and the following developments has been implementing.

(a) The processing time for issuing the export/import license has been improved within two days without delay by Ministry of Commerce.
(b) In the past, license was issued only by Naypyitaw; however, it is now issued in Yangon branch office step by step. CMP (Cutting, Making and Packing) manufacture can get license from Yangon.
(c) Restricted commodities come to be allowable to import under the quota system; soft drinks, biscuits, canned foods and instant noodles.
(d) Regulated commodities such as palm oil lubricating oil and fuel oil were liberalized to the private sector for import.
(e) Import of vehicles is deregulated; in the past, it was impossible to import more than five vehicles at one time.
(f) Regulated export commodities have been liberalized such as rice, beans, maize and rubber.

Following these reforms, 380 items were exempted from subjects for the export/import license in April, 2013. Facilitating license system also benefits for avoiding informal trade, because the main aim of informal trade was likely to skip a severe license control, resulting in the securing transparency in business. A typical example for automobile, importing automobile is liberalized and people can purchase at lower price than ever. In spite of the fact that license system is a big obstacle for trade, the border transport has been beneficial for facilitated license system; license is issuable at border post so that this is a significant advantage for border trade, which provides incentive for avoiding normal trade route.

4.4.4 Existing logistic facilities and issues in Southeast Myanmar

(1) Natural Condition of Proposed Site

1) Geology

Most area in eastern part of Mon State is underlain by strata of the Mergui Group such as metamorphosed quartzite, slate, greywacke and mudstone. Then, recent alluvium layers underlay in the western part along the coast, and granitoid rocks distribute only in the northwestern and southern parts. Grey limestone referred to as the Moulmein limestone overlies the Mergui Group in the Mawlamyine –Kyaikmaraw area and also in the northern part of the Mon State. Then, crystalline rocks are exposed in some areas of Kyaikkhami.

2) Mean sea level pressure

In daily mean sea level pressure at each area in 2012, the minimum value of the mean sea level pressure at Mawlamyine and Ye is 1004hpa and 1006hpa, respectively. The maximum value is about 1012hpa in both places.

3) Wind speed and direction

In daliy maximum wind speed and wind direction with the highest frequency in a month at each area in 2012, wind speed increases during southwest wind in monsoon season. Maximum wind speed is 4- 10 mph (1.8～4.5 m/s) in Mawlamyine and Ye, and 35 mph (15.6 m/s) in Kyaikkhami.

4) Tide level, current and waves

Average tide level difference at Mawlamyine and Kyaikkhami is 2.9 m and 4 m respectively. Those values during spring tide are 3.7 m at Mawlamyine and 6.1 m at Kyaikkhami（Myanmar Coastal Port Tide Table, 2013）

There are no regular measurement data in DMH and MPA for trend, but according to hearing result to MPA, current speed at around Kyaikkhami area is 5 knot.

Similarly, there are no wave data in DMH and MPA. According to hearing result to MPA, average and maximum wave level at around Kyaikkhami area is 0.6- 0.7 m and 1.5 m respectively.

5) Natural disaster

Mon State has relatively few natural disasters. Frequency of cyclone direct hits to the State is very few. Mon State can be classified to Moderate Zone for earthquake which is the second lowest dangerous condition.

(2) Mawlamyine port

1) Outline

Mawlamyine is the capital of Mon State, about 300 km southeast of Yangon, and has the population of about 300,000. It has prospered as a port city. The Mawlamyine port is at the Thanlwin River with the water depth of 4.5 m. According to the interview, the drifting sand pattern has changed since the nearby bridge was constructed, and occasional dredging of the sediment is necessary. Due to the existence of shoals, large vessels cannot call at the Mawlamyine port. Thus, the cargos are transshipped at Kyaikkhami offshore, and transported to the Mawlamyine port by smaller

vessels. The Mawlamyine port handles commodities such as foodstuffs, oils, medicines, fuels, construction materials, machineries, and car parts. The difference of high and low tides at the Mawlamyine port is about 4.6 m. The international cargo ships and vessels bring diesel fuel from Singapore, but no vessels export from Mawlamyine. Monthly import of diesel fuel is 1,000 to 1,500 ton. Recently, coastal transport of sea sand and crusher stones is prosperous. These are quarries near Mawlamyine, and sand and stones are distributed to large construction sites in Myanmar such as Kyaukpyu deep sea port project in Rakhine State.

2) Port facilities

The Mawlamyine port consists of 10 national jetties (Table 4.35). All jetties are of pontoon type except for the Thanlwin wharf and Kyaukmethwe berth. There is no ship-to-shore crane, and loading/unloading is carried out manually.

Mawlamyine has a good condition of transport access and developable hinterland but water depth is not enough for a regional port. Even though dredging work is being carried out, it is not easy to maintain water depth of channel because of large amount of sand from the Thanlwin River. Therefore, it will not be suitable for the development of new regional port at near existing port.

Table 4.35 Major National Berths at Mawlamyine Port

No.	Name	Type	Size		User
			Length (m)	Breadth (m)	
1	Kyaikphane Jetty	Pontoon Jetty	36.5	6	Inland waterway vessels and local boats
2	Zaygyi Jetty	Pontoon Jetty	36.5	6	Inland waterway vessels and local boats
3	Myeik Jetty	Pontoon Jetty	36.5	6	Inland waterway vessel and motor boats
4	Shwe Myine Jetty	Pontoon Jetty	36.5	6	Private motor boats
5	Myoma Jetty	Pontoon Jetty	36.5	6	VIP boats（not used as of 2012）
6	Seik Kan Thar Jetty	Pontoon Jetty	36.5	6	Coastal vessels and international schooner
7	Dawei Jetty	Iron-encrusted buoy Jetty	73	12	Iron-encrusted buoy Jetty
8	Yamanya Jetty	Pontoon Jetty	36.5	6	International schooner
9	Than Lwin Wharf	Concrete Wharf	36.5	6	Fishing boat
10	Kyauk-me-thwe (Coal) Berth	Concrete Jetty	-	-	Coal barge（not used as of 2012）

Source: JICA Study Team based on MPA data

(3) Inland waterway

Inland waterway ferry boats under IWT Thanlwin Division call at the Mawlamyine port. IWT has currently three service routes originating Mawlamyine : Mawlamyine～Natmaw (Thanlwin River, 9mile), Mawlamyine～Kalwi (Thanlwin River, 7 mile), and Mawlamyine～Chaungnakwa (Attran River, 3mile) as shown in Figure 4.26. Other four routes were abolished in June 2010 due to the decrease of the number of passengers as the road network was improved. They are Mawlamyine～Hpaan (33 mile), Mawlamyine ～ Htonai (17 mile), Mawlamyine ～ Kyarinn (73 mile), and Mawlamyine～Kyundo（42 mile）. However, except for townships served by the trunk roads, the use of the waterway transport remains important. Especially, during the rainy season from June to November, road transportation becomes difficult, and transportation relies on waterway.

The tourist boat service along Mawlamyine～Hpaan (33 mile) was also abolished in June 2010. Recently, there are demands from the tourist industry to resume the service since the number of

tourists is increasing.

Source: IWT

Figure 4.26 Waterway in IWT Thanlwin Division

1) Inland ports

The Mawlamyine port is the main inland waterway port in the Southeast Myanmar. Other than the Mawlamyine port, there are many river ports along the Thanlwin River. Among other major ports are the Hpaan port and the Kamamaung port.

The Hpaan port is located at the state capital, and future development is expected. Currently, an industrial zone development is underway in the vicinity. At the Hpaan port, however, the berthing facility is only a slipway. When loading and unloading, wooden plates are bridged between the vessel and river bank.

From Hpaan to Kamamaung, it takes 3.5 hours by car along the road on the west side of the Thanlwin River. Using the road along the east side of the Thanlwin River, it takes 1.5 hours to the east bank opposite Kamamaung. However, ferry boat crossing the Thanlwin River to reach Kamamaung is rarely operated. Though there are ferry boats at the Kamamaung port, they are rarely used due to the deterioration of the vessels and lack of berthing facilities. A river crossing ferry is operated in the Myaukkyarinn village in Kawkareik TS. However it takes more than 2 hours for cars to cross the river.

2) Navigational channels

Between Mawlamyine and Hpaan, there is one shallow area 200 m long. Between Hpaan and the Hpaan industrial zone, there is also one shallow area. During the dry season, these shallow areas hinter the navigation of vessels. However, the shallow areas are only few area of the channel, thus the deepening of the channel would be economically feasible.

During the rainy season in the areas where the feeder roads are flooded, waterway becomes the major mode of transportation. For example, between Shanywarthit on the Thai border in the east

Karen State and Kamamaung boats run by three hours. In the south, between Tadein, near Hpayarthonesu and Kyainseikgyi waterway is used for transportation, and there are about 50 small boats engaged.

Along all the aforementioned navigation channels, the channels are not maintained properly and the navigation aids are not sufficient.

3) Vessels

Majority of the vessel for the inland waterway transportation is a small boat (Photo 4.1). Vessels used between Mawlamyine and Kamamaung are small to medium size boats. These boats are deteriorate with, poor fuel efficiency, and less comfortable for the passengers (Photo 4.2).

Photo 4.1 Small Boat for Inland Waterway

Photo 4.2 Middle Class Boats for Inland Waterway

(4) Issues for inland water way in Southeast Myanmar

In Myanmar, the inland waterway network crisscrosses the Country, and waterway transportation as well as marine transportation is the important mode of transportation for passengers and cargo. This is also true for the Southeast Myanmar. However, due to the long economic sanction against Myanmar, many port facilities and vessels are deteriorated and not properly maintained, and concerned legislations are not established. Inland waterway services have problems of safety, punctuality, passengers comfort, redundancy, environment and costs. The problems are related not only to hardware, but the software side is also important such as operation, maintenance, and

management. Establishment of effective improvement plan is expected. Following are the main issues.

1) International port facilities

The existing port is located at the center of Mawlamyine. Loading and unloading are carried out by manual laborers, and safety and speed are problems. To meet the future increase of cargo volume, and reduce the logistic time and cost, modernization, expansion, deepening, and containerization of the Port will be inevitable. However, since the Port is located at the center of the city, the land space for container yard is difficult to obtain. Furthermore, deepening of the access river channel to the Port and maintaining the channel depth will be extremely expensive. Currently there is no large and modernized logistic center in the vicinity, and thus the connection to other modes of transportation (road and railway) is costly and time-consuming.

2) Inland waterway facilities and navigation channels

In Mon State and Karen State, inland waterway transportation by rivers such as the Thanlwin River, is prevalent. However, when loading and unloading, wooden plates are bridged between vessels and river bank, and in the dry season, water levels go down and vessels are obliged to slow down at the shallow spots. Furthermore, management of navigation channels, including navigation aids and maintenance dredging, are not properly conducted. Recently, due to the construction of road, there are some navigation routes where passengers and cargo shifted to road transportation. However, there are navigation routes that become only mode of transportation in the rainy season due to the flooding of the roads.

3) Inland waterway vessels

IWT and private vessels provide the inland waterway transportation services. Most vessels are deteriorated, low fuel efficient, and uncomfortable for the passengers. Furthermore, to conduct the repair and inspection of vessels, proper dockyards are inevitable. Dockyard owned by IWT is deteriorated, and not capable of conducting proper repair and inspection of the vessels.

4.4.5 Existing border trade and related facilities

(1) Border trade in Myanmar

The trade sanction made it difficult for Myanmar to depend on international trade through normal trade by ocean and air. This led to border transport playing important roles for international trade. According to border trade statistics in April 2011 to March 2012, 13% of export and 15% of import was by border trade (Table 4.36).

Table 4.36 Value of International Trade by Normal and Border Trade, April 2011 to March 2012

Item	Value (US$ million)			%		
	Public	Private	Total	Public	Private	Total
Export						
Normal trade	4,259	2,809	7,068	85.0	91.1	87.3
Border trade	752	276	1,028	15.0	8.9	12.7
Total	5,011	3,085	8,096	100.0	100.0	100.0
Import						
Normal trade	2,066	5,648	7,714	85.6	85.1	85.2
Border trade	348	992	1,340	14.4	14.9	14.8
Total	2,414	6,640	9,054	100.0	100.0	100.0

Source: "Explore Myanmar" Vol3.1, Ministry of Commerce

Table 4.37 shows the share of border trade by type of commodities. In export, only forestry and industrial materials heavily depend on normal trade, but the US$3,463 million of industrial goods is natural gas export to Thailand, which is exported by pipeline. It is apparent that the share of border trade is depressed by gas exportation. Excluding gas exportation, about one-third of export is presumably handled by border trade.

Table 4.37 Value of International Trade by Categorized Commodity, April 2011 – March 2012

Item	Value (US$ million)			% of Border Trade
	Normal	Border	Total	
Export				
Agriculture	1,519	855	2,373	36
Animal	7	684	691	99
Marine	452	255	706	36
Mineral	113	783	897	87
Forestry	629	13	642	2
Industrial	4,037	10	4,047	0
Other	312	312	625	50
Total	7,069	2,911	9,980	29
Import				
Capital	2,935	787	3,722	21
Intermediate	3,750	331	4,081	8
Household	1,029	222	1,251	18
Total	7,714	1,340	9,054	15

Source: "Explore Myanmar" Vol3.1, Ministry of Commerce

Import, on the other hand, seems to depend on normal trade rather than export. Table 4.38 shows the details. For capital goods, 21% is handled by border trade. Specifically, automobiles represent 32% of imported capital goods, and 20% is imported by border trade. Similarly, machine and spare parts represent 14% of imported capital goods, and 24% are handled by border trade. Unlike those two items, steel materials represent 42% in border trade.

Intermediate goods seem highly dependent on normal trade, while border trade represents only 8% of the total trade value as shown in Table 4.37. Taking a look at details in Table 4.38, 51% of intermediate goods are petrol and 97% of petrol is imported by normal trade. Plastic and iron steel shows the same tendency and high degree of dependency on normal trade. In contrast, fertilizer is highly dependent on border trade. If those four items are excluded, 22% of intermediate goods are imported by border trade, which is similar result of capital goods. Household goods show similar phenomenon with capital goods, as 18% of household goods is handled by border trade. Palm oil and medicine are major import goods, and both items are highly dependent on normal trade. When both goods are excluded, one-third of household goods are imported by border trade.

In this regard, some specific large import cargo pushes up the percentage of normal trade utilization. If those are excluded, a wide range of commodities depend on border trade even for import.

Table 4.38 Detailed Data on Import Goods, April 2011 – March 2012

Item	Sub-Item	Normal Trade (US$ million)	Border Trade (US$ million)	% of Border Trade
Capital	Automobile	947	237	20
	Machine and Spare parts	388	123	24
	Steel material	348	254	42
Intermediate	Petro	2,026	56	3
	Plastic	300	14	4
	Iron steel	512		0
	Fertilizer	20	154	88
	Other	812	261	22
Household	Palm oil	388		0
	Medicine	215	10	4
	Other	426	212	33

Source: ”Explore Myanmar” Vol3.1, Ministry of Commerce

(2) Thai border trade

Table 4.39 shows the import/export trade value of Thailand border trade. Export has been relatively stable around US$150 million from 2006/07 to 2010/11, but it increased to US$174 million in 2011/12. The major export item is marine products, accounting for 80% of total export to Thailand in 2011/2012. According to the director of border trade in Myawaddy trade zone (MTZ), marine products are exported through the Moton border gate in Tanintharyi.

Import has gradually grown until 2008/2009, and dropped in 2009/2010. Although value of import trade recovered in 2010/2011 and 2011/2011, it did not reach the peak in 2008/2009. Industrial raw materials were main import goods until 2008/2009. Afterwards, capital goods expanded shares in import goods.

Table 4.39 Value of Thai Border Trade

(Unit: US$ million)

Item	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Export							
Agriculture	6.0	4.4	8.8	14.7	17.1	9.9	20.4
Marine	93.7	116.3	107.0	92.5	113.1	124.5	140.6
Forest	1.2	16.1	8.1	24.3	2.6	9.8	7.7
Animal		0.2	0.0	0.1	0.1	0.1	0.0
Mineral		1.1	2.1	0.3	1.8	3.5	4.6
Industrial	4.7	16.2	18.9	3.0	1.8	2.7	0.8
Others	8.1	3.3	3.9	3.1	2.8	1.1	0.9
Total	113.8	157.6	149.0	137.9	139.2	151.6	174.9
Import							
Capital	34.3	35.7	21.7	23.2	32.3	37.6	55.7
Industrial raw material	36.1	54.4	97.7	116.3	72.5	74.1	71.3
Household goods	14.9	52.5	36.3	50.0	30.6	35.7	41.1
Total	85.3	142.6	155.8	189.5	135.4	147.4	168.2

Source: ”Explore Myanmar” Vol3.1, Ministry of Commerce

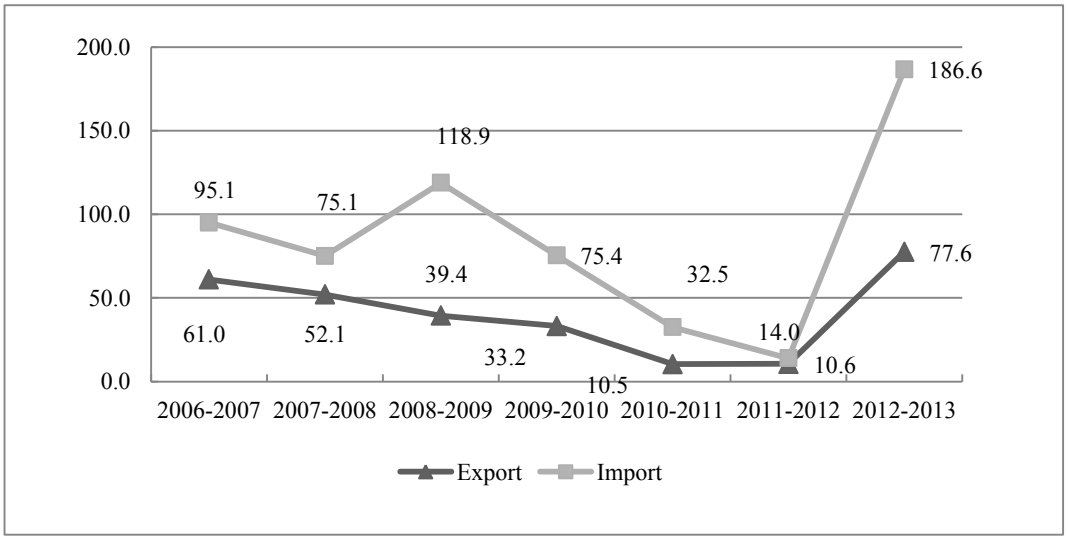
While Myawaddy is regarded as the foremost border post, its share in export to Thai border trade is not large as seen from Figure 4.27. The highest share was 39% in 2006/07 in the last six years. In import, Myawaddy represented considerable shares higher than 48% in the period from 2006/07 to 2009/10. Particularly, Myawaddy handled more than 60% in 2006/07 and 2008/09. Yet the

performance sharply declined to less than 10% in both export and import in 2010/11 and 2011/12. This does not seem indicating the falling status of Myawaddy. This was due to the unexpected border shut down which frequently took place. A trade performance of 2012/13 was recovered and jumped up, in particular, the import drastically increased as shown in Figure 4.27.

Table 4.40 Share of Myawaddy Border Post to Thai Border Trade

Item	Unit	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Export	%	39	35	29	24	7	6
Import	%	67	48	63	56	2	8

Source: JICA Study Team



Source: Department of Border Trade at MTZ

Figure 4.27 Value of International Trade at Myawaddy Border Post

Main import commodities at Myawaddy are shown in Table 4.41 for 2012/13. Vehicles (light truck and car parts) and motorcycle represent the large portion.

Table 4.41 Main Import Commodities at MTZ (2012/2013)

Item	Quantity	Value (US$)
Bicycle	2,750	39,750
Motor cycles	131	97,550
Palm Oil	31,260 (kg)	31,710
Mix LPG	126,960 (kg)	95,220
Light truck	11	92,086
Electric Iron	4,468	13,404
Soy milk	23,950 (l)	13,918
Washings machine	398	44,576
PVC compound	34,000 (kg)	43,520
Car spare parts	29,525 (kg)	55,706

Source: Department of Border Trade at MTZ

As for export, it is difficult to identify commodities which show continuous good performance in consecutive two years (Table 4.42), exempting broken rice, mug bean and assorted fish. Marine products seem major export items even for Myawaddy.

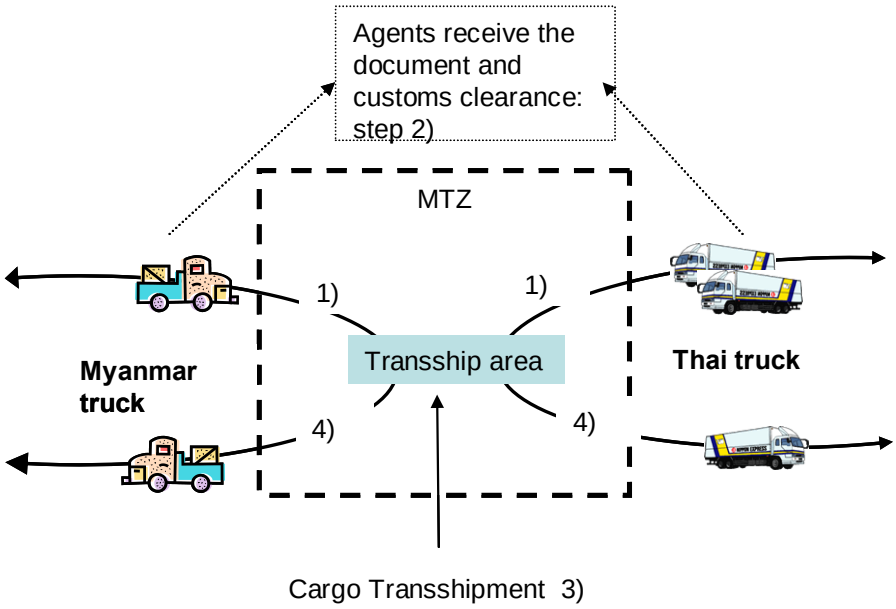
Table 4.42 Main Export Commodities at MTZ (2012/2013)

Item	2012/2013		2011/2012		Balance	
	(million ton)	(US$ million)	(million ton)	(US$ million)	(million ton)	(US$ million)
Rice	78.25	0.03	-	-	78.25	0.03
Broken rice	680.95	0.23	336.63	0.20	344.32	0.03
Green gram	38.00	0.02	143.95	0.09	-105.95	-0.07
Groundnut	-	-	150.00	0.11	-150.00	-0.11
Onion	649.20	0.26	-	-	649.20	0.26
Dry chilled	129.63	0.23	-	-	129.63	0.23
Ground nut (seed)	1,032.30	1.70	-	-	1,032.30	1.70
Mug beam	345.14	0.21	270.00	0.18	75.14	0.03
Turmeric root	10.00	0.02	3.87	0.01	6.13	0.01
Assorted fish	114.53	0.23	215.43	0.50	-100.90	-0.27
Shrimp	10.28	0.10	18.70	0.20	-8.42	-0.10

Source: Department of Border Trade at MTZ

(3) Border trade facilities at Myawaddy Trade Zone (MTZ)

Myawaddy trade zone (MTZ) was established to accommodate cross border transport in 2008. MTZ started transshipment operation. The original concept of MTZ is to facilitate the transshipment process; 1) matching of both Myanmar and Thai trucks; 2) customs procedure; 3) cargo transshipment between Myanmar trucks and Thai trucks; and 4) return to Myanmar and Thailand (Figure 4.28).



Source: JICA Study Team

Figure 4.28 Original Concept of Cargo Transshipment at MTZ

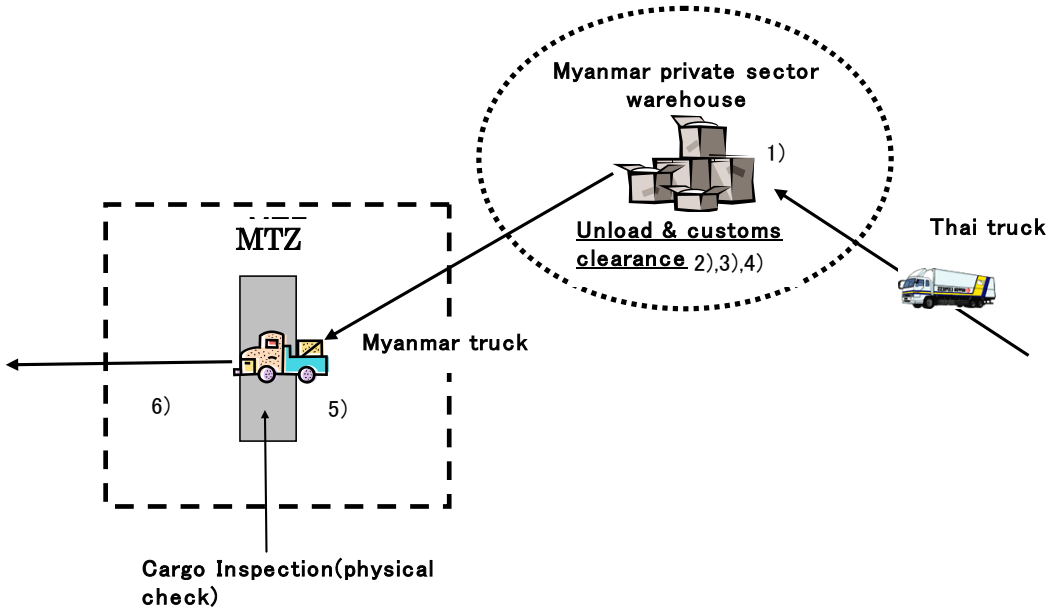
Myanmar situation, however, may not allow the envisaged cargo transshipment as shown in Figure 4.28. Main reasons are as follows.

(a) The Kawkareik - Myawaddy road is located in mountainous, and the road width is narrow that can allow just one way traffic. This means Myanmar trucks need two days drive for a round trip for Myawaddy: one day for Myawaddy and next day for return. The poor road condition is likely to force one day waiting at Kawkareik. In such a case, truck arrival at MTZ is delayed by two days from the original schedule. This is because the road is opened for the opposite direction only in next day.

(b) Current regulations do not allow Thai drivers stop-over in Myanmar territory. They have to leave Myanmar within the same day. If the transshipment is not finished within one day, they have to leave their trucks in Myanmar.

These constraints are likely to make it difficult for Myanmar and Thai trucks to meet at a designated place in a timely way. Therefore, alternative means have to be taken; 1) unloading of cargo from Thailand at private sector's warehouse adjacent to MTZ and submission of shipping documents to a custom agent; 2) preparation of declaration by the custom agent; 3) customs clearance, 4) loading of cleared cargo onto a Myanmar truck and transferring to MTZ; 5) physical check at MTZ; and 6) dispatch to destination in Myanmar (Figure 4.29).

Although this method is beneficial for cargo consolidation or provision of cargo storage, this is already an outdated operation behind the global standard. Nowadays, cross border transport practice of global standard tends to abolish physical cargo loading/unloading operations as well as warhorse operation, which is regarded as excess operation contributing to cost increases. Even for the ASEAN region, container-intact method becomes popular.



Source: JICA Study Team

Figure 4.29 Current Practical Operation Flow in MTZ

According to the interview survey for logistics providers, the lead time of import procedures is as summarized in Table 4.43. This indicates that total import procedure is completed within a day without any difficulties. It does not take long time to prepare documents (Process 2) by private sector and check the documents (Process 3) by customs, even for complicated commodities. Even if cargo physical check (Process 4 and Process 5) does not require long time in itself, waiting time for inspection is inevitable so that lead time for physical check should be assumed up to 2.0 hours. Cargo loading on to a Myanmar truck is available prior to customs document permission, avoiding idle time.

Table 4.43 Estimated Lead Time at MTZ based on Interview Survey

Item	Company A	Company B	Company C,D and E (group discussion)
Time for license acquisition	1 ~ 2 days	1 ~ 2 days	-
Time for unloading cargo at warehouse (Process 1)	-	- Manual operation base: 1 ~ 2 hours for a fully loaded truck - Equipment is leasable from owner in neighboring area.	- Average: 30 minutes ~ 1 hour - Motorcycle :1 hour - Large amount of carton by manual: 2 hours
Time to prepare document (Process 2)	- Within a day (1 hour for simple case)	- Within several hours - Simple case: within 1 hour - Complicated consolidation: 3 hours	- Less than 2 hours - Simple declaration: 15 minutes
Time to check document (Process 3)	- Simple case: 1 hour - Consolidation: 2 hours - Maximum: half day	- Average: 30 minutes for physical check - Waiting time is necessary. - "First come, first service" is principal, but parallel check is also available.	- Simple shipment: 1 ~ 2 hours - Acceptable duration: 24 hours
Physical check on cargo at MTZ (Process 4 and 5)	- Inspection time: 30 minutes - Waiting time is required.	- Inspection time: 20 ~ 30 minuets	- Average: 2 hours including waiting time

Source: JICA Study Team

Since the purpose of physical check is mainly for checking whether loading cargo volume is consistent with shipping documents, partial cargo unloading is necessary even when once cargo is loaded at private sector's warhorse in good condition. This is a waste of time and resources. Facilitation on cargo inspection system is necessary. According to the interview survey, export is more facilitated than import, and transshipment at MTZ is common, instead of using private sector's warehouse.

According to the survey by Japan International Freight Forwarders Association (JIFFA), the lead time of import procedure at Yangon port takes 2-3 days on average, which is longer than border trade. This implies that Myawaddy handles only Thailand trade so that it seems easier to identify the cargo and shipper's status than normal trade. The facilitation of border procedure is more advanced than normal trade.

4.4.6 Directions of logistic development and strategy

Ports in the Southeast Myanmar will be the gateway to the east-west economic corridor, and will be logistic centers to connect to other regions. However, the development will take time, and stepwise development will be necessary.

(1) Development of regional port

The Mawlamyine port is a river port at the Thanlwin River having water depth of only about 4m. Since the sedimentation rate is high, deepening of the channel by dredging will not be economically feasible. Presently, transshipment for the Mawlamyine port is carried out at offshore of Kyaikkhami, which is the potential location for development of a regional port. Kyaikkhami can be accessed from Thanbyuzayat, which is on the national highway running north to south along the east coast. Kyaikkhami could be one of the best candidates for the regional port, taking account of proximity to the road network, deep natural water (10 to 12 m), and the spacious hinterland. Kyaikkhami is located at the southern part of Mottama Bay, and 45 km south from Mawlamyine. Nearby is the Kyaikkhami pagoda and the Setse beach.

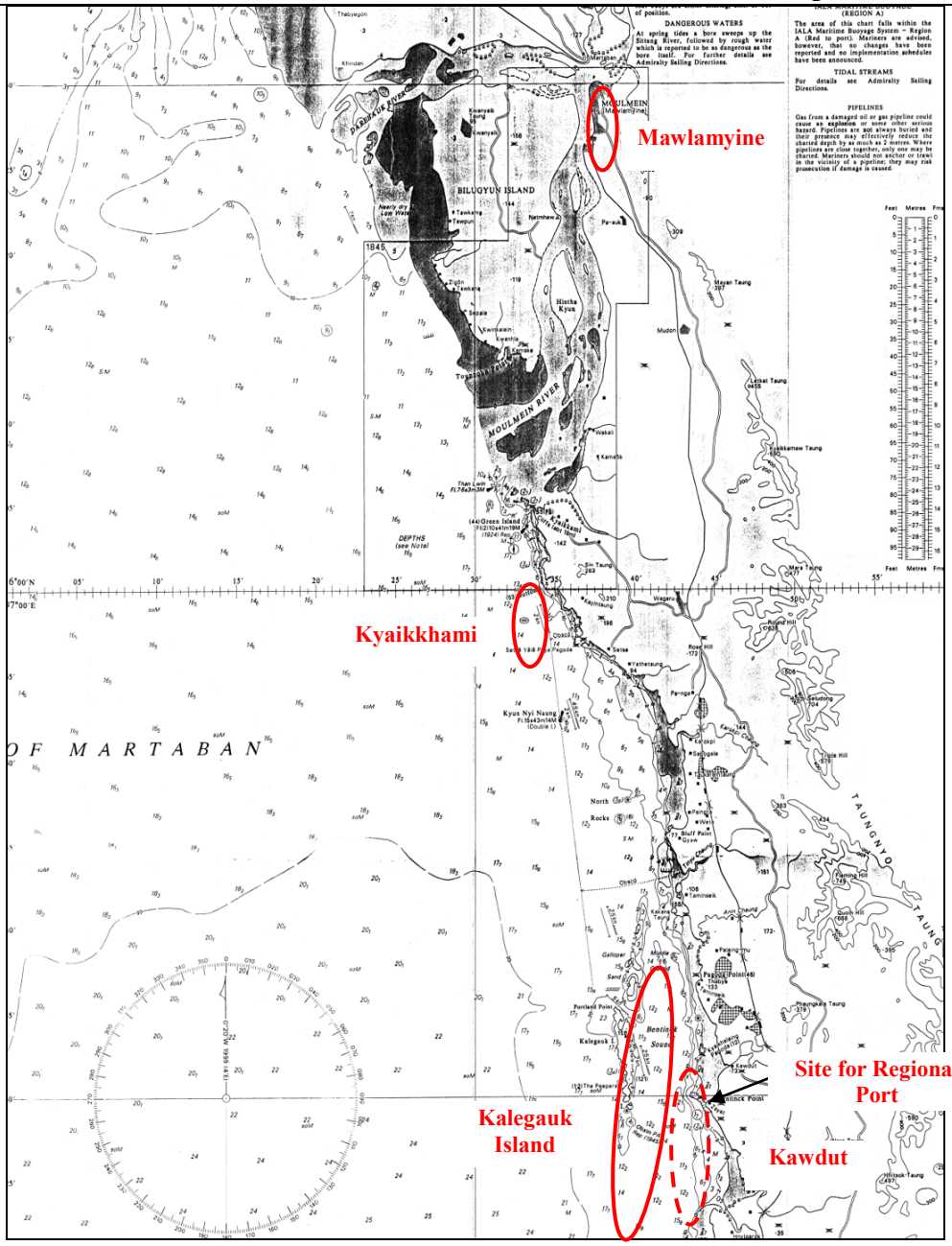


Figure 4.30 Location Map for Kyaikkhami and Kalegauk

1) Kyaikkhami port competitiveness and potential

The port usage ratio depends on whether new port can offer better and cost effective service in comparison with other ports like Yangon.

As for the truck transportation from Yangon to this area for the import containers arrived at Yangon Port, break bulk transport is more common than container transport. Containerization is very low so far. In developing counties where economic development is at an initial stage, it is normal to prefer break bulk delivery to container-intact deliver. However, this stage only lasts while the labor cost is low.

With the development of economy, speedy and dedicated delivery will be prioritized. This is the time when containerization is progressing, instead of bulk type transportation.. In this line with it, the providing cost effective container transportation will be an important incentive for attracting

Kyaikkhami port usage. The potential of cost effective container transportation in Kyaikkhami port is discussed in following topics of 'Transportation cost' and 'Demurrage cost/obligation'.

However, it is anticipated that Yangon port will keep its position as a main port of Myanmar, so it is important for Kyaikkhami port to create good feeder service with Yangon port. This will lead collaboration and complementary effect between both ports. To realize this scenario, coastal shipping development needs to be effective and important. Following topic 'Demurrage cost/obligation' will give the image to coastal shipping development.

➢ Transportation cost

Without the regional port, regional shippers/consignees are forced to carry container from/to Yangon port by land. Currently, poor road infrastructure and insufficient transport equipment result in making container in-tact delivery difficult and expensive. According to our cost inquiries, container transportation charge is expensive even for below 300 km distance from Yangon (Table 5.2). In contrast, break bulk delivery by trailer is far cheaper than contain intact delivery. Although this trend will be changed in accordance with containerization development, the regional port will be effective to transport cost reduction, which is most effective attraction for Mon and Kayin State economy. It is obviously true that short distance delivery is absolutely necessary factor for low cost delivery.

Table 4.44 Truck Delivery Cost from Yangon

(US$)

Route	20'	40'	Break bulk (16ton truck)
Hpaan	1,300	1,400	450
Mawlamyine	1,300	1,400	450
Kyaikkhami	1,400	1,550	600
Kwanut	1,550	1,770	750

Source: Inquiries for forwarders

➢ Demurrage cost/obligation

Currently, regional export/import has to pick up/return empty container from/to Yangon Port. This is one reason for high container transport cost. Viewing from shipping lines, however, Myanmar involves the risk of low turnaround ratio of container because of small export volume and high risk of staging empty return containers. Since low container turnaround ratio undermines the profitability of shipping line, they are likely to impose severe container-returning rule: demurrage.

In advanced counties, since forwarders are likely to do temporary container storage function at their facilities instead of shipping line, demurrage is not necessarily mandate practice. However, in Myanmar, according to interview surveys, demurrage system is mandatory. Moreover free-demurrage time is only 3-4 day. Taking account of delivery time for containers, this is one big reason why Myanmar people prefers break bulk delivery which do not required demurrage charge. Of course, the Kyaikkhami port will avoid demurrage practice, which is beneficial for users, and shorting delivery time is further beneficial for users

➢ Potential for coastal transport

It is critical for the Kyaikkhami port to form effective logistic network between big hinterland; Yangon. Good connectivity with Yangon certainly attracts user's attention. The advantage of the Kyaikkhami port is its capacity to have transport "options" for connecting Yangon not only by road but also by rail and coastal shipment. So far, railway container transport is not favorable because scheduled delivery is not guaranteed. Empty container transport by railway may be feasible.

Although it is apparent that coastal transport is effective for reducing cost and CO_2 emission, one of the most serious problems is shallow draft in Yangon Port. Combining with the development of containerization, it is desirable to install new type container feeder vessels which enable to operate in shallow draft. An example of Japanese new type container-barge which can carry 84 FEU with its draft only 4 m is illustrated in Figure 5.2. This type barge will be able to access Yangon Port without problem.

In particular, the Kyaikkhami port is forecasted to be export-oriented port so that empty container haulage to Kyaikkhami is an important issue. Container barge transportation is useful method for empty container haulage from Yangon and other neighboring ports. Good connectivity for coastal shipping will increase the potential of Kyaikkhami port.

2) Cargo demand forecast

In terms of cargo demand forecast for port development it seems normal to take following steps;

- ✓ Capturing current cargo volume as baseline (a)
- ✓ Fixing economic growth ratio (b)
- ✓ Fixing elasticity between cargo volume and GDP/GRDP growth ratio (c)

Then, calculating (a) x (b) x (c) is basic process; however, it is difficult to collect a basic cargo production data from/to hinterland, because this regional port program is a new port development, not extension plan of existing port. Since study team cannot adopt ordinal forecasting method, alternative method should be taken into account as following methodology.

- ✓ Step 1) Assuming baseline : calculating value add price for potential commodities
- ✓ Step 2) Converting value add price into gross production value
- ✓ Step3) Assuming port usage ratio
- ✓ Step4) Calculating cargo volume

Study team tries to clarify cargo volume as following criteria (Table 4.45)

Table 4.45 Cargo Criteria

Cargo status	Commodity	Volume (ton)
Export	Industrial goods	1,244,996
	Agricultural good	87,715
	Mineral	350,000
Import	Industrial goods	637,704

3) Rough examination of Kyaikkhami regional port development

➢ Classification of handling cargo volume by cargo type

To examine the required facilities of the new port, forecasted cargo handling volume shall be classified into cargo types.

Table 4.46 Classification of Handling Cargo Volume by Cargo Type

	Commodity	Volume			
		Total	General Cargo	Containerized	
		ton	ton	ton	TEU
Export Cargo	Industrial Products	1,244,996	0	1,244,996	(=114,220)
	Agriculture Products	87,715	0	87,715	(=6,091)
	Mineral (Antimony)	350,000	350,000	0	(=0)
	Sub-Total	1,682,711	350,000	1,332,711	(=120,311)
Import Cargo	Industrial Materials	637,704	127,541	510,163	(=35,428)
Total		2,320,415	477,541	1,842,874	(=155,739)

Source: Study Team

There is a large gap between export containerized cargo volume and import containerized cargo volume. A lot of empty container boxes shall be imported to fill the gap.

As the result, total container box handling volume becomes twice that of the export container cargo volume as shown below.

Total Container Cargo Volume	
Export Container Cargo Volume	120,311 TEU
Import Container Cargo Volume	120,311 TEU
Total	240,622 TEU

From the result of examination, regional port needs one container cargo berth and one multipurpose berth at the beggining of part operation in 2023.

➢ Ship size and navigation route

The Study Team assumes that container ships on route to the Yangon port from/to other Asian inter-connecting port wills call the new port at the initial stage. As there is a draft limitation at Yangon river channel due to the presence of shallow sand bar, the max size of container ship that can call at the Yangon port is 20,000 DWT class of 1,000 TEU with 10 m draft.

However, container ships sailing in intra-Asian shipping route are getting larger and larger. Taking into account the trends of the changes in container ship size in the world and the Asian region, Myanmar needs to develop a deeper port to accommodate larger ships.

There is no draft limit in the new port as it is a sea port. The design vessel size for the new port is set as 2,000 TEU (length 210 m) and design depth of berth is 12 m.

In the future, it is necessary to study the introduction of larger container vessel over 4,000 TEU, which calls the port of Colombo and European countries from Singapore.

➢ Capacity of container terminal

Capacity of container terminal is determined from such factors as the handling capacity on the pier side which depends on the handling capacity of gantry cranes and the yard handling capacity which depends on the area and the capacity of yard handling equipment.

Container handling capacity of one berth with a length of 240 m which is capable of accommodating the maximum ship size of 210 m LOA can be estimated at about 290,000 TEUs/year. The yard capacity needed for handling 241,000 TEUs/year is estimated at 8,600 TEUs in accordance with the factors given below. The slots required can be estimated at 1,700.

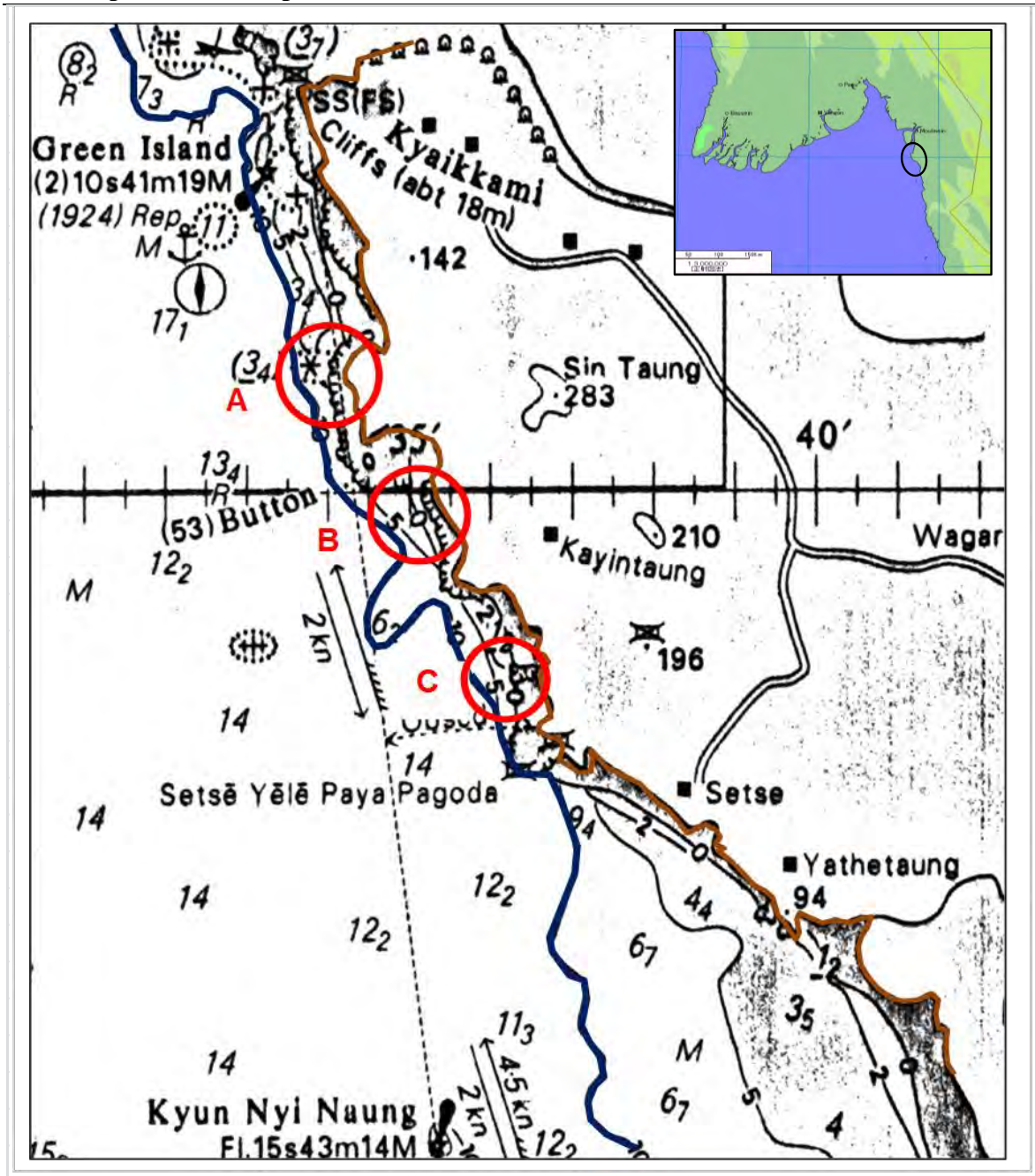
Theoretically, the containers generated from the region by 2023 may to be handled at a terminal with one berth of 240 m and a storage yard with a capacity of 8,600 TEUs. Sixteen hours are needed to handle containers of 1,000 TEUs per ship by two gantry cranes. In addition to this, an average of 4 hours in total will be required for berthing/unearthing. Taking that into account, the berthing time of one ship can be estimated at about 20 hours. On the other hand, five container ships need to call the port per week to transport 241,000 TEUs of containers per year.

- Capacity of multipurpose berth

The Study Team assumes that a multipurpose berth will not be equipped with a gantry crane and that a general cargo vessel will use its own ship crane for cargo loading and unloading. Annual cargo handling capacity of one berth of the 240 m multipurpose berth is about 500,000 tons for general cargo vessel and bulk cargo vessel.

4) Regional port development in the Study Area

The Study Area is the 16 km shore line between the Kyaikkhami town on the north side and the Setse beach on the south side. The Study Team assumes that soil conditions of this area is entirely similar as topsoil of red clay lay on the hard bedrock. Almost all of flat land in the hinterland is used as rubber plantation. In rubber plantation, there are trail to shoreline. The present study limits the survey area as mentioned above. However, it is desirable to enlarge the survey area in the subsequent master plan and feasibility study. Figure 4.31 shows proposed three sites for regional port development in the Kyaikkhami area. Using chart data, the Study Team identified three locations which are approximately within 1.5 km of an area with a water depth of -12 m.



Source: JICA Study Team

Figure 4.31 Proposed Sites for Regional Port

5) Selection of proposed regional port site

Table 4.47 shows the comparison result of the three sites proposed for the regional port. Each site needs a breakwater to secure calmness. Area C is the most suitable for port development.

Table 4.47 Comparison Table of Proposed Sites for Regional Port

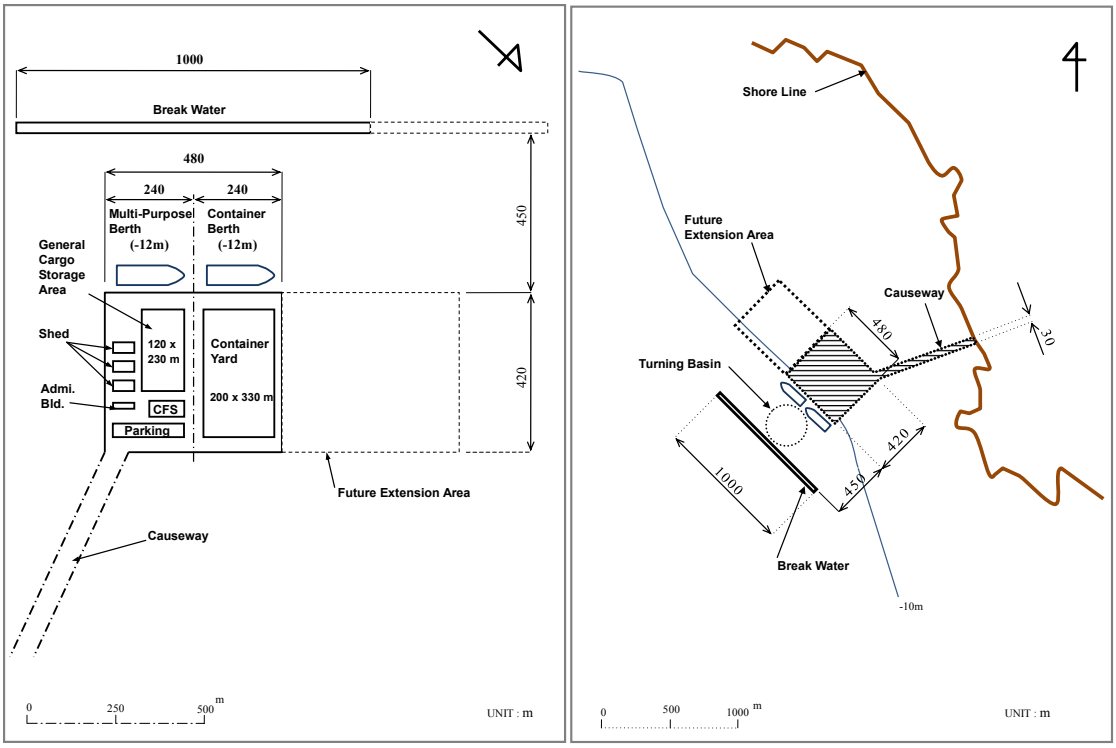
Condition to Examine	Area A	Area B	Area C
Presence of Calmness Area	×	×	×
Water depth more than -12m	○	○	○
Geographical Condition of Hinter Area	△	×	○
Development Space	△	×	○
Access to Land Transportation	△	△	△
Affected residents by development impact	Some	few	few
Proximity to main O/D of handling cargo	△	△	△
Total Evaluation	○	×	◎

Source: JICA Study Team

A large river, the Thanlwin River, flows into Martaban Bay at the Kyaikkhami town carrying a lot of earth and sand into sea from the upper stream. Southwest monsoon blows drift sand to shore and forms beaches in this area. Therefore, the impact of sand drift on port construction shall be analyzed carefully at the FS stage.

6) Terminal layout plan

Alignment of breakwater is at right angle to south-west monsoon wave. Future expansion of the terminal will be achieved by extending the berth in a straight line. Figure 4.32 shows outline of regional port layout and outline of regional port development plan respectively



Source: JICA Study Team

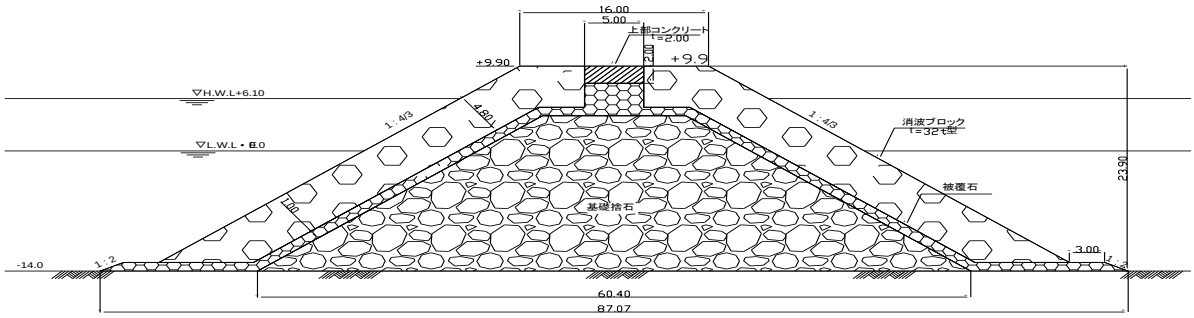
Figure 4.32 Outline of Regional Port Layout and Development Plan

7) Summary of Kyaikkhami port design

In the present study, the structure type has been selected based on the limited existing information. However, in the subsequent master plan and the feasibility study, natural conditions survey including field observation will be necessary.

➢ Breakwater structure type

Two structure types, wave-breaker blocks type and concrete caisson type, have been compared taking account of stability, workability, economy, and locality, and the artificial armour type was found out to be favorable.

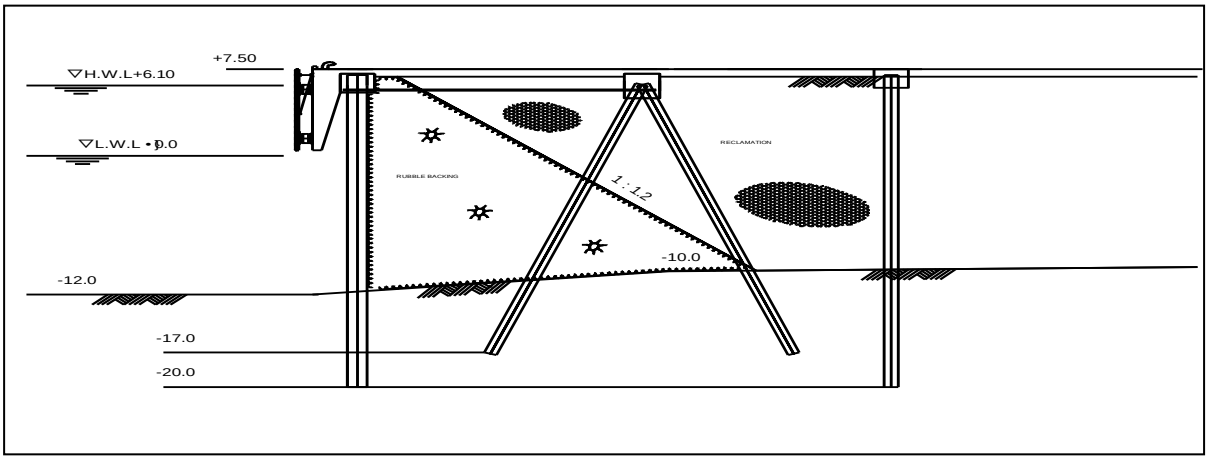


Source: JICA Study Team

Figure 4.33 Artificial Armour Type

➢ Barth structural type

Five structure types, sheet pile type, concrete caisson type, concrete block type, cell type, and pile deck type have been compared taking account of stability, workability, economy, and locality, and the sheet pile type was found out to be favorable.



Source: JICA Study Team

Figure 4.34 Sheet Pile Type

(2) Development of deep sea port

Kalegauk is a promising area for the construction of a deep sea port. This area is about 120 km south from Mawlamyine, four hours drive by car. The road condition from Mawlamyine to Thanbyuzayat is good, but from Thanbyuzayat to Kawdut (access point to the Kalegauk island) only one lane is paved. The candidate port site is the mainland side, where the Kalegauk island shield the waves

caused by southwest monsoon. When surrounding area is developed, there will be a necessity to construct the deep sea port. However, Dawei, where the deep sea port project is underway, is only 100 km away from here. If the deep sea port is to be constructed at Kawdut, it will compete with Dawei Port.

(3) Utilization of inland waterway

The importance of developing the regional port in the Southeast Myanmar was pointed out in the previous section. However, the development of the regional port will take quite a long time. Thus, meanwhile rehabilitation of the inland waterway port facilities, maintenance of the navigation channels, and replacement of vessels should be undertaken to ensure adequate access to most areas in the Region. Since the inland waterway transportation is low cost and suitable for mass transportation, the demand for this mode of transportation will not cease even after the regional port are constructed.

1) Containerization

Current containerization ratio in Myanmar is extremely low, but will rapidly increase as the economy of the Country developed. Container transportation is superior to conventional transportation in terms of efficiency, cost, storage, and security. For example, transport of agriculture goods by container vessel can prevent damages from rain and excess shaking.

When the Hpaan industrial zone is developed, containerization will be necessary. Containers originated from the industrial zone could be transported by container vessels to Yangon or regional ports. In order to realize containerization, not only construction of port and procurement of cargo handling equipment, maintenance of navigation channels and introduction of container vessels are also necessary. Container vessels could be repaired or maintained at IWT's upgraded dockyard in Mawlamyine.

2) Replacement of vessels

In the Southeast Myanmar, inland waterway transportation is the major mode of transportation during the rainy season (June to October, November), when the feeder roads are flooded, except for the major waterway routes. When the feeder roads are upgraded, waterway transportation will be diminished. However, road upgrading will take time, and the waterway transportation will be utilized for some time. The boats currently used are deteriorated, low in fuel efficiency, and not comfortable for the passengers. From now on, replacement of the vessels will happen. Introduction of FRP boats will be one of the options. FRP is durable, light weighted, strong, and easy for repair. In Japan most fishing boats and leisure boats are FRP boats. Japan's technology transfer is expected in this issue.

Another option is to introduce landing crafts. It will take long time and high cost to develop the regional port in full scale. Until then landing crafts can be used, since no port facilities are required, and the loading and unloading can be done mechanically.

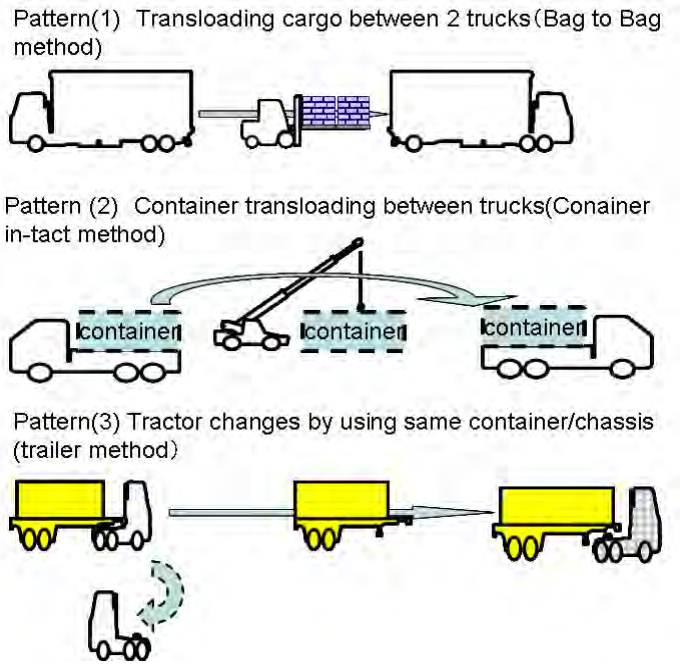
3) Utilization of ferry boats

As described above, the ferry service to cross the Thanlwin River at Kamamaung and Myaukkyarinn is rarely operated due to the deterioration of ferry boats and the lack of appropriate berthing facilities. In the future, when demand for crossing the river increases, a bridge will be constructed. In the meantime, replacement of ferry boats and construction of landing facilities will help to improve logistics in Karen State.

(4) Establishment of cargo transshipment system

Current border transshipment process focuses on truck loaded cargo, in particular, small sized trucks, not containers. A site survey revealed that most transport is handled by 4-axle trucks. This is mainly for the reason that conditions of road infrastructure make it difficult for large size trucks to transport. However, the road development will enable truckers to use container-type vehicles on this route.

It is necessary to adopt more modern technology which meets ASEAN and global standards. A cargo transshipment system will be changed to container-intact practice as observed in ASEAN countries (Figure 4.35). Current physical cargo transshipment practice at private warehouses, shown as Pattern (1) in Figure 4.28, will decline as the result of progress of the container-intact transportation, shown as Pattern (2) in Figure 4.28. In order to meet this trend, private sector warehouses should shift their function from transshipment to warehouse oriented services including inventory control to MTZ and FTZ users.



Source: JICA Study Team

Figure 4.35 Cargo Transshipment System

Following improvements should be scheduled in order to achieve container-intact operation at MTZ, which will have to provide sufficient waiting space for trucks and transshipment equipment to avoid manual operation.

1) Adoption for container intact or container transship method

Road infrastructure development enables container transportation in 2015 for the corridor between Myawaddy and Yangon. At that time, the cargo transshipment system will shift from current manual operation to trans-loading container method (Pattern (2)) or tractor change system (Pattern (3)) as shown Figure 4.28. In order to realize this, equipment and sufficient working space should be prepared.

2) Waiting space

Although container trans-loading method and tractor change system does not necessarily need to arrange simultaneous matching trucks for loading/unlading operation, temporary waiting space comes to be necessary for trucks and containers. If enough track/container pool is provided, it is not necessary to wait counterpart trucks for cargo transfer. This will result in high turnaround of trucks.

3) Facilitated customs procedure

Quick customs procedure is essential for customers, whose waiting time provides no value. ASEAN counties are now trying to progress facilitated customs clearance by adopting contemporary technologies such as e-customs procedure, advanced declaration, e-payment, risk management system, and preferential permit system for good compliance exporter/importer. Although border customs procedure is facilitated to some extent as shown Table 4.38, border procedure remains depending on manual document check, and physical inspection is still forced.

4) Transit system development

In Myanmar, customs procedure is likely to be carried out at border post as like MTZ. This is because collecting duty at border is safest way to avoid duty evasion. Yet, it is normal in the world to adopt transit system which can pass border easily by simple transit procedure, and customs clearance is implemented at destination where importers locate. This is more convenient for importers because smoother cargo arrival is available rather than border clearance. While CMP cargo is admitted transit procedure, transit system is not popular in Myanmar. The necessity of promoting transit procedure is agreed among concerned parties that the JICA Study Team interviewed. JICA experts being dispatched at customs department also agreed.

5) Private sector innovation

Approximately forty private logistics operators are already establishing their warehouse facilities adjacent to MTZ. Their facilities are relatively small and limited from point of international standard. Currently, cargo loading/unlading operation is likely to rely on manual operation, and equipment is not modernized. The standard of facilities is not sufficient for containerized cargo handling. It is desirable to integrate small facilities but investment and agreement among logistics providers will face difficulty. This is because there is the risk that investment for existing facilities will be useless for the private sector after the innovation. It seems important to consider an innovation program to upgrade warehouse facilities adjacent to MTZ among stakeholders

(5) Strategy for regional logistic development

1) Initial and advanced strategy

A stage-wise strategy is proposed for logistic development for Myanmar and the Southeast Myanmar: initial strategy and advanced strategy (Figure 4.36).

The initial strategy aims at establishing the Bangkok-Yangon access with two main sea ports opening to international trade. Since Yangon port service standards are much lower than Thailand port, it is important to utilize accessibility to Thailand to attract regional industries focusing on international trade. This is particularly important for industries relying on procurement of raw

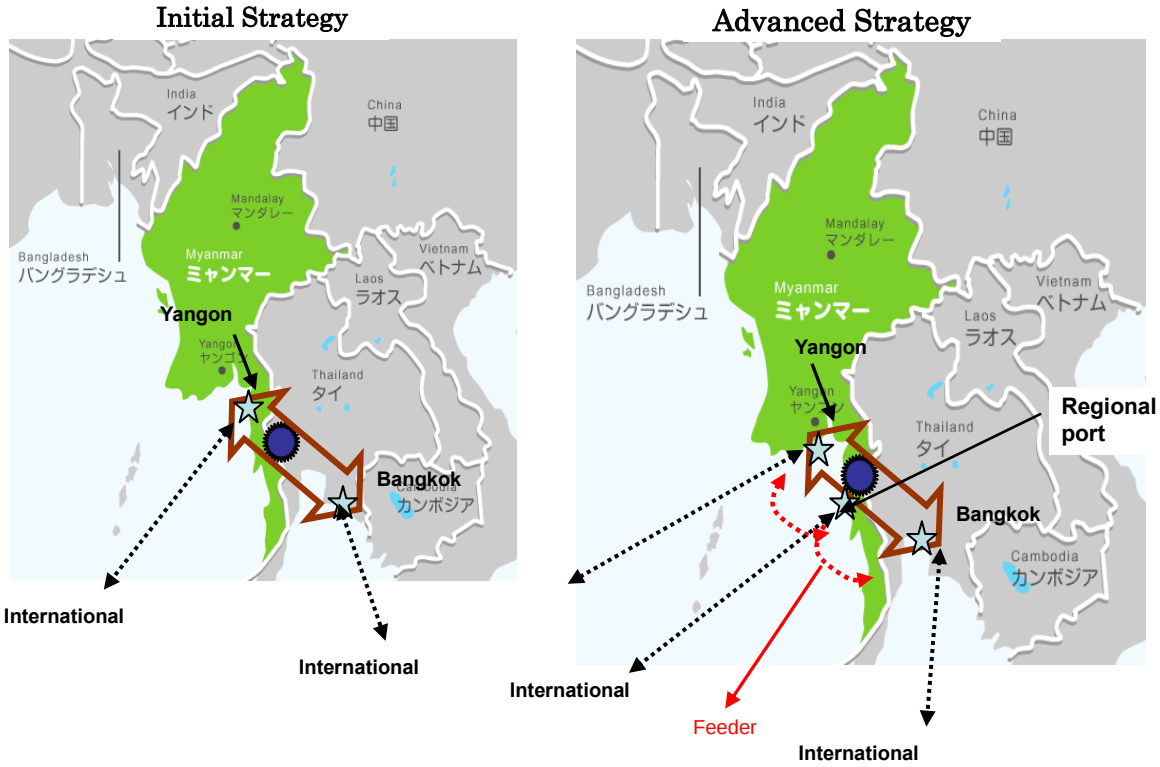
materials from Thailand. Regional textile industry is a typical example that imports all the materials from overseas through Thailand.

Regional inbound/outbound cargo can be consolidated with the Yangon trunk line movement, once efficient logistic facilities are provided. This will reduce transport costs for regional users. Good accessibility between Bangkok and Yangon will provide incentives for local industries, which can take advantage of the improved link.

The advanced strategy aims at strengthening port functions on the Myanmar side by complementary operation of the Yangon port and the new port in Mon State. Since Myanmar will remain to be a feeder country from the viewpoint of the world shipping industry even if a deep sea port is constructed, improvement of feeder services will be very important to conduct smooth international trade. Feeder services between the regional port in the Southeast Myanmar and the main port such as Yangon may be provided by both coastal shipping and railways.

2) Components of strategy

The Southeast Myanmar has a potential for creating unique and efficient logistics network if regional port construction is realized. The network will be supported not only by roads but also coastal shipping route and railway system. It should be supported also by soft component development. Customs procedure facilitation will be important issue as well as materializing facilitated transit system. In particular, cross border procedure facilitation is essential for the Region where the most important border posts locate. Since ASEAN is now eager to facilitate border procedures, the Southeast Myanmar has to catch up with the ASEAN standard to meet the demand for facilitated border cargo movement.



Source: JICA Study Team

Figure 4.36 Conceptual Presentation of Initial and Advanced Strategy for Regional Logistic Development

In line with the strategy presented above, the following should be examined for implementation.

i) Regional port development,
ii) Feeder network establishment connecting the regional port with the mother port,
iii) Intermodal facilities provision for connecting various transport modes,
iv) Facilitation on customs procedure and border crossing such as introduction of e-customs procedure,
v) Development of transit transport scheme,
vi) Bonded warehouse facilities to provide bonded storage service and quick dispatch to customers,
vii) Inland container depot (ICD) development to connect local/main ports with local port and local users,
viii) Provision of logistic facilities to provide comprehensive services,
ix) Consolidation scheme development, and
x) Establishment of Hpayarthonesu border facilities to provide similar services as MTZ

Specific projects to improve water transport in Southeast Myanmar are tentatively proposed as summarized in Table 4.48.

Table 4.48 Tentative List of Proposed Projects for Water Transport

Object	Project Name	Contents
Port Development Project	Southeast Regional Port Development M/P Priority: highest Start of study: 2013 fiscal year development scale:	Southeast Regional Port is important because it is the gateway of the East West Economic Corridor and is the logistic center of the region. Though there are several candidate locations for the port development, details of the development have not established yet. Thus, port development master plan shall be established in tandem with the regional development plan.
	Kyaikkhami Port Development Project Priority: highest Start of study: 2014 fiscal year development scale: large	Mawlamyine Port is the river port, of which water depth is shallow. Since the rate of accretion is high, deepening of the channel by dredging is not economically feasible. Presently, transshipment is carried out at offshore of Kyaikkhami. The water depth of this area is 10 to 12 m, thus the area is the potential for development as an international port. This Project is to carry out the port development feasibility study taking account of land usage, natural conditions, and demand forecast.
	Mawlamyine Port Rehabilitation Project Priority: high Start of study: 2014 fiscal year development scale: small	Currently there are eight pontoon type jetties and two fixed jetties, and the loading and unloading are carried out by manual labors. The safety is problem, and the efficiency is very low. Rehabilitation of the port facilities as well as containerization and mechanization will be necessary. This port will take the function of handling of containerization until complete construction of Kyaikkhami Port and also take a role as regional port for Mawlamyine area.
	Kalegauk Port Development Plan Priority: middle Start of study: 2020 fiscal year development scale: huge	The sea area between the Kalegauk Island and the mainland is deep, and there are several natural ports. As the Mon State and Karen State develop, the deep sea port development at this area will be necessary. However, Dawei Port, where deep sea port is being developed, is about 200 km south from here. Thus, Kalegauk Port shall be studied taking account of Dawei Port development, hinterland development plans, and road and railway development plans.
Inland Water Transportation, Vessel and Facilities Improvement Project	Southeast Region, Inland Waterway Network Improvement M/P Priority: highest Start of study: 2013 fiscal year development scale:	In the Southeast Myanmar, there are inland water vessel services to transport cargo and passenger. Improvement of the customer services to the areas, where only waterway can access, waterway is more convenient than other mode of transportation, or mass transport by vessel enables low cost transportation. With due consideration of road, railway, and industrial Zone development plans, establishment of master plan for improvement of inland waterway network.
	Project for efficiency improvement of water transportation logistics Priority: high Start of study: 2014 fiscal year development scale: medium	In the Southeast Myanmar, where there are no jetties, it is common for loading and unloading that vessels go ground or bridging wooden plates between vessel and river bank. By introducing the landing crafts, ferries, and FRP vessels at non-jetty areas, loading and unloading could be carried out efficiently. Water transportation has an advantage for long distance mass transportation and so its share is 40 % also in Japan where road transportation is developed. Therefore, increase of water transportation is expected in Myanmar with containerization in future.
	Project for improvement of safety in water transportation Priority: high Start of study: 2014 fiscal year development scale:	The difference of water levels between the rainy and dry seasons is large, and rate of the sand and mud sedimentation is high at the rivers in the study areas. There are no accurate navigation charts, no navigation aids, and no safety navigation facilities in the inland waterway, which lead in lack of safety, punctuality, and speed. This project is to improve the safety by upgrade of navigation facilities and channels, and to upgrade dockyard that can at least carry out upgrade of old vessels, repair and inspection. Especially in affluent rainy and typhoon seasons (June- Sep. & Oct. - Nov.), it is difficult to travel by road excepted in paved major arterial road.

	medium	Therefore, water transportation becomes a major mode for travel in this region and so improvement of safety is urgent necessary.