

Japan International Cooperation Agency

Office of the National Economic and Social Development Board The Kingdom of Thailand

# The Study on the Integrated Regional Development Plan for the Northeastern Border Region in the Kingdom of Thailand

# Final Report Sector Plan

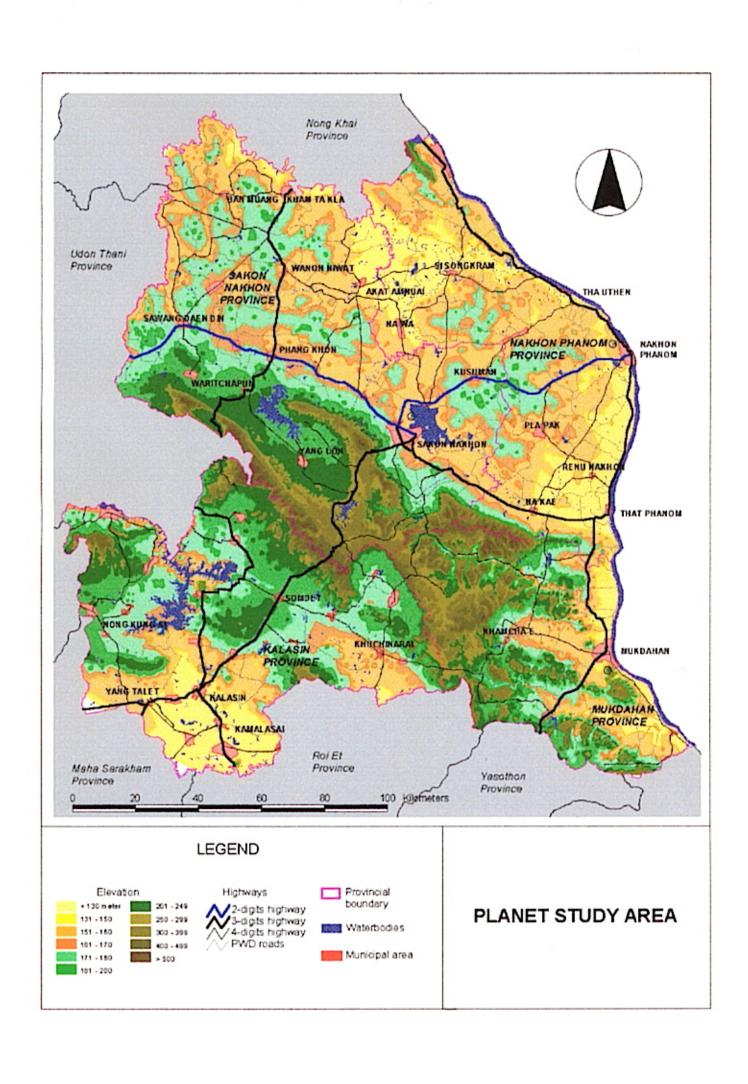
September 2001

Pacific Consultants International
International Development Center of Japan
KRI International

S S F JR 01-122(3/4)

The exchange rate applied in the Study is: US\$ 1.00 = Thai Baht 41.4

(1998 Bank of Thailand Reference Rate)



#### The Study on The Integrated Regional Development Plan For The Northeastern Border Region

## **FINAL REPORT: SECTOR PLAN**

#### **TABLE OF CONTENTS**

CHAPT	ER 1 ENVIRONMENTAL MANAGEMENT	
1.1 1.2	General Conditions	1-11
1.3 1.4	Natural System and Functions of the NBRSocio-economic Changes Affecting the Environment	
1.4	Issues on Environmental Management in the NBR	
1.6	Natural Environmental Management Plan	
CHAPT	ER 2 LAND USE	
2.1	Current Land Use	2-1
2.2	Socio-economic Changes Affecting Land Use	
2.3	Issues on Land Use Plan	
2.4	Land Use Framework	
2.5	Land Potential Analyses	
2.6	Land Use PlanFarm Activities Integration Project	
2.7	Farm Activities integration Project	2-43
СНАРТ	ER 3 WATER RESOURCES DEVELOPMENT	
3.1	General Conditions	3-1
3.2	Characteristics of Water Resources in the NBR	3-4
3.3	Issues Concerning Water Resources in NBR	3-7
СНАРТ	ER 4 AGRICULTURE	
4.1	Agricultural Development Policy	4-1
4.2	Present Agricultural Conditions	
4.3	Irrigation Development	4-31
4.4	Agricultural Development Plan	4-38
СНАРТ	ER 5 FISHERY	
5.1	Fishery	5-1
СНАРТ	ER 6 LIVESTOCK	
6.1	Present Situation of Livestock Industry in Thailand	6-1
6.2	Future Demand for Livestock Products in Thailand	
6.3	Possibility and Issues of Livestock Farming Development in Northeastern Thailand	6-11
6.4	Policies for Livestock Farming Development	6-14
СНАРТ	ER 7 RURAL DEVELOPMENT	
7.1	Macro-Overview of the NBR	
7.2	Rural Society in NBR: Micro-level Analysis	
7.3	Past Development Policy and Program	
7.4	Current Development Policy	7-34
7.5	Planning Issues of the Study Area	
7.6	Development Strategies	/ -39

7.7	Development Project and Program	7-41
СНАР	ER 8 INDUSTRY	
8.1	Current Development	Q_1
8.2	Current Situation of Local Industry	
-	Current Situation of Local Industry	0 12
8.3	Direction of the Local Industry Development	
8.4	Considerations of Industrial Development Strategy	
8.5	Regional Development Projects and Programs	8-92
СНАР	ER 9 TOURISM	
9.1	Tourism in the NBR	Q_1
9.2	Tourism Development Potential of the NBR	
9.3	Tourism Development Strategies	
9.4	Tourism Development Plan	
9.4	Tourism Development Flan	9-17
CHAP	ER 10 HUMAN RESOURCES DEVELOPMENT	
10.1 10.2	Present Human Resource Development Efforts	
10.2	Issues to be Addressed in NBR Human Resource Development	
10.3	Regional Human Resource Development Plan	
10.4	Regional Figure 1 Resource Development Figure 1	10-14
CHAP	ER 11 EDUCATION	
Current	Situation and Problems in the Education Sector	11-1
11.2	Issues to be Addressed in NBR Education Development	11-20
11.3	Regional Education Development Plan	
CHAP	ER 12 PUBLIC HEALTH	
12.1	Current Situation of Study Area	12-1
12.2	Past Development Policy, Program and Its Achievement	12-12
12.3	Current and Future Development Policy	12-17
12.4	Future Trends and Constraints	12-20
12.5	Planning Issues of the Study Area	12-20
12.6	Development Strategies	12-23
12.7	Development Plan and Project	12-24
CHAP	ER 13 LOCAL ADMINSTRATION AND FINANCE	
40.4	Proceed Ottontion	40.4
13.1	Present SituationA Move Toward Decentralization in Thailand	13-1 40-40
13.2	A wove Toward Decentralization in Thalland	13-10
13.3	Benefits of Decentralization	13-18
13.4	Constraints of Decentralization	13-19
13.5	Recommendations	13-19
СНАР	ER 14 URBAN DEVELOPMENT	
14.1	Current Situations of Urban Development	14-1
14.2	Socio-Economic Perspectives	
14.3	Planning Issues on Urban Development	14-17
14.4	Planning Framework	
14.5	Urban Development Plan	
СНАР	ER 15 INFORMATION AND COMMUNICATIONS	
_	Current Situation	15 1
15.1 15-2	Planning Issues	
15-2	Development Strategies	
15-3	Telecommunications Development Projects	10-0 15-10
. U T	rologorii nariloationo Dovolopinioni i Tojogo	

#### **CHAPTER 16 TRANSPORTATION**

16.1	International and Inter-Urban Transport System of Thailand	16-1
16.2	Regional Transport System of North-East Thailand	
16.3	Commodity Transportation	
16.4	Review of Future Transport Development Plans	
16.5	Issues in Developing Land Transportation System	
16.6	Proposed Transportation System Development	
	TER 17 ELECTRIC POWER	
•	1613 17 - 666 5 11315 F 57 8 8 6 13	
17 1		17-1
17.1 17.2	Introduction	
	IntroductionPower Sector Organization	17-2
17.2	Introduction	17-2 17-7
17.2 17.3	Introduction Power Sector Organization Power Tariff System Historical Power Demand and Load Forecast Existing Power System	17-2 17-7 17-11 17-21
17.2 17.3 17.4	Introduction Power Sector Organization Power Tariff System	17-2 17-7 17-11 17-21

#### MAstEr plan

CHAPTER 1 INTRODUCTION TO THE STUDY
CHAPTER 2 THE NORTHEASTERN REGION
CHAPTER 3 PLANNING ENVIRONMENT
CHAPTER 4 MODEL ANALYSIS
CHAPTER 5 DEVELOPMENT STRATEGIES AND ACTIONS

CHAPTER 5 DEVELOPMENT STRATEGIES AND ACTIONS
CHAPTER 6 STRENGTHENING OF LOCAL GOVERNMENT

CHAPTER 7 IMPLEMENTATION PROGRAM

CHAPTER 8 PRIORITY PROJECTS AND PROGRAMS
CHAPTER 9 CONCLUSION AND RECOMMENDATION

#### **PRE-FEASIBILITY STUDY**

CHAPTER 1 INTRODUCTION

CHAPTER 2 INTEGRATED FARMING IN RAIN-FED AREAS

CHAPTER 3 LOCAL INDUSTRY PLATFORM

CHAPTER 4 IT HRD CENTER IN RAJAMANGALA INSTITUTE OF TECHNOLOGY, KALASIN

CHAPTER 5 NEW RAJABHAT INSTITUTE, MUKDAHAN

CHAPTER 6 MUKDAHAN GOODS DISTRIBUTION AND PROCESSING CENTER

# **LIST OF TABLES**

Table 1.1	National Parks in NBR	1-11
Table 1.2	Changes in Land Use from 1985 to 1995	1-12
Table 2.1	Land Use Structure from 1985 to 1995	2-5
Table 2.2	Trend of Crop Cultivation and Other Uses	2-6
Table 2.3	Change of Forest Area between 1976 and 1999	2-6
Table 2.4	Current Land Use in the Deforested Area	2-6
Table 2.5	Land Use Composition	2-11
Table 2.6	No. of Land Reform Projects in the NBR	2-13
Table 2.7	Irrigation Projects in the NBR	2-15
Table 2.8	Farm Holding Size	2-17
Table 2.9	Proportion of Owned Farmland	2-17
Table 2.10	Distribution of Farm Holding Size	2-18
Table 2.11	Urbanization in the NBR	2-18
Table 2.12	National Parks in the NBR	2-19
Table 2.13	Change of Occupation Structure	2-20
Table 2.14	Macro Economic Framework	2-23
Table 2.15	Land Use Targets	2-23
Table 2.16	Future Population and Urban Areas Required	2-24
Table 2.17	Current Land Use by Agricultural Zone	2-35
Table 2.18(1)	Land Utilization by Agricultural Zone	2-37
Table 2.18(2)	Land Utilization by Agricultural Zone	2-38
Table 2.19	Future Land Use Composition in 2020	2-41
Table 2.20	Land Use Changes between 2000 and 2020	2-41
Table 3.1	Meteorological Conditions in NBR	3-1
Table 3.2	River Basins in Each Province	3-3
Table 3.3	Rainfall in NBR	3-4
Table 3.4	Current Consumption of Water Resources in NBR	3-5
Table 3.5	Water Facility Project in NBR	3-6
Table 3.6	Large-sized Water Facility Projects in NBR	3-6
Table 3.7	Comparison in Evaporation and Rainfall	3-7
Table 4.1	Economic Policy and Measures by MOAC under the Revised 8 <sup>th</sup> Plan	4-3
Table 4.2	Harvested Area of Major Crops	4-5
Table 4.3	Major Production and Yield in the NBR, 1988-1998	4-7
Table 4.4	Harvested Area, Production and Yield of Major Crops	4-15
Table 4.5	Livestock Population in the NBR: 1985-1998	4-18
Table 4.6	Number of Livestock by Amphe in the NBR	4-19
Table 4.7	Freshwater Culture Households, Number of Ponds, Area and Inland Fishery Ca	tch in the
	NBR in 1998	4-22
Table 4.8	Lending Operation, BAAC	4-24
Table 4.9	Major Farmer's Organization in the NBR	4-26
Table 4.10	Planted Area, Production and Yield of Para-Rubber in the Study Area, 1997	4-28
Table 4.11	Harvested Area of Major Fruits Trees, Production and Yield in the NBR	4-30
Table 4.12	Irrigation Projects in the NBR	4-33
Table 4.13	Summary of Planted Area, Number of Farmers and Investors for Agro-Industry	

	in Nam Un Irrigation Project	4-34
Table 4.14	Dry Season Crops in Lam Pao Irrigation Project	4-34
Table 4.15	Planted Area and Target of Dry Season Crops in the NBR	4-36
Table 4.16	On-going Medium Scale Irrigation Projects	4-37
Table 4.17	Major Development Constraints and Planning Consideration	4-39
Table 5.1	Fish Production in BMR (MT)	5-1
Table 5.2	Volume of Fish Catch and Fish Culture in the Study Area	5-3
Table 5.3	Major Fishing Grounds in the Study Area	5-3
Table 5.4	Aquaculture Production in the Study Area in 1966 (MT)	5-4
Table 5.5	DOF Manpower and Seed Production and Utilization in the Study Area	5-5
Table 5.6	Number of Agricultural Cooperatives and Members in the Study Area	5-6
Table 5.7	Some Topics of Research Conducted in Fishery stations in the Study Area	5-7
Table 5.8	Institutes Offering Courses in the Study Area	5-7
Table 5.9	Composition and Percentage of Household Food Consumption	5-9
Table 5.10	Estimated Fish Demand Increase in the Study Area up to Year 2015	5-9
Table 5.11	Number of Fish Farms in the Study Area	5-10
Table 5.12	Constraints of Fishery Development Identified by Local DOF Officers	5-11
Table 6.1	Livestock Promotion Plan under 8 <sup>th</sup> NESDP	6-2
Table 6.2	Change Livestock Raising	6-3
Table 6.3	Distribution of Livestock Raising by Kind and by Region	6-4
Table 6.4	Production of Provinces in Milk Cow Raising in 1997	6-5
Table 6.5	Livestock Population	6-7
Table 6.6	Calorie Consumption Projection	6-8
Table 6.7	Food Consumption per Capital per Year	6-10
Table 6.8	Estimate of P.F.C.per Country Food Consumption	6-10
Table 6.9	Food Balance Projection	6-11
Table 7.1	Village Basic Minimum Needs Indicators of the NBR (Year 2000 and 1999)	7-2
Table 7.2	Village Basic Minimum Needs Indicators in the NBR (Year 1992)	7-3
Table 7.3	The Ratio of Backward Villages by Province	7-5
Table 7.4	Household Land Holding Size by Province	7-6
Table 7.5	Average Cash Income of Farm Household in Thailand, 1995	7-6
Table 7.6	Average Cash Income of Farm Household in NBR	7-7
Table 7.7	Provision of Main Social Service and Infrastructure	7-8
Table 7.8	Sample Villages for the Social Survey	7-9
Table 7-9	Yield and Price of Paddy	7-11
Table 7.10	Paddy Cultivation of Sample Households	7-12
Table 7.11	Cost and Benefit of Paddy Cultivation	7-13
Table 7.12	Field Crop Cultivation of the Sample Households	7-13
Table 7.13	Livestock in the Sample Villages	7-14
Table 7.14	Household Cash Flow: Household with Commercialized Agriculture	7-15
Table 7.15	Household Cash Flow: Large-scale and Diversified Farm Household	7-16
Table 7.16	Income Structure of the Sample Households	7-17
Table 7.17	Expenditure Structure of the Sample Households	7-19
Table 7.18	Debt Situation of the Sample Households	7-21
Table 7.19	Situation of Labor Migration in the Sample Villages	7-23
Table 7.20	Achievement of Poverty Alleviation Project (Phase I: 1993-97)	7-35

Table 7.21	Summary of Village Needs	7-38
Table 8.1	Major Export Goods from Thailand (Top 10 Goods)	8-6
Table 8.2	Thailand Exports by Group of Products	8-7
Table 8.3	Gross Regional Products for Manufacturing Sector at Current Price	8-11
Table 8.4	Gross Domestic Products by Industrial Business Field in Thailand	8-15
Table 8.5	Gross Regional Product by Industrial Business Field in Northeastern Region	8-16
Table 8.6	Gross Provincial Product by Industrial Business Field in Nakhon Phanom	8-18
Table 8.7	Gross Provincial Product by Industrial Business Field in Sakon Nakhon	8-19
Table 8.8	Gross Provincial Product by Industrial Business Field in Mukdahan	8-19
Table 8.9	Gross Provincial Product by Industrial Business Field in Kalasin	8-20
Table 8.10	Number of Manufacturing Establishments in the Study Area in 1996	8-25
Table 8.11	Out put of Manufacturing Establishment	8-25
Table 8.12	Top 10 Manufacturing Industries in Nakhon Phanom in 2001	8-26
Table 8.13	Top 10 Manufacturing Industries in Sakon Nakhon in 2001	8-26
Table 8.14	Top 9 Manufacturing Industries in Mukdahan in 2001	8-27
Table 8.15	Top 10 Manufacturing Industries in Kalasin in 2001	8-27
Table 8.16	Products List of Cottage and Family Industries in Four Province	8-29
Table 8.17	Breakdown of Manufacturing Industry in Thailand	8-30
Table 8.18	Comparison of the Industrial Loan Conditions by Financial Sources	8-31
Table 8.19	Investment in Tak Province	8-34
Table 8.20	International Commodity Prices in USD	8-37
Table 8.21	Real Power of Oita Prefecture	8-42
Table 8.22	Target Industries by Activity by Market	8-52
Table 8.23(1/3)	One Hundred Business Opportunities for NBR	8-53
Table 8.23(2/3)	One Hundred Business Opportunities for NBR	8-53
Table 8.23(3/3)	One Hundred Business Opportunities for NBR	8-54
Table 8.24	Regional Conditions for Industrial Location	8-59
Table 8.25	Projects and Programs for Local Industrial Activities	8-93
Table 9.1	Summary of Tourism Resources in the Study Area	9-5
Table 9.2	Tourism Market of Thailand	9-6
Table 9.3	Current Tourist Arrivals of the NBR	9-6
Table 9.4	Present Accommodation in the NBR	9-7
Table 9.5	Road Distance Table	9-8
Table 9.6	Projects/Programs Proposed by Tourism Development Master Plan	
	In Northeastern Region by TAT	9-10
Table 9.7	Evaluation of Tourism Development Potential of Thai Study Area	9-12
Table 9.8	Projection of Future Tourism Demand in CBR	9-14
Table 9.9	Major Festivals/Events in the Northeastern Thailand	9-17
Table 10.1	Participants in Courses Offered by DNFE (1999)	10-2
Table 10.2	Participants to SDC Training Sources in NBR (1998)	10-4
Table 10.3	Participants to BIED and BSID Training Courses (1998)	10-5
Table 10.4	Educational Attainment and Occupation	10-7
Table 10.5	Labor Market Situation in NBR	10-7
Table 10.6	Employed Population Attaining Tertiary Education or More and	
	Middleclass Workers in NBR	10-13

Table 11.1	Total Budget and Budget per Student	11-4
Table 11.2	Gross Enrollment Ratio (Primary Education) in Thailand	11-5
Table 11.3	Gross Enrollment Ratio (Primary Education) in NBR (1999)	11-5
Table 11.4	Number of Drop-outs (Primary Education) in Thailand	11-6
Table 11.5	Number of Drop-outs (Primary Education) in NBR	11-6
Table 11.6	Teacher-Student Ratio and Number of Students per Class	
	(Primary Education) in NBR (1998)	11-6
Table 11.7	Educational Background of Teachers in NBR (1999)	11-7
Table 11.8	Ratio of Students with more than Average Score (Primary Education)	
	In NBR (National Competency Test 1997)	11-8
Table 11.9	Gross Enrollment Ratio (Secondary Education) in Thailand	11-8
Table 11.10	Gross Enrollment Ratio (Secondary Education) in NBR (1999)	11-8
Table 11.11	Drop-outs (Lower Secondary Education) in Thailand	11-9
Table 11.12	Drop-outs (Lower Secondary Education) in NBR (1998)	11-9
Table 11.13	Teacher-Student Ratio and Number of Students per Class	
	(Lower Secondary Education) in NBR (1999)	11-9
Table 11.14	Ratio of Students with more than Average Scores (Secondary	
	Education) in NBR (National Competency Test 1997)	11-10
Table 11.15	Gross Enrollment Ratio (Higher Education) in Thailand	11-11
Table 11.16	Higher Education Institutes and Students in Thailand	11-12
Table 11.17	Higher Education Institutes and Students in NBR	11-12
Table 11.18	Educational Background of Teachers in Higher Education Institutes	11-12
Table 11.19	Certificates in Vocational and Technical Education in Thailand	11-13
Table 11.20	Enrollment Ratio (Vocational Education) in Thailand	11-14
Table 11.21	Vocational & Technical Institutes and Students in NBR	11-15
Table 11.22	Teacher-Student Ratio (Vocational & Technical Education) in Thailand	11-15
Table 11.23	Enrollment of Basic Education in Thailand (1998)	11-18
Table 11.24	Enrollment of General Education in NBR (1999)	11-19
Table 11.25	Personnel in Non-Formal Education Centers (2000)	11-19
Table 11.26	NFE Centers in NBR	11-19
Table 11.27	Gross Enrollment Ratio in NBR (1999)	11-20
Table 11.28	Drop-outs in NBR (1999)	11-21
Table 11.29	Reasons for Dropping Out from School, NBR (1999)	11-21
Table 11.30	Population and Primary School Students in NBR (1999)	11-22
Table 11.31	Students Living Far From School and Commuting Ways (1999)	11-22
Table 11.32	Educational Background of Teachers in NBR (1999)	11-23
Table 11.33	School Types in NBR (1999)	11-24
Table 11.34	Higher Education Institutes in NBR	11-25
Table 11.35	Vocational Schools, Students and Teachers in NBR	11-26
Table 11.36	Vocational Schools in Mukdahan	11-27
Table 11.37	Vocational Schools in Nakhon Phanom	11-27
Table 11.38	Vocational Schools in Sakon Nakhon	11-28
Table 11.39	Vocational Schools in Kalasin	11-29
Table 11.40	Districts, Population and Vocational Schools in NBR	11-30
Table 11.41	Educational Background of Vocational Education Teachers in NBR	11-31

Table 12.1	Infant Mortality Rates and Maternal Mortality Rates in NBR	12-2
Table 12.2	Common Causes of Diseases of Out-patients in 1998	12-3
Table 12.3	Common Causes of Diseases of in-patients in 1998	12-4
Table 12.4	Common Causes of Deaths in 1998	12-4
Table 12.5	Latest Data on HIV Surveillance for the Target Areas	12-5
Table 12.6	Number of Health Facilities and Their Beds	12-6
Table 12.7	Number of Health Personnel and Number of People covered by one Health Worker	12-8
Table 12.8	Health Insurance Schemes in Thailand	12-10
Table 12.9	Ten Most Prevent Diseases of Laotian Out-patients	12-12
Table 12.10	Objectives and Indicators of the Health Development ('97-'01)	12-18
Table 12.11	Strategies of the Health Development ('97-'01)	12-19
Table 12.12	Dental Health of School Children	12-25
Table 12.13	Number of Dentists and Number of People Covered by One Dentist	12-25
Table 12.14	Indicators in the Field of Dental Health of School Children	12-26
Table 12.15	Percentages of Children Falling Below Weight/Height Standard	12-27
Table 12.16	Growth Indicators in School Children	12-28
Table 12.17	Targets and Activities of NCD Programs of Mukdahan Health Dept.	12-30
Table 12.18	Coverage of Screening of Main NCDs and Their Morbidity and Mortality	12-31
Table 12.19	Standard Items of Health Screening for Government Officials I Kalasin	12-32
Table 12.20	Targets of Coverage of NCD Health Screening among the Target Group	12-32
Table 13.1	Actual Number of Tessaban, Sukapibans and TAOs in 1997 and Their Database	13-4
Table 13.2	Population, Revenues and Expenditures in Tessaban Muang, 1997	13-5
Table 13.3	Differences in Financial Powers Between Tessaban Muang and	
	Tessaban Tambon, 1997	13-6
Table 13.4	Difference in Financial Situation in Each Tessaban Tambon in 1997	13-7
Table 13.5	Financial Situation of TAOs, Averages in Each Province, 1997	13-8
Table 13.6	Large Gap of Financial Situation in Each TAO in 1997	13-9
Table 13.7	Dependence on Subsidies	13-9
Table 13.8	Actual Work of Each of Three TAOs	13-12
Table 13.9	Actual Revenues of The Three TAOs and Tessaban in Kalasin Province	13-13
Table 13.10	Difference of Taxpayer Rates between Non Na Chan TAO and Bua Ban TAO	13-14
Table 13.11	Ratio of Residents per Local Official in the Three TAOs	13-14
Table 13.12	Expenditure Structure	13-15
Table 13.13	Result of Merger of TAOs and Tessabans in the Tambon	
	in the Same District(Amphoe) in Nakhon Phanom	13-16
Table 14.1	Urban Centers in the Northeastern Region	14-3
Table 14.2	Development of the Urban Economic Sector in the Northeastern Region	14-6
Table 14.3	Changes in Municipal Population Rates	14-7
Table 14.4	Population Growth on the NBR	14-8
Table 14.5	Urbanization in the NBR	14-8
Table 14.6	Business Establishments in the NBR	14-9
Table 14.7	Summary of Water Supply	14-12
Table 14.8	Wastewater Treatment Project	14-13
Table 14.9	Current Solid Waste Management in the NBR	14-14
Table 14.10	Position of Infrastructure Provision of the NBR in Whole Country	14-15
Table 14.11	Structure of Occupation of the NBR in 1999	14-16

Table 14.12	Population Framework	14-19
Table 14.13	Future Urban Population by Municipality	14-20
Table 14.14	Urban Areas Required in Future	14-21
Table 14.15	Urban Facilities Requirements in 4 Municipalities	14-21
Table 15.1	Market Liberalization Schedule	15-2
Table 15.2	PSTN System in the NBR Region (1990)	15-5
Table 15.3	Telephone Charges for PSTN Subscribers	15-5
Table 15.4	Mobiles Stations in the NBR Region	15-6
Table 15.5	Development Target of Telephone Units	15-9
Table 16.1	Highway Classification by Numbering System	16-1
Table 16.2	Highway Classification by Jurisdiction	16-2
Table 16.3	Highway Development by DOH	16-2
Table 16.4	Asian Highway in Thailand	16-3
Table 16.5	Current Railway System in Thailand	16-5
Table 16.6	Registered Motor Vehicles in 1999	16-9
Table 16.7	Highway Traffic Volume in the NBR	16-10
Table 16.8	Total Commodity Volume Attracted to Transport Centers	16-11
Table 16.9	Total Commodity Volume Generated from Transport Centers	16-12
Table 16.10	Commodity Movement in the Northeastern Region at Major Centers	16-15
Table 16.11	Distance from Major Urban Centers	16-16
Table 16.12	Transit Cargoes Transported by ETO from Lao through Thai to the 3 <sup>rd</sup> countries	16-18
Table 16.13	Transit Cargoes Transported by ETO from the 3 <sup>rd</sup> Countries through Thai to Lao	16-19
Table 16.14	Exported Commodity Volume by ETO from Thai to Lao	16-19
Table 16.15	The Second Phase 4 – Lanes Highway Widening Project	
	Approved for Construction Budget	16-21
Table 16.16	The Second Phase 4 – Lanes Highway Widening Project	
	Proposed for Loan Project in Fiscal Year 2000	16-22
Table 16.17	The Second Phase Four – Lane Highway Widening Project	
	Construction Planning in 1999-2008	16-23
Table 16.18	Track Rehabilitation Projects	16-24
Table 16.19	Track Doubling Projects	16-24
Table 16.20	Track Doubling Projects under 8 <sup>th</sup> Plan	16-25
Table 16.21	New Railway Project	16-25
Table 16.22	Annual Domestic Air Passenger Demand	16-27
Table 16.23	Cost Estimates of Mukdahan Airport in 2002	16-27
Table 16.24	Priority of Airport Development by EIRR	16-28
Table 16.25	Planned Urban Population	16-31
Table 16.26	Proposed Transport Project under PLANET	16-36
Table 16.27	Project Costing and Schedule	16-37
Table 17.1	Bulk Supply Electricity Tariffs to MEA and PEA	17-7
Table 17.2	Electricity Tariffs Schedule of Thailand	17-8
Table 17.3	Historical Record of Electricity Generation and Consumption	17-11
Table 17.4	Historical Record of Generation, Transmission and Distribution Losses	17-11
Table 17.5	Major Parameters of The Power Demand in 1999	17-13
Table 17.6	Category-wise Energy Consumption in Recent Years	17-14
Table 17.7	List of Electrification Rates	17-17

Table 17.8	Comparison of load Forecast of the Country (1), Peak Demand	17-18
Table 17.9	Comparison of Load Forecast of The Country (2), Energy Requirement	17-19
Table 17.10	Load Forecast of the Northeast Region Based on MER,	
	Peak Power and Energy Requirement	17-19
Table 17.11	Summary of Forecasted Growth Rates	17-20
Table 17.12	Load Forecast to 2020 of the Country and Northeastern Region,	
	Peak Power and Energy Requirement	17-21
Table 17.13	Summary of Existing Power Plants	17-21
Table 17.14	Existing Installed Generating Capacity (As of April 2000)	17-23
Table 17.15	Existing Transmission Lines and Substations (As of April 2000)	17-26
Table 17.16	Power Supply in the Four Provinces of The Study Area	17-27
Table 17.17	Overall Quantities of the Existing Transmission	
	And Distribution Facilities in the Northeastern Region	17-31
Table 17.18	Summary of Generation Development Plans up to 2011	17-34
Table 17.19	Load Forecast of Substations in the Study Area	17.38

## **LIST OF FIGURES**

Figure 1.1	Topographic Characteristics of the NBR	1-3
Figure 1.2	Climate of NBR	1-5
Figure 1.3	Annual Fluctuation of Rainfall	1-6
Figure 1.4(1)	Main Landforms of NBR	1-7
Figure 1.4(2)	Soil Units in the NBR	1-8
Figure 1.5	Forest Area in the NBR	1-10
Figure 1.6	Deforestation Area	1-13
Figure 1.7	Potential Areas of Saltation in the NBR	1-16
Figure 1.8	Overall Environmental Issues in the NBR	1-22
Figure 1.9	Proposed Buffer Zone Areas in Phu Phan Mountain	1-25
Figure 2.1	Contour Map of the NBR	2-2
Figure 2.2	Annual Rainfall Distribution	2-3
Figure 2.3	Soil Fertility of the NBR	2-4
Figure 2.4	General Land Use in the NBR	2-7
Figure 2.5	Forest Area in 1974	2-8
Figure 2.6	Forest Area in 1999	2-9
Figure 2.7	Current Land Use in Deforested Areas	2-10
Figure 2.8	Land Use in Dry Season	2-12
Figure 2.9	Distribution of Land Reform Projects in the NBR	2-14
Figure 2.10	Location of Irrigation Projects in the NBR	2-16
Figure 2.11	Land Suitability for Paddy	2-26
Figure 2.12	Cropping Area in the Rainy Season	2-27
Figure 2.13	Suitability Area for Vegetables	2-28
Figure 2.14	Suitability Area for Fruits	2-29
Figure 2.15	Suitability Area for Para-rubber	2-30
Figure 2.16	Comprehensive Environmental Evaluation	2-33
Figure 2.17	Zoning for Agricultural Development	2-36
Figure 2.18	Concept of Urban Networking for the NBR Development	2-40
Figure 2.19	Proposed Land Use Plan	2-42
Figure 2.20	System of Farming Company	2-44
Figure 3.1	Main River Basins in the NBR	3-2
Figure 3.2	Mean Monthly Discharge	3-8
Figure 3.3	Flood Prone Area	3-10
Figure 4.1	Major Rice Production 1988-1998	4-8
Figure 4.2	Second Rice Production 1988-1998	4-9
Figure 4.3	Cassava Production 1988-1998	4-10
Figure 4.4	Sugarcane Rice Production 1988-1998	4-11
Figure 4.5	Groundnut Rice Production 1988-1998	4-12
Figure 4.6	Kenaf Rice Production 1988-1998	4-13
Figure 4.7	Calendar of Major Crops in the Study Area	4-17
Figure 7.1	Village Location Map	7-10
Figure 7.2	Influence of Negative Factors on Household Cash Flow	7-22
Figure 8.1	Number of Foreign Direct Investment	8-4

Figure 8.2	Changes in Industrial Structure	8-7
Figure 8.3	Thailand's Exports by Group of Products	8-8
Figure 8.4	Location of Industrial Estate by IEAT	8-10
Figure 8.5	Season of the Agricultural Product in Thailand	8-36
Figure 8.6	GPP Manufacturing Share in 1998	8-44
Figure 8.7	Asian Highway and Industrial Corridor	8-45
Figure 8.8	Industrial Linkage Among Four Province	8-48
Figure 8.9	Function of Four Provincial Towns	8-49
Figure 8.10	Industrial Development Strategy	8-57
Figure 8.11	Types of Product Development	8-62
Figure 8.12	Product Development Sequence	8-63
Figure 8.13	Investigation on Target Industries	8-76
Figure 8.14	Concept of Information Network for Local Industrialization	8-80
Figure 8.15	Concept of LIP	8-83
Figure 8.16	Concept of LIP's Functions	8-85
Figure 8.17	Infrastructure for Promotion of Industrial Linkage	8-87
Figure 8.18	Industrial Allocation Plan	8-91
Figure 8.19	Model Process for Business Creation	8-92
Figure 8.20	Location of the Projects and Programs and Its Linkage	8-94
Figure 8.21	Alternative Industrial Location in Nakhon Phanom	8-102
Figure 8.22	Alternative Industrial Location in Sakon Nakhon	8-103
Figure 8.23	Alternative Industrial Location in Mukdahan	8-104
Figure 8.24	Alternative Industrial location in Kalasin	8-105
Figure 9.1	Major International Tourist Route in the Northeastern Region	9-2
Figure 9.2	Tourism Destination of Nakhon Phanom	9-3
Figure 9.3	Tourism Destination in Mukdahan	9-3
Figure 9.4	International Tourist Arrivals in Thailand (1990-1999)	9-5
Figure 9.5	Number of Tourist Arrivals in Nakhon Phanom Province	9-7
Figure 9.6	Guest Arrivals by the Type of Accommodation (Nakhon Phanom)	9-7
Figure 9.7	Present Transportation Network in the Northeast Thailand	9-9
Figure 9.8	Modal Share of Tourist in the NBR	9-9
Figure 9.9	Strategies for Tourism Development in the NBR	9-17
Figure 9.10	Concept for Excursion Crossing Three Tourism Area	9-19
Figure 9.11	Concept of Tourism Free Zone	9-24
Figure 10.1	DNFE Training Course	10-1
Figure 10.2	Training Courses of CDD	10-2
Figure 10.3	Training Courses of DSD	10-3
Figure 10.4	Training Courses Offered by BIED and BSID	10-4
Figure 10.5	Training Courses Conducted by Non-Government Organizations	10-5
Figure 10.6	Targeted Areas of Training Institutes in Thailand	10-6
Figure 10.7	Educational Attainment of Labor Force in Thailand	10-8
Figure 10.8	Educational Attainment of Labor Force in NBR	10-8
Figure 10.9	Industrial Structure for Labor-Intensive Industry and Technology-	
	Intensive Industry	10-9
Figure 10.10	Flow of Students in NBR	10-11
Figure 10.11	Possible Scenarios	10-13

Figure 10.12	Overall Project Implementation Schedule	10-17
Figure 10.13	Overall Project Implementation Schedule	10-19
Figure 11.1	Education System in Thailand On-Going Reform Plan (as of October 2000)	11-2
Figure 11.2	Result of the National Competency Test, 1997 (Secondary Education)	11-10
Figure 11.3	Vocational & Technical Institutes by Region	11-14
Figure 11.4	Employment Status by Educational Attainment (2000)	11-16
Figure 11.5	Employment Status by Vocational Education Level	11-16
Figure 11.6	Student Transition toward Higher Level of Education	11-17
Figure 11.7	Estimated Current Transition to Higher Education in NBR	11-24
Figure 11.8	Enrollment in Vocational Education in Thailand	11-32
Figure 11.9	Enrollment in Vocational Education in NBR	11-32
Figure 11.10	Strategy for NBR Education Development Plan	11-37
Figure 11.11	CBT Model in NBR	11-42
Figure 11.12	Internship System	11-43
Figure 12.1	Basic Structure of Health Service Provision in the Target Area	12-7
Figure 12.2	Concept of Future Change of Health Insurance Coverage	12-9
Figure 12.3	Success of PHC	12-16
Figure 12.4	Comparison of Disease Structure between NBR and the Whole Country	12-22
Figure 13.1	Revenue Structure of Bua Ban TAO	13-11
Figure 13.2	Expenditure Structure of Bua Ban TAO, 1999 (Oct.98-Sep.99)	13-11
Figure 13.3	Proposed Organizational Structure of Local Government Association	13-27
Figure 14.1	Regional Spatial Structure of Northeastern Region	14-2
Figure 14.2	Population Distribution in Thailand	14-4
Figure 14.3	Urban Population Distribution in Thailand	14-5
Figure 14.4	Population Distribution of Northeastern Region	14-7
Figure 14.5	Population Density of the NBR	14-10
Figure 14.6	Commodity Flow of Northeastern Region	14-11
Figure 14.7	Flow of Wastewater in Sakon Nakhon	14-13
Figure 14.8	Urban Development Concept	14-26
Figure 14.9	Concept of Local Area Network by IT	14-29
Figure 15.1	Privatization of TOT and CAT	15-3
Figure 15.2	Telecommunications Network in the Northeast	15-4
Figure 15.3	Area Coverage by GSM in NBR	15-6
Figure 15.4	Mobile System Development for Service Area Expansion and Value Added Service	15-9
Figure 15.5	Development Target of Telephone Units	15-10
Figure 16.1	National Highway System	16-4
Figure 16.2	Railway Network in Thailand	16-6
Figure 16.3	Land Transport Network in the Study Area	16-9
Figure 16.4	Volume of Commodity generation and Attraction at Nakhon Ratchasima	16-12
Figure 16.5	Volume of Commodity generation and Attraction at Khon Kaen	16-13
Figure 16.6	Volume of Commodity To/From Nakhon Ratchasima, Khon Kaen and Bangkok	16-14
Figure 16.7	Domestic Transport Cost Applied byETO	16-17
Figure 16.8	Domestic Transport Cost by 10 wheels Truck	16-17
Figure 16.9	Truck of Lao PDR at tha Nakhon Phanom Pier,	
	A Truck from the ESB to Lao PDR at Nakhon Phanom	16-30
Figure 16.10	Urban Development Concept	16-32

Figure 17.1	Power Utilities in Thailand	17-3
Figure 17.2	Organization of EGAT	17-4
Figure 17.3	Record of Energy Sales	17-12
Figure 17.4	Daily Load Curve on Peak Days of EGAT System	17-15
Figure 17.5	Daily Load Curves on Peak Days of Northeastern Region	17-16
Figure 17.6	Forecast Peak Demand	17-20
Figure 17.7	Transmission Network of Overall EGAT System	17-25
Figure 17.8	Transmission System in the North eastern Region	17-30

#### ABBREVIATION

ADB Asian Development Bank AFTA ASEAN Free Trade Area

AIDAB Australian International Development Assistance Bureau

**ARP** Agricultural Rehabilitation Plan

ASEAN Association of Southeast Asian Nations

**BAAC** Bank of Agriculture and Agricultural Cooperatives

**BMA** Bangkok Metropolitan Administration

BMR Bangkok Metropolitan Region BOI Office of the Board of Investment

CD Community Development

CDD Community Development Department, Ministry of Interior

CDW Community Development Worker

CIPO Center for Integrated Plan of Operations, NESDB

CND Cross-National Development CSO Civil Society Organization

DDC District Development Committee

D/D **Detailed Design** 

DEDP Department of Energy Development and Promotion, Ministry of Interior DLD Department of Land Development, Ministry of Agriculture and Cooperatives

DOA Department of Aviation, Ministry of Transport and Communications

DOAE Department of Agricultural Extension, Ministry of Agriculture and Cooperatives

DOL Department of Lands, Ministry of Interior

**DOLA** Department of Local Administration, Ministry of Interior

DOF Department of Fisheries, Ministry of Agriculture and Cooperatives DOH Department of Highway, Ministry of Transport and Communications

DOVE Department of Vocational Training, Ministry of Public Welfare

DRF Drug Revolving Fund

**NGOs** Non Governmental Organizations

**NESDB** National Economic and Social Development Board

**NPOs** Non Profit Organization

ΕIΑ **Environmental Impact Assessment** 

**ESB** Eastern Seaboard

FDI Foreign Direct Investment

**RFD** Royal Forest Department, Ministry of Agriculture and Cooperatives

F/S Feasibility Study

GIS Geographical Information System **GMS** Greater Mekong Sub-region

Green Isan Project

GOJ Government of Japan **GDP Gross Domestic Product** GIP

GPP **Gross Provincial Product GRP Gross Regional Product** 

**GSIC** Greater Saraburi Industrial Core HRD Human Resource Development

IEAT Industrial Estate Authority of Thailand
IEE Initial Environmental Examination

IEs Industrial Estates

IFCT Industrial Finance Corporation of Thailand

IMF International Monetary Fund

IMR Infant Mortality Rates

JICA Japan International Cooperation Agency

LTD Land Transport Department, Ministry of Transport and Communications

MMR Maternal Mortality Rates

MOAC Ministry of Agriculture and Cooperatives

MOE Ministry of Education
MOF Ministry of Finance
MOID Ministry of Industry
MOPH Ministry of Public Health

MOSTE Ministry of Science, Technology and Environment

MOUA Ministry of University Affairs

NBR Northeastern Border Region

NESDB National Economic and Social Development Board

NIEs Newly Industrialized Economies

NRDC National Rural Development Committee

NRDDC National Rural Development and Decentralization Committee

PAO Provincial Administrative Organization

PCM Project Cycle Management

PDC Provincial Development Committee

PHC Primary Health Care

PLWHA People living with HIV/AIDS

PWD Public Works Department, Ministry of Interior

PWWD Provincial Water Works Department

RAPS Project on Restructuring of Agricultural Production Systems

RID Royal Irrigation Department, Ministry of Agriculture and Cooperatives

RJCP Rural Job Creation Project
RRA Rapid Rural Appraisal
RTG Royal Thai Government

SKR Savannakhet and Khammouan Region
SME Small and Medium-scale Enterprise

SMI-IE Industrial Estate for Small and Medium-scale Industries

SMIs Small- and Medium-scale Industries

SWOT Strengths, Weaknesses, Opportunities, Threats

TAO Tambon Administrative Organization

TAT Tourism Authority of Thailand

TOT Telephone Organization of Thailand

TC Tambon Council

VHVs Village Health Volunteers
WID Women in Development