The MRC Basin Development Plan

Monographs

BDP Library Volume 11

March 2005
Revised December 2005

Mekong River Commission

BDP

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Foreword

The BDP Library was compiled towards the end of Phase 1 of the BDP Programme. It provides an overview of the BDP formulation, together with information about the planning process and its knowledge base, tools and routines.

The library incorporates the essence of more than a hundred technical reports, working papers and other documents. It consists of 15 volumes:

1 The BDP planning process

2 Sub-area analysis and transboundary planning

3 Sub-area studies (including 13 sub – volumes)

4 Scenarios for strategic planning

5 Stakeholder participation

6 Data system and knowledge base

7 MRCS Decision Support Framework (DSF) and BDP applications

8 Economic valuation of water resources (RAM applications)

9 Social and environmental issues and assessments (SIA, SEA)

10 IWRM strategy for the Lower Mekong Basin

11 Monographs. March 2005

12 Project implementation and quality plan

13 National sector reviews

14 Regional sector overviews

15 Training

The work was carried out jointly by MRC and the NMCs with comprehensive support and active participation by all MRC programmes and more than 200 national line agencies. Financial and technical support was kindly granted by Australia, Denmark, Japan, Sweden and Switzerland.

The library has been produced for the purpose of the BDP and is intended for use within the BDP Programme. The work was done from 2002 to 2005, and some information may already have been superseded by new developments and new knowledge. The library does not reflect the opinions of MRC nor the NMCs.

It is hoped that the work will contribute to the sustainable development of water resources and water-related resources in support of the MRC vision of *'an economically prosperous, socially just and environmentally sound Mekong River Basin'.*

Contents

Figures

Tables

Acknowledgement

The authors gratefully appreciate the data, information, guidance and support received in connection with the work from other MRC programmes, from the NMCs and from many national line agencies.

Acronyms and abbreviations

ADB	:	Asian Development Bank
AFTA	:	ASEAN Free Trade Area
AIA	:	ASEAN Investment Area
AICO	:	ASEAN Industrial Co-operation Scheme
ASEAN	:	Association of South East Asian Nations
BDP	:	Basin Development Plan (of the Mekong River Commission)
BMA	:	Bangkok Metropolitan Administration
CEPT	:	common effective preferential tariff
DFID	:	Department for International Development (UK)
EDC	:	Eléctricité de Cambodge
EGAT	:	Electricity Generating Authority of Thailand
EIA	:	environmental impact assessment
FDI	:	foreign direct investment
FMM	:	flood management and mitigation
GDP	:	gross domestic product
GMS	:	Greater Mekong Sub-Regional Economic Cooperation Programme (of ADB)
GMS	:	Greater Mekong Sub-Region
GWh	:	giga-watt hours
ha	:	hectares (= 10,000 m2)
HDI	:	human development index (of the United Nations Development Programme)
IAI	:	Initiative for ASEAN Integration
ICEM	:	International Centre for Environmental Management
IFI	:	international financial institutions
IIT	:	inter-industry trade
I-PRSP	:	Interim Poverty Reduction Strategy Paper
IRRI	:	International Rice Research Institute
IWRM	:	integrated water resources management
IWT	:	inland waterway transport
LMB	:	Lower Mekong Basin (the Mekong Basin parts of Cambodia, Lao PDR, Thailand and Viet Nam)
MDG	:	Millennium Development Goals
MFA	:	Multi-Fiber Arrangement
MRC	:	Mekong River Commission
MRCS	:	Mekong River Commission Secretariat
NA, n/a	:	not applicable
NAC	:	newly agro-industrialised country
NESDB	:	National Economic and Social Development Board (of Thailand)
NGO	:	non-governmental organization
NMC	:	National Mekong Committee
NPL	:	non-performing loan
NPRS	:	national poverty reduction strategy
NRE	:	natural resources and environment

NTFP	:	non -timber forest products
ODA	:	official development assistance
PAD	:	protected areas and development
PIP	:	public investment plan
PPA	:	Participatory Poverty Assessment
PRSP	:	poverty reduction strategy papers
RAM	:	Resource Allocation Model
RAM	:	Resource Allocation Model
RBC/RBO:		River Basin Committee/Organization
RCA	:	revealed competitive advantage
SARS	:	severe acute respiratory syndrome
SEDP	:	Social and Economic Development Plan (of Cambodia)
SIA	:	social impact assessment
SOE	:	state-owned enterprise
TFP	:	total factor productivity
UN	:	United Nations
WCD	:	World Commission on Dams
WTO	:	World Trade Organisation
WUP	:	Water Utilization Programme (of MRC)
WUP-FIN:		Water Utilisation Programme - Finland

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Executive summary

Agriculture

More than 41% of the watershed areas in the Lower Mekong Basin (LMB) are used for agricultural production and the area under cultivation is steadily expanding to produce more food for the burgeoning populations of Cambodia, Lao PDR, Thailand, and Viet Nam.

Agriculture is also responsible for 80-90% of all water abstractions from the Mekong river, most of which is for crop cultivation. Crop irrigation, animal raising and fish farm operation occur almost exclusively on flatter terrains. Within this land type, 64% of the area is utilised for agriculture. The largest non-cultivated area is in Cambodia.

Access to water is a major constraint to increasing crop yields in the LMB and there is continuing installation and improvement of irrigation schemes in each of the four countries to lift production. Most of the water is derived from surface reservoirs or directly from the river, although groundwater is important for coffee farmers in the central highlands of Viet Nam and Lao PDR, some fruit growers in the Mekong Delta and an increasing number of rice growers in Cambodia.

Available water reserves are not fully utilised in NE Thailand because crop yields on the infertile soils are low and uneconomic, especially in the dry season. Better soils and a high level of renewable water resources mean the potential for irrigation development is greater in Lao PDR than the other three countries. There is 10 million ha of potentially irrigable land in Cambodia, some of which could be developed for irrigation, while the remainder could be cultivated to upland and perennial crops or cleared for grazing.

The Mekong Delta in Viet Nam faces problems with accessing water during the critical months of February-May. Cultivation of rice during this period is responsible for most of the current abstractions from the Mekong River. New farming systems proposed by the Government for each of the ecological zones in the delta may reduce the amount of water consumed by rice, but increase the level of abstractions by upland crops, perennials and fish/shrimp ponds. These abstractions are more likely to occur during the critical period, especially for crops susceptible to water logging at the beginning and end of the dry season. Farmers also need to reduce the risks of changing from one farming system to another.

Progress on developing strategies for farmers to lessen the risks associated with using more water efficient farming practices are dependent on improvements in marketing of produce, storage and agro-processing facilities, pest control, water quality and stress, availability of labour and capital, improved plant nutrition and knowledge.

Poverty and livelihoods

The Lower Mekong Basin is one of the most ethnically, culturally and ecologically diverse places on earth. The Mekong River runs through the region, and is an important life source sustaining all aspects of this diversity.

Approximately 54 million people reside in the lower basin, in regions as diverse as the northern Lao highlands, where predominately ethic minority peoples practice traditional forms of agriculture and foraging in the river's high watersheds; to the flat and flood prone delta region, where Vietnamese farmers can produce three rice crops a year, where rice output is critical to the food security and economic prosperity of the whole of Vietnam. Despite this regional diversity, livelihoods throughout the region share a close and direct dependence upon the natural environment and its resources, particularly water.

Considerable debates continue around the definition of poverty, and the identification of poverty groups. Poverty definitions determine poverty populations, as well as policy prescription to address the poverty identified. Poverty is, therefore, a politically loaded concept. Despite the considerable differences in perspectives, it is clear that the most intense levels of poverty (in the sense of lack of basic subsistence needs) are in the two poorest countries of the region; Laos and Cambodia. It is here where livelihoods are strongly linked to the health of the Mekong, through small scale fishing and farming. Livelihood vulnerability and conflict here and elsewhere in the basin are driven by a number of key interlinked factors, which include:

Increasingly insecure tenure and rights of access of the poor to natural resources, such as land, forests and rivers. This process of alienation and marginalisation has been driven in part by policy reforms paradoxically intended to legitimise rights to land, through privatization and individual holdings. These reforms have resulted in the poor being excluded from land, forests and rivers to which they previously had common access. The reforms have given power to elites, and concession holders to close off resources that were previously shared, and communally managed. Competition is becoming increasingly intense this context, around the Tonle Sap great lake in Cambodia for example, and increasing the risks of serious conflicts.

Economics

The LMB comprises nearly all (97%) of Laos PDR, about 86% of the Kingdom of Cambodia, some 36% of the Kingdom of Thailand (i.e., the whole of the northeast region and some of the northern region) and about 20% of the Socialist Republic of Viet Nam (i.e., the Mekong Delta and Central Highlands). Thus for the Cambodian and Lao areas of the LMB their national economies and entire geographic circumstances are largely synonymous with their constituent parts of the LMB, while for both Thailand and Viet Nam only (quite distinctive) parts of their economic and geographic space are included in the LMB.

While the LMB may therefore be seen as a natural physical and geographic planning unit, its economic logic and analysis may be somewhat more complex. In particular,

- the fact that the Thai and Vietnamese parts of the LMB have more in common economically (i.e., in terms of prevailing policy regimes, prices, administrations, regulations etc) with other parts of their respective national economies means that they cannot really be considered in isolation from those circumstances, and (consequently)

- the LMB economic space can really best be seen as a subset of the regional economic space created by the whole national economies of Laos, Thailand, Cambodia and Viet Nam.

The importance of a wider (i.e., essentially subregional) setting for the LMB is also strengthened by the fact that

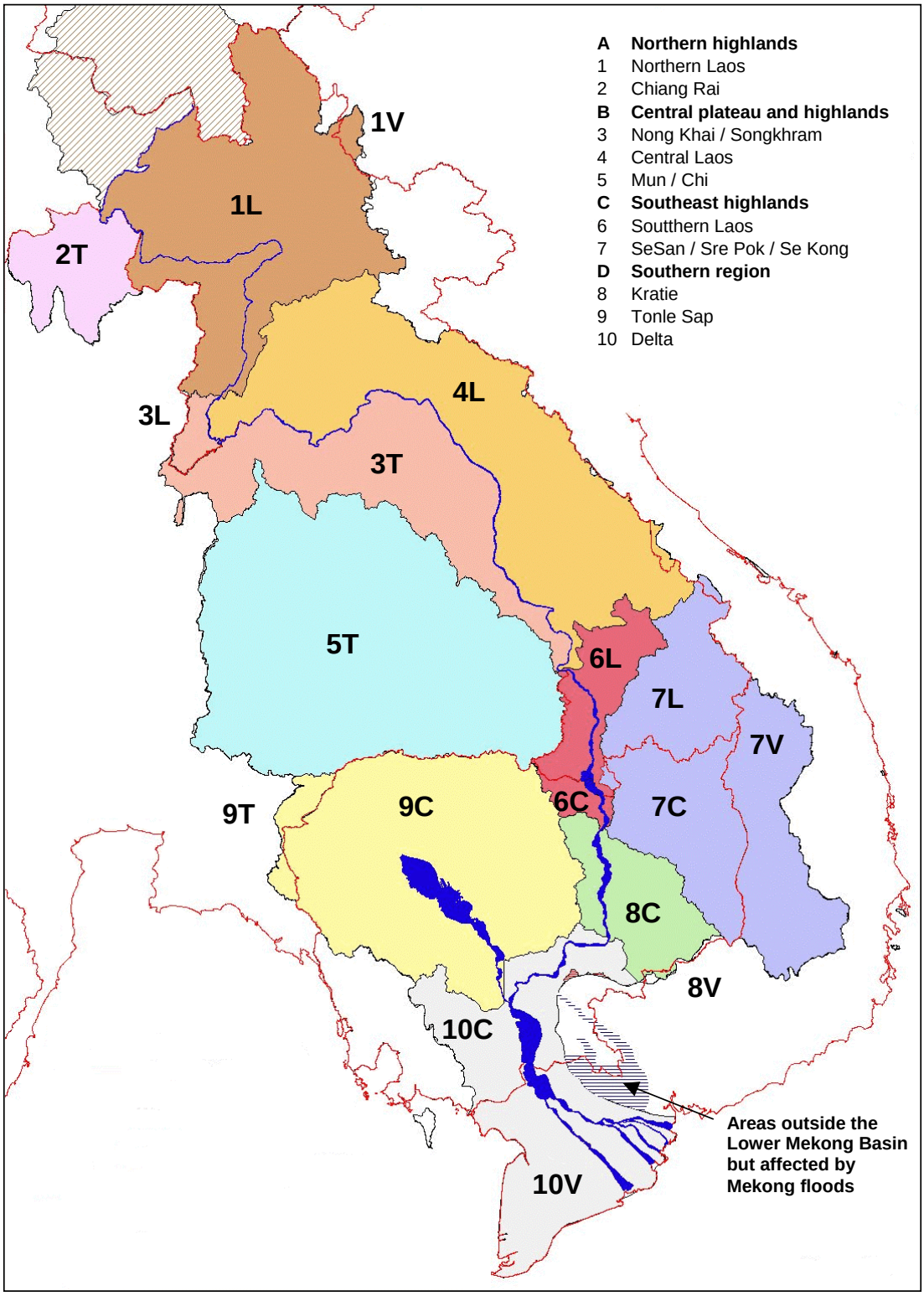
- all constituent/riparian countries within the LMB are to some extent following export-oriented growth models, and

- all constituent/riparian countries within the LMB are formally committed to increased subregional integration, not only through the ADB-sponsored Greater Mekong Subregion (GMS) program, but through membership of AFTA (and its CEPT tariff provisions), though participation in various ASEAN fora, by involvement in various investment promotion schemes, etc.

In sum, the economic space of the LMB will most fully and properly be defined in terms of all of the following:

- the constituent individual national parts of the basin, plus
- (in the cases of Thailand and Viet Nam) the relationship these specific national parts of the basin have to their formal economic hinterlands, plus
- the consequences of co-existence and interaction between four economies within one geographic space, plus
- the relationship of the economic space of the LMB to the wider subregional (i.e., GMS) economy and the rest of Asia and the world.

Map of BDP sub-areas



1 Introduction

The MRC Basin Development Plan (BDP) was instituted by the April 1995 Mekong Agreement. Following a series of preparatory studies, the BDP project document was approved by the MRC Council in October 2000. The BDP formulation (Phase 1) started in October 2001 and is scheduled for completion in July 2006.

The vision of the Basin Development Plan (BDP) is to contribute to acceleration of inter-dependent sub-regional growth by establishing a process and framework conducive to investment and sustainable development. To contribute to this vision, the BDP process being undertaken by the Mekong River Commission (MRC) should establish a planning framework for development programmes, capable of balancing efficient use of resources with protection of the environment and the promotion of social justice and equity.

There are two main outputs sought from the first phase of the BDP programme. First, the establishment of a more participatory form of basin planning than has previously existed in the Lower Mekong Basin for use in subsequent planning rounds. Second, an agreed short-list of high priority development projects with basin-wide or trans-boundary significance which have benefits that transcend national borders.

This paper presents some key contributions to the knowledge base for the planning process.

1.1 Origin of document

The document is a compilation of working papers prepared between October 2002 and June 2005:

Chaudhry, Peter and Muanpong Juntopas (Jan 05): Water, poverty and livelihoods in the Lower Mekong Basin. Mekong River Commission, Vientiane, Lao PDR

Nesbitt, H.J. (Feb 05): Lower Mekong Basin: Future trends in agricultural production. Mekong River Commission, Vientiane, Lao PDR

Nesbitt, H.J. (Mar 05): Water used for agriculture in the Lower Mekong Basin. Mekong River Commission, Vientiane, Lao PDR

Ward, Keith and Petrina Rowcroft (Jun 05): Economic Development And Water Resource Demands In The Lower Mekong Basin. Mekong River Commission, Vientiane, Lao PDR

Ward, Keith (Oct 02): Economics in the BDP: Macroeconomic overview of the Lower Mekong Basin. Mekong River Commission, Phnom Penh, Cambodia

1.2 Basis and context

1.2.1 Link/relationship of subject to IWRM

The papers compiled in the present document are closely related to different important IWRM perspectives: [1]

- Agriculture represents the largest actual water use as well as the largest potential demand in the Lower Mekong Basin, and is a sector with important water-related development challenges in order to balance the availability and the demand of water, and in order to achieve improved efficiencies of the water-consuming production systems.
- Poverty alleviation and rural livelihoods consolidation and development are overruling concerns in the development policies and socio-economic development plans of all four MRC member countries. Within a foreseeable future, most rural livelihoods in the LMB will remain water-dependent, and the various related development options must be duly considered in connection with IWRM.
- The economic perspective of IWRM is emphasised by the 4th Dublin principle: *'Water has an economic value in all its competing uses and should be recognised as an economic good'.* The economics of water utilisation and water resource allocation is an essential IWRM discipline, both for traditional cost-benefit assessments and as a support for broader cross-sector and basinwide considerations.

1.2.2 Link/relationship of subject to BDP Inception Report

The Inception Report retains the stage-wise approach to BDP formulation that had been identified during the programme formulation:

Stage 1 - analysis of the LMB and of sub-areas

Stage 2 - analysis of development scenarios

Stage 3 - strategy formulation

Stage 4 - compilation of long-list of programmes and projects

Stage 5 - compilation of short-list of programmes and projects

Between them, the monographs contribute to Stages 1 and 2, from where results are carried forward to Stage 3 and the following stages.

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[1] Article 18.9 of Agenda 21 deals with IWRM: 'Integrated water resources management, including the integration of land- and water-related aspects, should be carried out at the level of the catchment basin or sub-basin. Four principal objectives should be pursued, as follows: (a) To promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, that integrates technological, socio-economic, environmental and human health considerations; (b) To plan for the sustainable and rational utilisation, protection, conservation and management of water resources based on community needs and priorities within the framework of national economic development policy; (c) To design, implement and evaluate projects and programmes that are both economically efficient and socially appropriate within clearly defined strategies, based on an approach of full public participation, including that of women, youth, indigenous people and local communities in water management policy-making and decision-making; (d) To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth.'

1.2.3 Link/relationship of subject to other BDP reports / activities

The analyses presented here build partly on the national and regional sector reviews and the sub-area studies, and have formed an important part of the basis for the scenario analyses and strategy formulation.

1.2.4 Link/relationship of subject to BDP's Logical Framework Matrix

In the BDP Logical Framework, the monographs contribute comprehensively to

Output 2.4	Basin-wide strategies in general, and
Activity 2.4.1	Scenario review
Activity 2.4.2	Strategy components
Activity 2.4.3	Formulation of strategies

in particular. Also, the studies have provided valuable contributions to

Output 2.5	(long-list of programmes and projects).

1.3 Significance

1.3.1 Significance of subject for strategic planning

Between them, the studies provide aggregated information about baseline conditions, development trends as they appear at present, development needs and options, and an assessment of potential future developments.

This information is highly useful in connection with strategy formulation and identification of useful and practical development interventions.

1.3.2 Significance of subject for Mekong Basin

The main perspective of the BDP is IWRM at the basin scale, and the studies presented in the present report have been carried out in a basinwide perspective.

Hereby, they provide a supplement to the national and regional sector reviews that have been prepared in parallel.

This is one step towards an understanding of regional (and inter-sector) synergies and trade-offs that can contribute to a healthy regional development in its own right, as well as by adding value to the many development programmes at the national level.

1.3.3 Significance of subject for MRCS / BDP 1

Together with the national sector reviews and the sub-area studies, the studies presented in the present report have formed a platform for scenario analysis of inter-sector dependencies

(synergies and constraints), as well as for the preparation of a holistic, integrated IWRM Strategy[1] and for identification of viable development projects.

2 Summary of approach

The studies are based on (i) information from previous studies and literature; (ii) information from national and regional sector reviews; (iii) data and information received from other MRC programmes; and last but not least (iv) data and information received from the NMCs and national line agencies.

The basis for each analysis is reflected in the list of references for each chapter.

[1] In preparation (mid 2005)

3 Water used for agriculture in the Lower Mekong Basin

by Harry Nesbitt, March 2005

Executive summary

More than 41% of the watershed areas in the Lower Mekong Basin (LMB) are used for agricultural production and the area under cultivation is steadily expanding to produce more food for the burgeoning populations of Cambodia, Lao PDR, Thailand, and Viet Nam.

Agriculture is also responsible for 80-90% of all water abstractions from the Mekong river, most of which is for crop cultivation. Crop irrigation, animal raising and fish farm operation occur almost exclusively on flatter terrains. Within this land type, 64% of the area is utilised for agriculture. The largest non-cultivated area is in Cambodia.

The majority of the soils in the flatter areas are infertile acrisols, which have proved to be low agronomic producers. The fertility of these soils and others improves when they are flooded to a point where the root zone becomes anaerobic, and then releases nutrients. Rice is an ideal plant to grow in waterlogged and slightly flooded conditions and, for this reason, rice is by far the dominant crop grown in the LMB.

Fertiliser and pesticide use is low in rain-fed areas but increases with irrigation as farmers spend more money on chemical inputs to promote crop growth and protect their investment. Chemical leakage into the river system is currently not affecting water quality except on the Mekong Delta in Viet Nam where canal and river water pollution is becoming a problem in aquaculture areas.

Access to water is a major constraint to increasing crop yields in the LMB and there is continuing installation and improvement of irrigation schemes in each of the four countries to lift production. Most of the water is derived from surface reservoirs or directly from the river, although groundwater is important for coffee farmers in the central highlands of Viet Nam and Lao PDR, some fruit growers in the Mekong Delta and an increasing number of rice growers in Cambodia.

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Progress on developing strategies for farmers to lessen the risks associated with using more water efficient farming practices are dependent on improvements in marketing of produce, storage and agro-processing facilities, pest control, water quality and stress, availability of labour and capital, improved plant nutrition and knowledge.

3.1 Introduction

The aims of the Mekong River Commission's Basin Development Plan (BDP) are "to contribute to acceleration of inter-dependent sub-regional growth by establishing a process and a framework conducive to investment and sustainable development. The BDP is establishing a planning framework for development programmes aimed at balancing efficient use of resources with protection of the environment and promotion of social justice and equity" (MRC, 2002a). The following review on water used for agriculture in the Lower Mekong Basin (LMB) is part of the process of establishing that framework. The review will discuss the current farming systems employed in the LMB, the rational for their adoption, the potential for change and implications the current and future farming systems will have on abstraction of water from the Mekong river system. The discussion of these issues has the following outline:

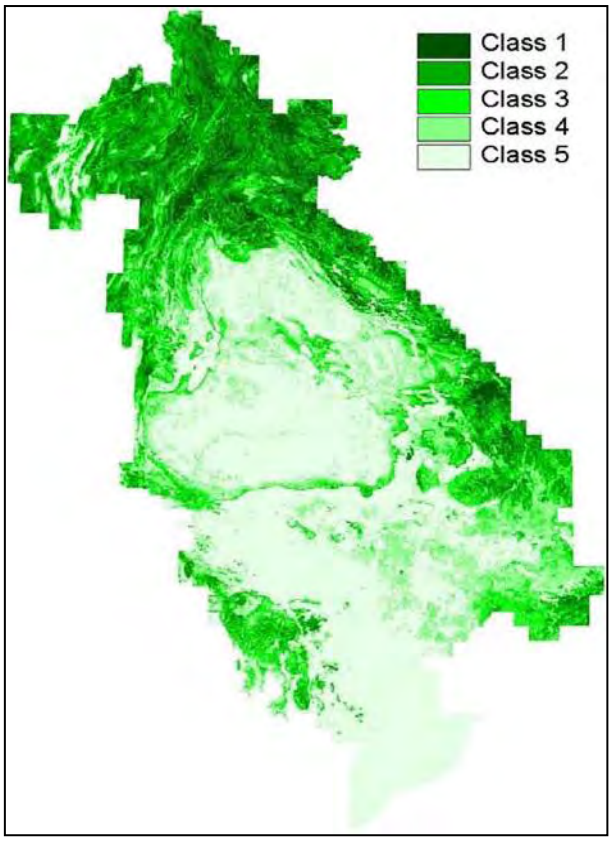
- A short description of the study area
- A brief review of current farming systems in the LMB including cropping systems, animals, fish and shrimp production
- Why rice dominates agriculture in the LMB, preference for dry season production and some rice cultivation techniques
- Constraints to crop production including soils, fertilisers and pesticides, farm mechanisation, marketing and agro-processing, credit and irrigation water
- Discussion on current water consumption, identification of potential alternative farming systems with varying water consumptions and limitations to their adoption
- A short review of water quality in the LMB
- Government policies and potential for agricultural development in the LMB watersheds
- Identification and discussion of risk reduction measures for cropping systems
- Reviewing current research work and trials to expand the range of systems for productivity and profitability improvement

3.2 The study area

The Lower Mekong Basin study area is comprised of watersheds (catchments) in the majority of provinces in the Lao PDR (97% of country); three provinces in the Central Highlands and a major proportion of the Mekong River Delta region of Viet Nam (20% of country); most of Cambodia (86% of country); and the NE plus a part of Northern Thailand (36% of country).

Parts of Myanmar and of the Yunnan province of China are included in the entire Mekong valley catchment and approximately 18% of the total 460 cubic kilometres (km3) of water which flows annually down the Mekong River originates from outside of the LMB. The left bank tributaries in Lao PDR contribute the largest proportion of total flow (Halcrow, 2003). Catchments in Lao PDR provide 35% of the total flow of the river, 18% comes from Thailand, 18% from Cambodia and 11% from Viet Nam (MRC, 2002b).

Figure 3.1: Classes of watershed land types in the LMB



Agriculture is by far the most important activity in the LMB, providing livelihoods for a majority of its residents. The population of the basin has grown by nearly 50% since 1980 and projections forecast a similar growth rate for at least the next 20 years, and the increased demand for food will place further pressure on the land.

Although the total catchment area in the LMB is 60.6 million ha, much of the land in the central highlands of Viet Nam, many of the provinces in Lao PDR and parts of Thailand and Cambodia are mountainous and remain uncleared. The MRC watershed classification system classes these areas (Figure 3.1, Table 3.1) as having high or moderate levels of degradation potential and should remain uncleared or be managed carefully. Very steep slopes and rugged landforms (Class 1), which should remain forested to prevent serious soil erosion, make up 7% of the total area, while steep slopes at higher elevation (Class 2) account for a further 16%.

These steep slopes, moderately-steep slopes (Class 3) and gently sloping land suitable for upland cultivation (Class 4) are used for slash and burn agriculture, some agro-forestry and upland crops including upland rice, maize, cassava and legumes. They are not suitable for irrigation.

Table 3.1: MRC watershed classification system and areas

Class	Area description	Recommended land suitability	% of LMB	Area utilised (%)
1	Steep slopes and rugged landforms	Permanent forest cover	7	5
2	Steep slopes at higher elevations	Production forests, agro-forestry and grazing	16	8
3	Moderate to steep slopes and less eroded landforms	Commercial forests, grazing and agro-forestry	11	16
4	Gently sloping land	Upland agriculture	17	39
5	Gently sloping land and flat areas	Upland crops and paddy rice	49	63
TOTAL			100	41

Thirty nine per cent of Class 4 land (17% of the total area) is currently utilised for agriculture, usually for upland crop production and industrial tree crops. Much of the undeveloped areas are in Lao PDR and eastern Cambodia (Table 3.2).

Table 3.2: Areas of Class 4 (Gentle slopes) land in LMB Zones

Watershed area	% of LMB watershed area	Area of Class 4 land (000 ha)	Area utilised (000 ha)	Area utilised (%)
Cambodia	5	2,941	144	5
Lao PDR	5	3,051	762	25
Thailand NE and part N	6	3,601	2,696	75
Viet Nam CH	2	1,131	581	51
Viet Nam MD	0	10	7	68
TOTAL	17	10,635	4,189	39

Note: Source MRC. CH = Central Highlands, MD = Mekong Delta.

Forty nine percent of the total LMB area is classified as Class 5 land consisting of gentle slopes and flat areas that are potentially suitable for irrigation (Table 3.3). Seventy percent of this area is in NE Thailand and Cambodia. Approximately 72% of the watershed in Cambodia is classified in Class 5, 13% of Lao PDR, 65% of Thailand, 11% of the central highlands of Viet Nam and 99% of the Mekong Delta. Despite the high percentage of the watershed land categorised as Class 5, the area being utilised for irrigation remains small (Table 3.4). The utilisation rate for irrigated agriculture currently runs at 13-14 % across the LMB for both the dry and wet season, although much of this is partial irrigation. Section 14 of this report gives a fuller discussion of the reasons for the low adoption of irrigation.

Table 3.3: Areas of Class 5 (Gentle slopes and flat) land in LMB Zones

Watershed area	% of LMB watershed area	Watershed area Class 5 (%)	Area of Class 5 (000 ha)	Area utilised (000 ha)	Area utilised (%)
Cambodia	18	72	11,243	3,481	31
Lao PDR	5	13	2,317	944	41
Thailand NE and part N	20	65	12,157	11,543	95
Viet Nam CH	1	11	361	129	36
Viet Nam MD	5	66	3,256	2,868	88
TOTAL	49		29,334	18,966	65

Note: Source MRC. CH = Central Highlands, MD = Mekong Delta

Table 3.4: Utilisation of Class 5 area for irrigation in dry and wet seasons

Watershed area	Area of Class 5 land (million ha)	Area dry season irrigation (000 ha in 2000)	Current utilisation (%)	Current use in wet season, for partial irrigation (%)
Cambodia	11.2	250	2	11
Lao PDR	2.7	132	2	17
Thailand	12.2	156	1	12
Viet Nam CH	0.4	37	10	30
Viet Nam MD*	3.3	3,402	100	22
TOTAL	29.8	3,977	13.4	14

Note: Source MRC. CH = Central Highlands, MD = Mekong Delta. * Includes double cropping in dry season

3.3 Typical cropping systems in the LMB

The dominance of rice cultivation predicates the cropping systems employed in the LMB (see Sections 6, 7 and 8 for more details). Rain-fed rice dominates farming in Lao PDR, the central highlands of Viet Nam, NE Thailand and Cambodia, while fully or partially irrigated rice is grown year round in parts of the Mekong Delta of Viet Nam (Table 5a). The area of land dedicated to growing upland crops (Table 3.5a and Table 3.5b) is much smaller in total than that planted to rice and fluctuates in area from year to year. Fruit and industrial crop production is expanding rapidly from a low base (Table 3.5c, MAC, 2000; BLS 2001; MAFF, Cambodia 2000, VSY, 2002).

Table 3.5a: Cropping areas in LMB ('000 ha) – upland crops

Country	Year	Season	Rice	Maize	Cassava	Sugarcane	Mungbean
Cambodia	2000	Wet	1,647	54	14	5	18
		Dry	255	3	2	2	5
Lao PDR	1999	Wet	631	41	13	5	2
		Dry	87	0	0	0	0
Thailand	1999	Wet	4,647	383	620	480	20
		Dry	67	0	0	0	0
Viet Nam CH	2000	Wet	181	87	38	25	0
		Dry	51	0	0	0	0
Viet Nam MD	2000	Wet	2,425	19	153	76	0
		Dry	1,537	0	0	0	0

Note: CH = Central Highlands, MD = Mekong Delta.

Table 3.5b: Cropping areas in LMB ('000 ha) – upland crops

Country	Year	Season	Soybean	Peanuts	Cotton	Kenaf
Cambodia	2000	Wet	33	8	0	21
		Dry	0	3	0	0
Lao PDR	1999	Wet	7	13	0	0
		Dry	0	0	0	0
Thailand	1999	Wet	38	30	5	27
		Dry	0	0	0	0
Viet Nam CH	2000	Wet	21	22	10	0
		Dry	0	0	0	0
Viet Nam MD	2000	Wet	0	9	0	0
		Dry	0	0	0	0

Note: CH = Central Highlands, MD = Mekong Delta.

Table 3.5c: Cropping areas in LMB ('000 ha) – fruit and industrial crops

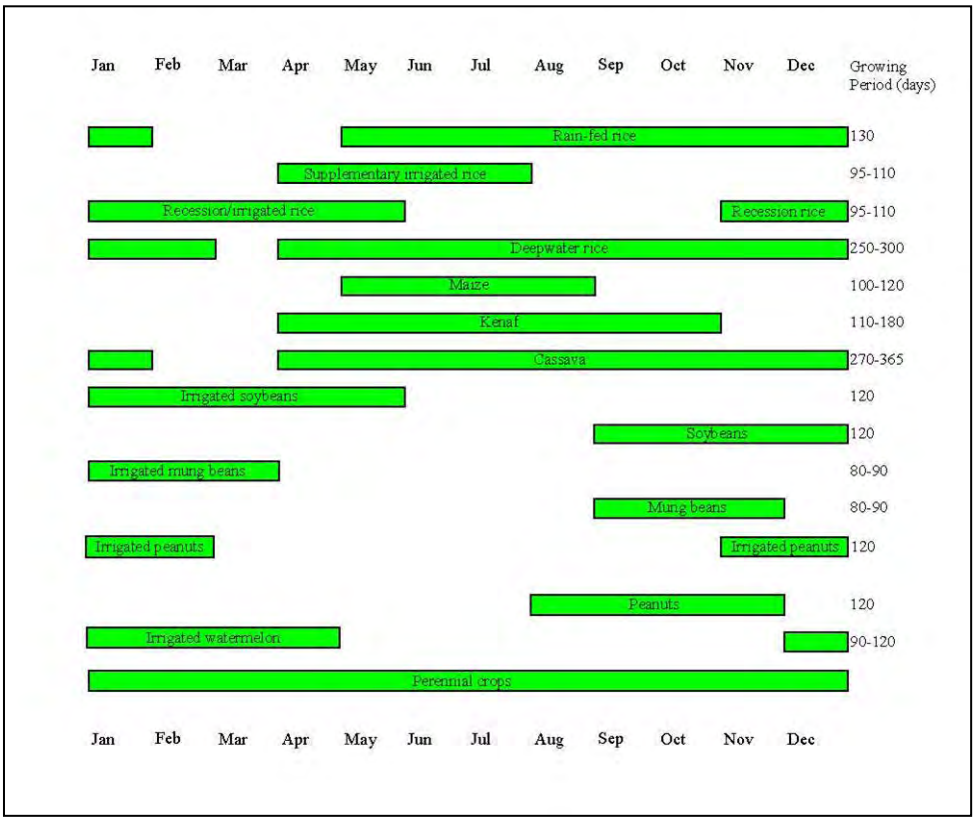
Country	Year	Fruit trees	Coffee	Vegetables
Cambodia	2000	164	little	32
Lao PDR	1999	0	42	43
Thailand	1999	381	0	39
Viet Nam CH	2000	0	300	0
Viet Nam MD	2000	300	0	0

Note: CH = Central Highlands, MD = Mekong Delta.

Rain-fed rice is generally sown at the beginning of the wet season (May-June) and harvested from October through to the following January, depending on the maturity of the cultivated variety (Figure 3.2). These crops may be direct seeded or transplanted. Double cropping in

the wet season is now possible with recently introduced faster maturing High Yielding Varieties (HYVs). This practice is more common in Cambodia than in other countries and is gaining popularity in areas where there is sufficient rainfall to plant a HYV early in the wet season and harvest it in time to transplant a second traditional, photoperiod sensitive variety. Some early wet season crops may receive supplemental irrigation.

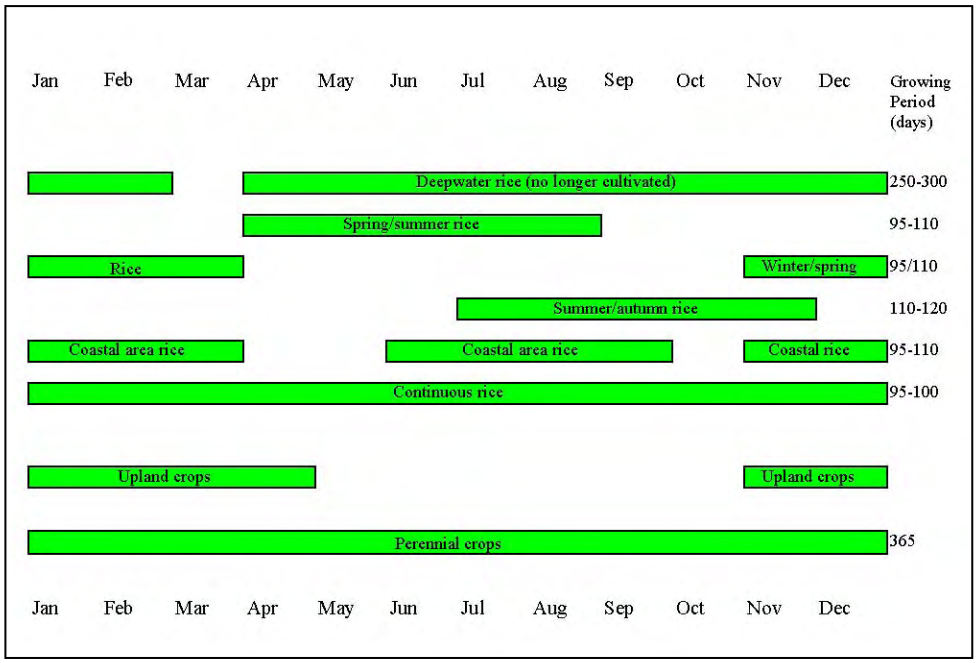
Figure 3.2: Generalised cropping pattern for Laos, Thailand and Cambodia



The total area of land cultivated to rice in the LMB during the wet season is currently well over 10 million ha. Approximately 9.5 million ha is harvested. It is currently estimated (MRC figures in Table 3.4) that over 4 million ha of wet season rice receives some form of supplemental irrigation. If drainage from one field to another is included in the calculation, the area may be much greater. Included in this estimate are about 750,000 ha of nursery in NE Thailand, Lao PDR, Cambodia and the central highlands of Viet Nam receiving extra water prior to transplanting in June, July or August.

On the Mekong Delta, two dry season crops (April-August and November-March) are regularly cultivated in flood prone areas, although rice is grown in some fashion all year round where water is accessible and flooding not a problem (Figure 3.3). Traditional rain-fed rice varieties are now rarely planted in the Mekong Delta.

Figure 3.3: Generalised cropping pattern for Mekong Delta



Other rain-fed crops include maize, sugarcane, mungbean, sesame, cassava, soybeans, peanuts and kenaf. Often, maize is cultivated on the more fertile soil along riverbanks; planting takes place early in the wet season and harvesting just prior to floods later in the year, usually in August or September. Sugarcane is also planted after the onset of monsoonal rains in May and harvested from November through to the following April.

Harvesting mungbeans and sesame, sown on the opening rains, takes place prior to transplanting rice in July/August. Farmers in the uplands of Cambodia, Thailand and, to a lesser extent, the central highlands of Viet Nam and Lao PDR, sow soybeans later in the wet season (sometimes after mungbeans). Harvesting cassava, planted in well-drained soils during April/May takes place in December/January.

Cultivation of all upland and perennial crops is limited to topographies that do not flood regularly. Only mungbeans and possibly peanuts receive supplemental irrigation during the wet season and approximately 129,000 ha of these two crops were grown in the LMB during 1999/2000 (Table 3.5). No more than 30,000 ha of these crops would have received supplemental irrigation.

Fully irrigated rice is cultivated extensively in the Mekong Delta (1.5-2 million ha) but little fully irrigated rice is grown elsewhere in the region. In 1999 Thailand grew 67,000 ha of dry season rice, the central highlands of Viet Nam grew 51,000 ha and 87,000 ha was grown in Lao PDR (Table 3.5a). In all probability, these areas receive all of their water requirements from irrigation. (Fully irrigated rice crops consume 8-10,000 m3/ha per crop). Less than half of the 255,000 ha of dry season rice grown in Cambodia are fully irrigated. The remainder is recession rice receiving supplemental irrigation at a rate of approximately 4,000 m3/ha.

Upland crops grown in the dry season include maize, mungbeans, sesame and sugarcane. Areas under irrigation are very small and not mentioned separately in all LMB countries'

agricultural statistics. The small areas of upland crops grown in Cambodia during the dry season (Table 3.5) are often sown in soils which have retained moisture or cultivated early in the wet season, receiving little if any irrigation water.

Each of the LMB countries has put aside significant areas for growing perennials including coffee and fruit trees plus vegetables. Coffee areas in Viet Nam, for example, increased from 119,000 ha in 1990 to over 561,000 ha in 2000. Much of this was in the central highlands with 130,000 ha in one watershed in Dak Lak province alone (Giang et al 2000). Approximately 60% of Vietnamese coffee originates from an estimated 300,000 ha of trees in the central highlands (www.financialexpress.com/fe/daily). There are also 42,000 ha planted with coffee in Lao PDR. Coffee plantations in eastern Cambodia were established during the 1990s, but the total area has not been estimated. Coffee is generally grown on fertile, porous soils and supplemental irrigation is required during the dry season, using groundwater sources. Water consumption estimates for coffee in Dak Lak ranged from 2000 m3/ha to 7,000 m3/ha (Nong Lam University staff, pers comm.)

Fruit trees were grown on 381,000 ha of NE of Thailand in 1995, but the area may have expanded further since then (MAC, 2000). In the Mekong Delta, the area under fruit trees is known to have expanded from 175,000 ha in 1995 to nearly 300,000 ha in 2002. This area is expected to increase to more than 500,000 ha in the near future as markets are established for the produce. OVPC (Overseas Project Corporation of Victoria) quote the area of fruit in Cambodia as being 164,000 ha (OVPV 2002). The central highlands of Viet Nam and Lao PDR may produce an extra 100,000 ha of fruit, increasing the total area of fruit in the LMB to approximately 950,000 ha. When fully irrigated, fruit in the Mekong Delta consumes 3,000-6,000 m3/ha during the dry season (NEDECO, 1991).

Total vegetable production in the LMB was approximately 120,000 ha in 2000 (Table 5c). Based on farmers' experience in the Mekong Delta, consumption of water for vegetables on porous soils is about 2,500-3,500 m3/ha during the dry season.

3.4 Animal production

The total number of large animals in the LMB has increased significantly over recent years (MacLean, 1998, FAO, 2003). Buffalo numbers in Thailand and the Mekong Delta in Viet Nam have diminished slightly as farmers shift from using animal-drawn implements to machinery for crop cultivation. However, the increased number of cattle and pigs across the basin has offset this decline (Table 3.6).

The increase in large animal numbers is a reflection of improved crop production and of the general welfare of farmers. Higher rice grain yields for example, have resulted in associated increases in the quantity of stubble made available for grazing both cattle and buffaloes. Such dry season grazing areas are particularly prevalent in Thailand, Cambodia and Lao PDR. Pigs on the other hand are fed with rice bran, a bi-product of milling. Increased grain production results in the support of a greater number of pigs, chickens and ducks.

Animal sales are a major source of income for subsistence farmers who see them as 'banks' for accumulation of wealth. Chickens are generally a source of protein for farmers, although there has been an expansion in the number of intensive chicken farms in the LMB over the past decade. Large animals consume approximately 50 litres of water per animal per day and there are approximately 24 million cattle, buffaloes and pigs in the LMB.

Table 3.6: Number of Large Animals in LMB in 2000 (millions)

	Cattle	Buffaloes	Pigs
Cambodia	2.9	1.9	1.9
Lao PDR	1.1	1.2	1.8
Thailand	2.7	3.2	1.2
Viet Nam CH	0.5	0.6	1.2
Viet Nam MD	0.2	0.6	2.9
TOTAL	7.4	7.5	9.0

Note: CH = Central Highlands, MD = Mekong Delta

3.5 Fish and shrimp production

Fish caught from rice paddies are a major source of protein for farming populations in Cambodia, Lao PDR and NE Thailand. Studies by the Asian Institute of Technology estimated that fish collection from rain-fed rice fields in NE Thailand was in the range of 300-400 kg/household/year in a 'good year' and 100 kg/household/year in a 'bad year' (Gregory, 1997), thereby significantly surpassing chicken and other meats. Cambodians also catch fish living in rice fields (CIAP, 1998). Some researchers have estimated that the volume of fish caught in the paddy fields rivals that captured in the river system (Gregory pers comm.). The introduction of exotic herbivorous fish species to deeper fields in Cambodia and NE Thailand has also enhanced the supply of 'paddy fish'. Small areas of freshwater aquaculture fish farms have also been installed in Lao PDR, NE Thailand and Cambodia.

The importance of the rice-fish combination to the overall health of farmers in all but the Mekong Delta in Viet Nam cannot be overstated and this type of food source needs protected from diminution through chemical abuse and poor land management (see section 10).

Fish production from irrigated rice paddies in the Mekong Delta is not significant and this is a reflection of shallower water depths, multiple cropping and overuse of pesticides. However, during the wet season fishers catch large quantities of fish in river ways, large canals and flooded areas. In addition, the Mekong Delta hosts a considerable fish aquaculture industry.

Fishery products currently provide half the protein for the Vietnamese population, and approximately 15% of these products come from inland fisheries in the Mekong Delta (Xuan and Matsui, 1998). In 1994, aquaculture production occupied 231,000 ha, of which fish occupied one-third and shrimp two-thirds. By 2000 the area under fisheries had increased to 445,000 ha (VSY, 2002), despite productivity dropping because of pollution (Do Van Xe, pers comm.). MRC-JICA, (2003) suggest that the area under fishponds on the Mekong Delta in 2001 was 511,760 ha, 392,200 ha of which was for shrimp culture and 119,560 ha for fresh water fish.

3.6 Why rice dominates agriculture in the LMB

Rice is the staple for a vast majority of the population in the LMB and has been so for thousands of years. It is likely to remain the staple for many years to come for reasons of: tradition; subsistence; land suitability; risk; ease of storage; and, marketability.

Tradition

The people of the LMB consume larger quantities of rice than those in other rice-eating countries. Annual consumption of milled rice ranges from 100 kg/head/year in Thailand to 162 kg/head/year in Lao PDR (Figure 3.4). For these people rice is an important element of daily life; most eat it three times a day, it feeds domestic animals and it plays a large part in religious ceremonies. As shown by the International Rice Research Institute (IRRI) in Figure 3.5, people are unlikely to make a significant shift to eating wheat, legumes or other staples until the average income exceeds $1,500 per annum. Even at this income level, rice consumption will remain high enough to encourage farmers to cultivate rice for personal use.

Figure 3.4: Milled rice consumption in Asian countries

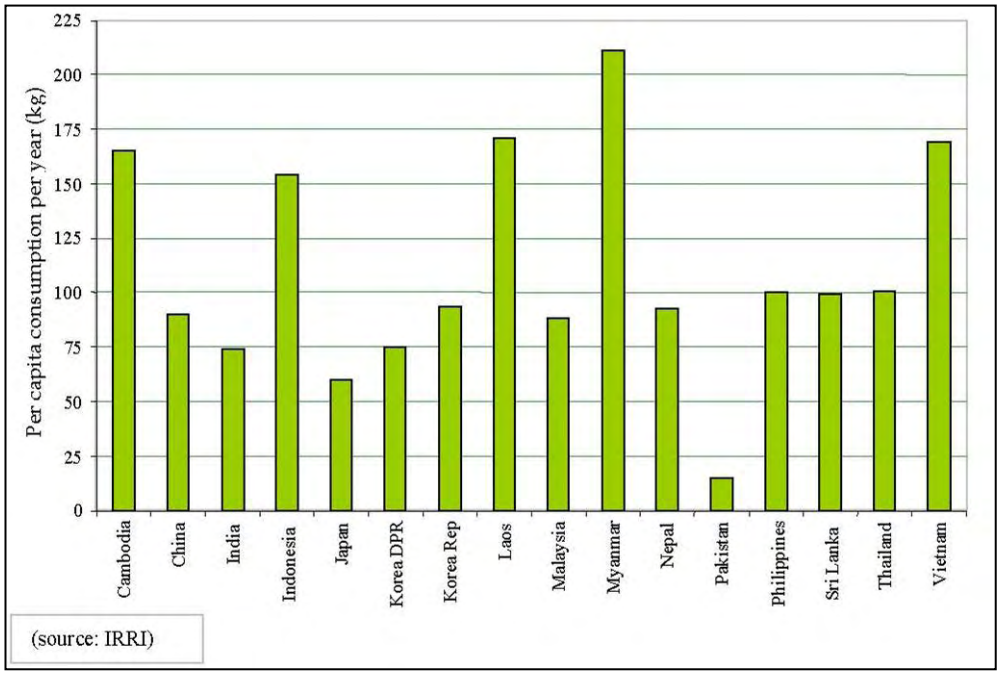
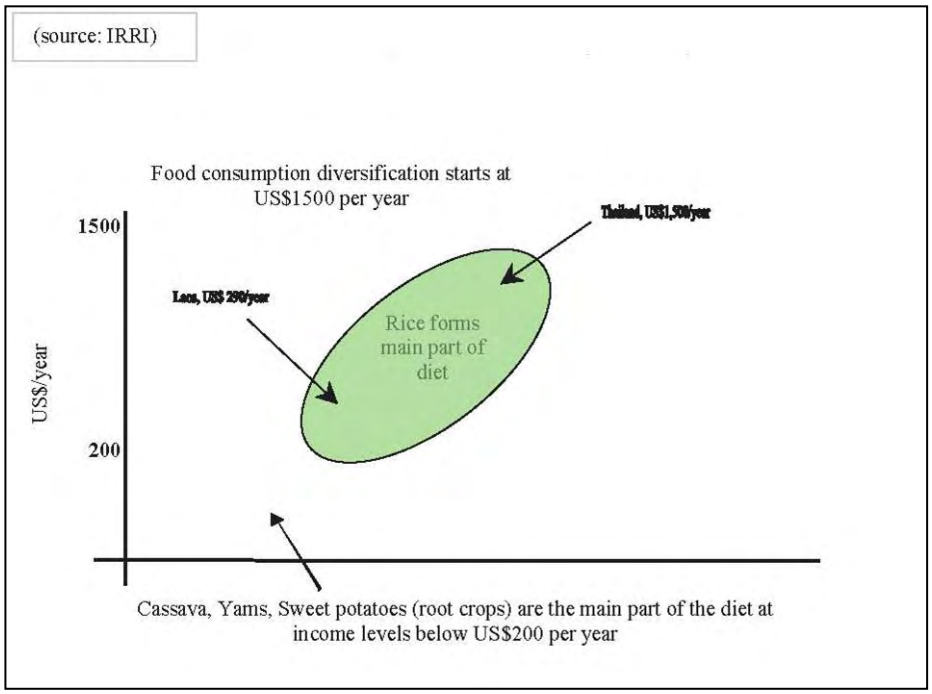


Figure 3.5: Food consumption behaviour and income levels



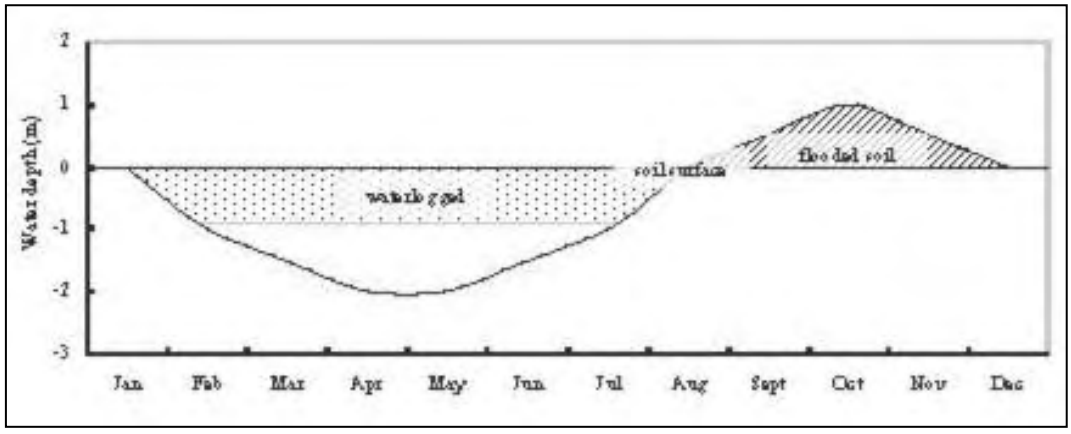
Subsistence

The rural poor of Cambodia and Lao PDR are predominantly subsistence farmers. Surplus rice is exported from NE Thailand and the Mekong Delta, but in 2003, the majority of farmers in all four LMB countries still relied on producing sufficient rice to feed their families before looking at selling surplus production. Surplus grain can be stored and eaten if the price drops excessively.

Land and soil suitability

Waterlogging and inundation are common characteristics of the rain-fed lowland ecosystem. After a period of rainfall, the water table rises towards (waterlogging) and often above (inundation) the soil surface (Figure 3.6). Most plants cannot tolerate waterlogging and inundation. Rice, on the other hand, is a semi-aquatic plant, the shoots of which possess aerenchyma cells that transport oxygen from the leaves to the roots, allowing rice to grow under waterlogged soil conditions.

Figure 3.6: Typical inundation and waterlogging pattern in the lowlands



Many of the soils of the LMB are also acidic, have low levels of organic matter, low Cation Exchange Capacities (CECs), fix phosphorus and can possess toxic levels of aluminium under aerobic conditions. These constraints to crop growth change within a few days of the soil flooding. Waterlogged soil quickly becomes anaerobic, inducing an increase in pH to a neutral level, toxic aluminium levels drop and phosphorus becomes available to the plant.

In addition, many of the soils are sandy loams, which form a hard plough pan or seal at the surface preventing water penetration. This results in temporary waterlogging after initial rainfall or irrigation. Upland crops do not grow well in these soils, but they are suited for rice production.

Risk

Resource-poor farmers in SE Asia operate on low cash flows and carefully weigh the risks of adopting more costly farming practices. In addition, farmers are reluctant to risk their food security. Changing from rice to other crops entails investment in seed and other inputs, in addition to making capital-intensive modifications to the farm layout. Recent failed agricultural enterprises in the NE of Thailand include poor production, loss of markets or poor markets for basmati rice, castor seed, cashew nuts, cassava and milking cows, and that has emphasised the risk involved with newer systems. In the Mekong Delta, farmers can make considerable profit from brackish fish cultivation, but the investment is very high as are the risks of failure, especially in tough international markets.

Storage

Some harvested grain deteriorates rapidly under tropical conditions. Peanuts develop a potentially lethal aflatoxin if stored in humid conditions and soybeans lose their viability after a few months. Fruit may only be stored for days while some freshwater fish deteriorate within hours if not iced properly. Un-milled rice can be stored for months or years with little loss of quality.

Marketability

All the LMB countries have a well-developed rice market. Marketing of other products is much more difficult. After the harvest, traders are willing to buy any surplus rice either on or off the farm, while markets for other products are unreliable, especially for lower grade products. The insistence by traders for production of high quality grain often pre-empts many farmers from attempting to grow crops that initially appear to be of higher value.

3.7 Dry season vs. wet season cropping

The potential yield of any photosynthetic crop is dependent on plants receiving optimum amounts of energy, water, air (oxygen and carbon dioxide) and minerals. They also need protection from excessive temperatures, pests and diseases, toxic effects and other growth retardants. In addition, traditional varieties require a change in day length for maturation.

Energy

The amount of sunshine the plant receives, particularly over the last two months of its growing cycle, determines the available energy for growth. Solar radiation figures are not commonly available in the LMB. In terms of energy supply, the number of hours of sunshine per day is more important than the day length. Figure 8 shows the relationship between day length in Phnom Penh and hours of sunshine in Ubon, NE Thailand and Omon, Mekong Delta. As shown in the figure, maximum solar radiation in LMB countries occurs during the dry season from February to May. After May, the solar radiation declines as cloud cover builds up for the monsoon season, reaching a low point in July and August at the peak of the rainy season. It then increases as the clouds clear.

Oxygen and carbon dioxide

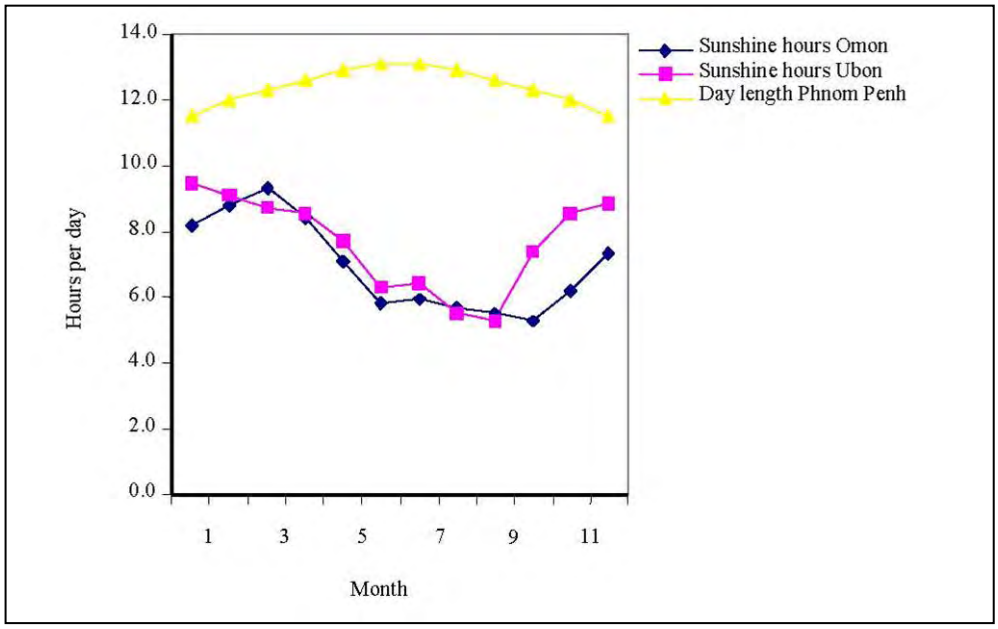
Most crops suffer from a lack of oxygen when either their roots or leaf material become covered in water. Rice is able to grow in waterlogged soil but like upland plants suffer if the whole plant is inundated with water for more than a couple of days. Dramatic reductions in yield will occur under these conditions. Carbon dioxide should be available to the leaves at all times for photosynthesis.

Water

Insufficient or excessive supply of water retards crop growth. As mentioned previously all crops suffer from oxygen depletion if flooded. Farmers in much of the Mekong Delta avoid inundation of their crops by planting immediately after the floods recede and harvesting before their onset. Short 'mini droughts' in the wet season are also a serious problem for rain-fed crops. However, 4 to 5 cm of supplementary irrigation during these periods can double yields or save complete loss of the crop.

Irrigation in the dry season overcomes the risk of both flood and drought. The dry season is also the period of highest potential yield from an energy point of view.

Figure 3.7: Sunshine hours in the Mekong Delta and NE Thailand compared with daylight hours in Phnom Penh



Plant nutrition

Plants receive their nutrition from the soils via roots. Soil properties strongly influence the way in which inherent and applied nutrients reach the roots. Soil characteristics differ greatly across the LMB and will be discussed further in Section 9.

Temperature

Extreme temperatures, especially during the reproductive period, will also affect the development of crops. All SE Asian crops, including rice, are susceptible to hot days; temperatures in excess of 38 to 40 ^{o}C have the potential to cause pollen damage, reducing grain yields. Cold may also retard growth in higher altitude, dry season crops in Lao PDR (Goeppert, pers comm) and in the central highlands of Viet Nam (Parkin pers comm.). In general, however, temperature extremes do not adversely affect either rice or upland crops in the LMB.

Pests and diseases

No crop can reach its potential yield when suffering from infestations of pests and diseases. Pests and diseases therefore need to be controlled.

Potential crop yields in the LM

Under ideal growing conditions, the yield potential of all crops in the LMB is higher during the dry season than in the wet season due the greater amount of sunshine received during this period (Nesbitt, 1997, Linquist and Sengxua, 2001). At the Cambodian Agricultural Research and Development Institute (CARDI) rice yields of the same variety are often more

than 35% higher in the dry season under research conditions (Cambodia-IRRI-Australia Project, 1998/1999).

The potential yield for rice cultivated near Phnom Penh is estimated at being 9t/ha (IRRI, pers comm) and yields on small plots of irrigated, highly fertile soils in Southern provinces of Cambodia approach this figure. Reaching the potential yield in both seasons is dependent on diligently managing all factors affecting plant growth. Average dry season yields in Cambodia during 2002 were 3.1t/ha, well short of this target.

3.8 Rice cultivation techniques

Rice is grown in the LMB across a wide range of topographies and environments. Plants can be cultivated in different water depths and times of the year using floodwater, direct rainfall or irrigation water to maximise grain yields.

Upland rice

In the mountainous areas, native rice varieties are dibbled into the hillsides in combination with legumes, maize and tubers. This rice does not stand in ponded water and its yields are highly susceptible to weed competition plus drought. Selected varieties are tall and broad leafed to shade out weeds. After two or three cropping seasons, the soils become degraded and vigorous weed populations build up, forcing the farmers to rotate their fields. This is often termed shifting cultivation agriculture. Upland rice is sensitive to day length, ensuring the plants flower before the wet season draws to an end. Upland rice is never irrigated.

Rain-fed lowland rice.

Lowland rice is more suited to grow in standing water than upland rice. Varieties are generally narrower leaved and tiller more profusely than upland rice, providing a higher yield potential. Traditional varieties are photoperiod sensitive and can be classified as being early, medium or late maturing. Early-maturing varieties (maturing November/December) are usually shorter in stature and grow in areas where the water depth does not exceed 20-30 cm. Medium duration (maturing December) varieties grow in deeper water environments. Harvesting of late maturing varieties takes place in December/January; these varieties grow in water depths often exceeding 50 cm.

Cultivation of non-photoperiod, early-maturing rice varieties for the rain-fed lowlands is becoming more popular in areas of improved water control. These crops may gain some supplemental irrigation and be harvested before the main traditional rain-fed crop is transplanted later in the wet season. Such early wet season crops are found mainly in Cambodia.

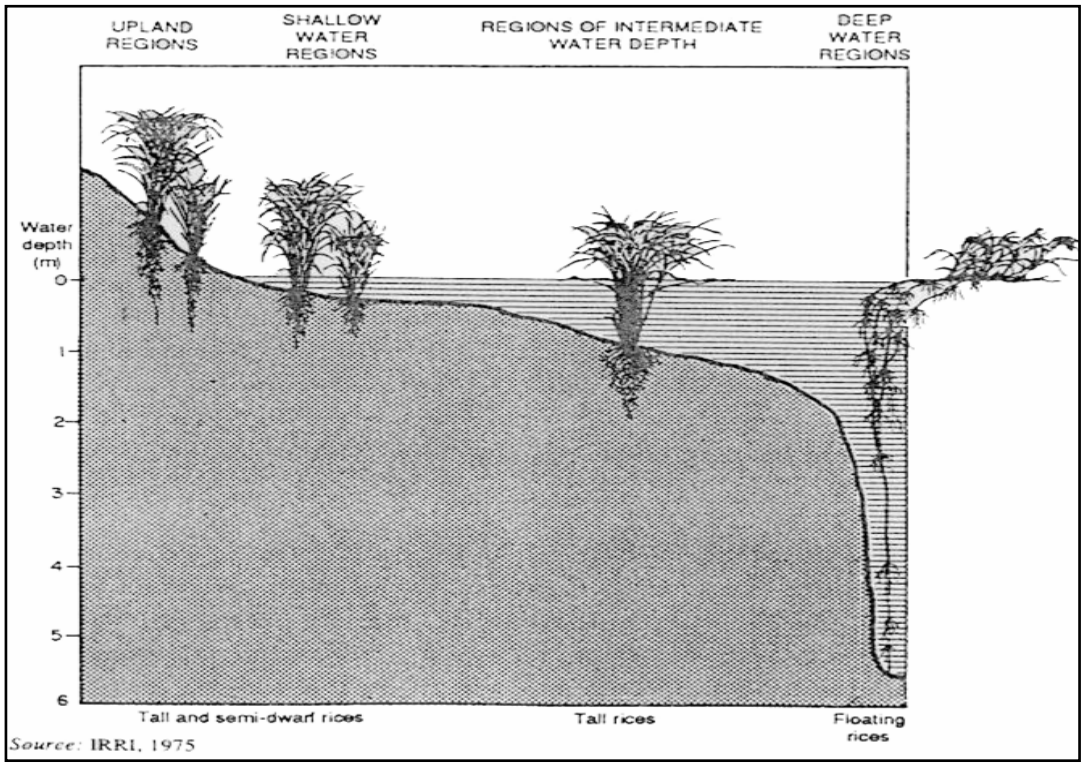
Deepwater/floating rice

Crops growing in water depths greater than 50 cm are often referred to as deepwater rice. If parts of the rice plant (including the main growing points) float on top of the water during peak water periods, they are called floating rice. In the LMB countries harvesting deep floating rice crops are generally takes place during January/February.

Deepwater and floating rice seed is broadcast at the beginning of the wet season to allow sufficient time for the plants to reach a physiological stage when they can elongate to keep

pace with rising water levels. Many varieties can grow in excess of 30 cm per day and often have culm lengths of four to five metres. These crops suffer from drought and weed competition early in their life cycle and drought or excessive flash flooding later in the season. Farmers consider deepwater/floating rice as being a low-maintenance, but high-risk crop and most farmers have converted these areas to growing HYV recession rice or irrigated dry season crops.

Figure 3.8: Rice ecosystems found in the LMB



Irrigated rice

The term *'irrigated'* refers to all rice crops receiving off-field applications of water. This terminology often leads to confusion when figures are compared between one country and another. For example, in Lao PDR, there are cases of rain-fed crops growing within irrigation schemes being included in datasets for irrigated rice (Goeppert, pers comm). Conversely, dry season crops are not all fully irrigated. Some dry season, recession rice crops on the edge of Tonle Sap Lake in Cambodia, for example, are not irrigated at all while other recession crops on gentler slopes further to the south are fully watered. Other potentially irrigable areas are only partially irrigated because of labour shortages or other constraints. Despite these problems, the areas of crops receiving supplemental water have increased in all LMB countries, particularly in recent years.

Photoperiodicity has been bred out of high yielding rice, allowing crops to be cultivated at any time during the year. Non-photoperiod varieties are considered early maturing if they can be harvested before 120 days, medium maturing when they can be harvested between 120 and 150 days and late maturing at stages after 150 days. Apart from exceptional cases, farmers in the LMB seek early maturing rice varieties of less than 115 days for irrigation. New varieties can be harvested within 95 days of seeding but they are of low quality.

Transplanting vs. direct seeding

Early, medium and some late duration traditional rice varieties are transplanted in the rain-fed lowlands of Cambodia, Lao PDR and Thailand. Nurseries growing seedlings take up 15-25% of the farm area. The farmer carefully tends the nursery until there is freestanding water in the main field. The optimum age for transplanting traditional varieties of seedlings is at four to five weeks. If insufficient rain falls in the early part of the wet season, seedlings often range in age from two to five months at transplanting, some of which may need pruning to prevent lodging (falling over). Transplanting shock sets back the development of all plants; especially those transplanted late or into poorly prepared main fields. Most HYV seedlings are transplanted at three to four weeks old.

Transplanting is a laborious method of growing rice. However, under typical conditions, the rice is transplanted into a flooded field that is virtually free of weeds and the weed-free environment persists until harvest. A weed-free crop is also possible if the seed is broadcast directly into a field possessing good water control. Broadcasting or 'direct seeding' is practised with all floating rice crops and approximately 30% of rain-fed and irrigated crops in Cambodia and NE Thailand. There is little direct seeded rain-fed rice in Lao PDR or the central highlands of Viet Nam. Transplanting has not been practised in the Mekong Delta of Viet Nam for two decades and all crops are now direct seeded.

Direct seeding can shorten the maturation period of HYVs by five to seven days, thereby reducing water consumption. In some locations, direct seeding increases the chance of a second crop being planted during the same year.

3.9 Soils

3.9.1 Soil types and distribution

The soils of the LMB have been classified over a number of years using different systems. In Lao PDR, for example, French, Russian, US and FAO classifications were used during the 20th century. In Cambodia, identification of most soils was initially based on a US map (Crocker, 1962) followed by the use of French and Vietnamese systems. The rice soils of Cambodia have also been classified on agronomic criteria (White et al, 1997). The US Soil Taxonomy system was used for soil mapping of Thailand and both Vietnamese and FAO/UNESCO systems in Viet Nam. All systems were utilised by the MRC in developing a basin wide land resources inventory for agricultural development using the FAO/UNESCO (FAO/UNESCO, 1988) soil classification system as a standard (MRC, 2002c).

Table 3.7 gives the major soil types in the LMB. Acrisols are the major soil type in terms of area and percentage of the LMB followed by cambisols. Gleysols are common in the Mekong Delta along with a range of other soil groups. This table does not accurately describe the soils in the areas that are potentially irrigable. When the Class 5 areas are examined, almost all of the Mekong Delta is classified as being suitable for irrigation: 65% of

the Mekong watershed in Thailand and 72% of Cambodia (Table 3.8), but only 13% of the Lao PDR watershed as a whole and 11% of Viet Nam.

Table 3.7: Soils of the LMB

	Cambodia		Lao PDR		Thailand		Viet Nam	
	Area (mio. ha)	*Area (%)*	*Area (mio. ha)*	*Area (%)*	*Area (mio. ha)*	*Area (%)*	*Area (mio. ha)*	*Area (%)*
Acrisols	7.6	49.0	12.8	61.0	11.4	61.0		
Cambisols	1.7	11.0	4.3	21.0	0.1	3.5	0.2	3.5
Gleysols	1.5	10.0			0.8	4.0	2.6	39.0
Fluvisols							0.5	7.0
Leptosols	2.0	10.0	2.1	13.0			0.1	1.5
Ferralsols	0.6	3.7					0.6	9.0
Other groups	2.2	16.3	1.6	5.0	6.6	31.5	2.7	40.0
TOTAL	15.6		20.8		18.8		6.7	

Table 3.8: Percentage of area classified as suitable for irrigation

Watershed	%
Thailand	65
Cambodia	72
Lao PDR	13
Viet Nam Central Highlands	11
Viet Nam Mekong Delta	99

Almost 71% of the irrigable area in the NE of Thailand is classified as being occupied by acrisol soils, 50% in Lao PDR, 59% in Cambodia, 68% in the central highlands of Viet Nam and 2% in the delta of Viet Nam. (See Table 3.9).

Table 3.9: MRC watershed classification systems – Class 5 soils in the LMB

	Cambodia		Lao PDR		Thailand		Viet Nam CH		Viet Nam MD	
	Area (mio. ha)	*Area (%)*	*Area (ha10 6)*	*Area (%)*	*Area (mio. ha)*	*Area (%)*	*Area (mio. ha)*	*Area (%)*	*Area (mio. ha)*	*Area (%)*
Acrisols	6.65	59	1.37	50.0	8.69	71.0	0.25	68	0.06	2
Cambisols	1.29	11	0.86	32.0	0.05	0.0	0.02	5	0.17	5
Gleysols	1.35	12	0.24	1.0	0.63	5.0	0.01	2	2.54	75
Fluvisols	0.13	1	0.14	1.0	0.26	2.0	0.03	9	0.44	13
Leptosols	0.20	2	0.04	2.0	0.00	0.0	0.00	1	0.00	0
Ferralsols	0.20	2	0.03	1.0	0.06	0.0	0.04	11	0.00	0
Other groups	1.46	13	0.05	13.0	2.49	22.0	0.01	4	0.02	5
TOTAL	11.28		2.73		12.18		0.36		3.23	

Note: CH = Central Highlands, MD = Mekong Delta

MRC defines acrisols as soils that developed on old land surfaces of undulating topography in seasonally dry and humid tropical and monsoon climates (MRC, 2002c). They generally have a very thin layer of topsoil and possess low cation exchange capacity (CEC), are acidic in the subsoil, and are often saturated in aluminium to toxic levels when aerobic. Recurrent inputs of lime and fertiliser are needed for continuous cultivation and it is recommended that mechanical clearing of natural forests be avoided at all costs. Such soils would appear to be unsuited to agriculture except for the cultivation of acid-tolerant crops, such as cashews and pineapples. These soil characteristics do, however, change under flooded conditions.

Thirty-two percent of the soils in the potentially irrigable areas of Lao PDR are classified as being cambisols. These soils are characterised as having reasonable structural stability, high porosity, good water holding capacity and being moderately to highly fertile. Cambisols are thought to make good agricultural land and can be cultivated with a range of crops. According to the MRC land classification system, there is potentially 860,000 ha of this land in Lao PDR and 1.2 million ha in Cambodia. Only small areas are found in the other three watersheds. These soils appear to be ideally suited to growing upland crops including perennials, but may consume large quantities of water to keep the soil profile wet.

Gleysols are the most common soil type found in the Mekong Delta, taking up 75% of the potentially irrigable area (Table 9). These soils developed under long periods of waterlogging and are suitable for irrigated rice. For other arable cropping, horticulture or tree crops lowering of the water table by draining will be required. (MRC, 2002c). Some areas of these soils developed in brackish water sediments contain pyrite and may have turned into acid sulphate soils.

An extra 1.35 million ha of gleysol soils are found in Cambodia, generally on the Mekong Delta down towards the border with Viet Nam. Approximately 630,000 ha of gleysols are also found on flat areas in Thailand.

Small areas of fertile fluvisol soils are found along the edge of river systems in all five watersheds of the LMB. They are particularly prominent in the Mekong Delta. Such soils are productive for a wide range of dry land crops. As with gleysols, however, they have already developed into acid sulphate soils if inundated with marine or brackish water for long periods of time.

Two hundred thousand (200,000) hectares each of Leptosol and Ferralsols soils are also found in Cambodia. Leptosols are usually associated with hilly and mountainous areas, which possess thin soil layers and are highly susceptible to erosion and, if cropped, drought. Ferralsols on the other hand are extremely weathered and possess high percentages of kaolinite clays. They are generally low in CECs, nutrient reserves and inactive applications of phosphorus. If carefully managed these soils are suitable for cultivation of oil palm, rubber and coffee, plus grazing of animals or for tree plantations.

3.9.2 Soils and plant nutrition

The major soils covering the irrigable areas of Cambodia, Lao PDR, Thailand and the central highlands of Viet Nam generally possess 'low natural fertility' (Linquist and Sengxua, 2001) and are often "difficult to manage" (White et al, 1997). One author (Euroconsult, 1998) described the soils of NE Thailand as being "rated among the poorest in South and SE Asia". Untreated soils inherently result in low yields. Improvements are possible through the age-old practice of annually supplying organic matter to the fields in the form of manure or compost. The cultivation and incorporation of green manure crops also increases grain yields. However, to produce a reasonable amount of biomass, it may be necessary to add phosphorus to the green manure crop beforehand. Most farmers are reluctant to do this.

Acrisol soils and some cambisols are invariably deficient in nitrogen, phosphorus and potassium and possibly sulphur, magnesium and boron in the sandier phases. Soil management recommendations for these soils usually include the application of fertilisers in small doses throughout the life of the crop. Prolonged flooding to overcome low pH, aluminium toxicity problems and the low CEC are also recommended for the cultivation of rice.

Nitrogen is the most limiting element for most lowland soils in the LMB and requires applications in quantities greater than other nutrients. For very 1000 kg of yield, the required uptake is about 15 kg (Linquist and Sengxua, 2001). Recommendations for rain-fed rice on sandy soils range from 50 kg of urea, 25 kg of di-ammonium phosphate (DAP) and 50kg of potash to 125 kg of urea, 75 kg of DAP and 50 kg of potash per hectare (CIAP, 1998) and higher rates for heavier soils. Farmers rarely apply these rates of fertiliser because of the cash requirements for purchase and the high risk of 'mini' droughts occurring during the rainy season that would negate the value of the fertiliser. However, technology does exist for farmers to increase rice yields if farm-gate grain prices rise, particularly when the risk of drought can be eliminated. Increasing yields of upland crops on these soils is much more difficult.

On the Mekong Delta there are 1.1 million ha of fertile alluvial soils ideally suited for rice production (Xuan and Matsui, 1998). Fertiliser applications on these soils often exceed 150 kg/ha. In other parts of the delta there are problems of highly acidic, acid sulphate soils (1.6 million ha) mainly in the Plain of Reeds and Long Xuyen-Ha Tien quadrangle, and with saline soils along the coastal region (0.8 million ha). Soil management practices for each soil are vastly different. Farmers downstream of the acid sulphate soils also suffer problems of accessing acid irrigation water at the beginning of the wet season when the area is flushed.

In conclusion, a vast majority of the soils in flat areas suited for irrigated agriculture in the LMB are infertile and acidic. Large areas of land are therefore unlikely to provide good economic returns to the cultivation of upland crops or perennials without substantial modifications to the soil. Such modifications would include an increase in the soil pH, increase in CEC and an improvement in soil fertility. Some of these problems can be overcome if the soils are anaerobic after being flooded for long periods. Under these conditions, the soil pH increases to neutral and phosphorus is released from the soil into a form more readily taken up by the plant. Applied nutrients are also more readily absorbed. Farmers may therefore continue to grow rice on these soils until upland crop technology is improved.

3.10 Fertiliser and pesticide use

3.10.1 Fertiliser

The annual growth rate in the consumption of mineral fertiliser between 1989 and 1999 ranged between 3.9% (Cambodia) and 25.8% (Lao PDR) on a countrywide basis (MRC, 2002b). In these two countries, however, the consumption of fertiliser per ha in 1999 was very low at 2.1 and 8.5 kg/ha of agricultural land respectively. This compares with 100.1 kg/ha for all of Thailand and 263.2 kg/ha for Viet Nam. In Cambodia and Lao PDR much of the imported fertiliser was applied to vegetables and fruit trees, with the remainder being applied to dry season rice production and upland crops.

Only 9.9% of all Lao farmers used chemical fertilisers according to an agricultural census conducted in 1998/99 and 14.8% only applied organic fertilisers (Nippon Koei, 2001). Most

of the wet season rice in Lao PDR and Cambodia is still grown using traditional low input methods. These methods involve applying cow manure to the fields just prior to the onset of the monsoon rains and ploughing it into the soil during its first preparation. Applications are concentrated on the nursery fields (15-25% of the total area) to improve seedling quality. If they have reserves of cash to purchase it, some farmers will apply urea at panicle initiation. Farmers in NE Thailand also follow a similar practise; here inorganic fertiliser applications are much higher at 40-50 kg/ha on rice (JICA, 1993). In Viet Nam, use of inorganic fertilisers continues to rise as the farming practices intensify.

Composition of the applied fertilisers has progressively changed over the past 5-10 years in response to research results showing that most soils in the LMB are deficient in phosphorus and becoming increasingly deficient in potassium. Imbalanced fertiliser applications are particularly evident in the Mekong Delta where farmers apply nitrogen at 180-200 kg/ha (Nhan, 2003) but phosphorous and potassium are applied at very low dosages. In all countries where the farmers are better informed they apply phosphorous and potassium fertilisers in addition to nitrogen. Targeted fertiliser applications will reduce pollution of the waterways, improve the efficiency of water usage and increase yields. Fertiliser losses to the waterways are not a serious problem in any of the LMB countries.

3.10.2 Pesticides

Pesticide consumption figures on a watershed basis are not available for LMB countries. In general though, use of pesticides in all LMB countries is low compared with western countries (www.fftc.agnet.org). In Lao PDR, the use of pesticides are restricted by the Lao Government. Herbicides are banned and insecticides plus fungicides are rarely used except on vegetables. Heong and Esculada (2000) estimated that pesticides were applied approximately 0.3 times per year in 2000. Government agriculture officials discuss Lao rice as being 'purely organically grown' and claim to receive a premium price on international markets because of it (Bountiep Chounthavong, pers comm.). As a result, water runoff from the paddies into the Mekong River possesses very low levels of pesticide residues.

Pesticide consumption in Thailand appears to be extremely high, the nation consuming over 47,000 tonnes of pesticide in 1995. However, farmers in NE Thailand farmers apply only 5% of the amount their counterparts in the central plain use and 10% of the usage of farmers in the north of the country (MAC, 2000). These farmers tend to follow low input practices in their wet season crops and applied only US$2.99 worth of pesticides per ha in 1998/99 (MAC, 2000). These levels of pesticides are unlikely to pollute seriously the waterways in NE Thailand. Fish production from the wet season rice paddies supplements the diet of most farmers in this watershed, indicating pollution of paddies is not causing problems.

In Cambodia, approximately 27% of wet season farmers and 59% of dry season farmers used pesticides on their rice in 1996 (Jahn et al, 1996) averaging US$1.23 and US$4.67 per ha in the wet and dry seasons respectively. These pesticides included insecticides, herbicides and chemicals used to kill rodents. Duuren et al., (2003) found that the use of pesticides increased towards the Viet Nam border where two thirds of the border farmers used pesticides compared with a quarter elsewhere. Wet season rice paddies are virtually pesticide free and pesticide applications rarely cause fish fatalities. Runoff from these paddies is reasonably clean of pesticide residues. However, dry season cropping, most of which is close to the border with Viet Nam, is subjected to an increasing number of pesticide applications, despite the efforts of Integrated Pest Management (IPM) practitioners.

Pesticide consumption is much higher in Viet Nam than in the other three LMB countries, especially in the intensively farmed Mekong Delta. Estimates of the number of applications

range from 3.9 (Heong and Esculada, 2000) to 7.4 per crop (www.fftc.agnet.org) but rates are considered to be comparatively low at 1 kg/ha of active ingredient, compared with 11.8 kg/ha in Korea and 19.4 kg/ha in Japan. Farming systems specialists in Viet Nam are concerned at the level of pesticide use in the Mekong Delta and do not consider dry season rice paddies to be suitable for rice-fish production. Pesticide levels in the paddy water may also be high in more intensively farmed areas during the wet season, but the volume of water passing through parts of the Mekong Delta during this period flushes the system and fish farming is considered to be an option for farmers with deeper paddies.

Water quality close to the fish farming areas of the Mekong Delta is a serious concern for the industry. Drainage from fish and shrimp farms pollutes some waterways (Guttman, pers comm.). Such drainage contains toxins from intensive fish farm feeding activities and pesticide used to eliminate pests prior to filling the ponds. This problem will need to be addressed as fish farming activities in the Mekong Delta expand.

3.11 Farm mechanisation

Mechanising farming activities has the potential of increasing farm productivity and improving production. For example, replacing animal traction with engine-powered tractors will vastly speed up land preparation, thereby improving the timing of cropping patterns. A reduction in the time it takes to prepare the soil improves the chance of the plants taking advantage of higher solar energy months and avoiding droughts or floods. In some areas, it may also improve the number of crops that can be cultivated in one year. Therefore, a higher percentage of the agricultural land can be cropped.

However, agricultural equipment is expensive to purchase and operate. Adoption of tractor-powered land preparation, engine-driven water pumps, combine harvesting and mechanical threshing are therefore also dependent on the cost of labour and opportunity cost of time lost through the employment of slower practices. Labour costs and cropping intensities are vastly different in the four LMB countries; hence, farm mechanisation varies dramatically across the region.

In Lao PDR, there is no shortage of farm labour and little of the land is prepared by tractor. There is no combine harvesting of rice but mechanical threshing is increasing rapidly in the lowlands (Table 10). Tractors are almost exclusively used for land preparation in Thailand (because of the high labour rates) and the Mekong Delta of Viet Nam (to enhance opportunities for extra cropping and because grazing areas are in short supply). Combine harvesters are used extensively in the flatter provinces in the east and with decreasing frequency towards the undulating topography in the west of NE Thailand. Some farmers are now increasing paddy sizes in the NE of Thailand by land leveling to improve the prospects of mechanised farming.

Combine harvesting is either not economically feasible (in Cambodia and Lao PDR) or impractical (small paddy size in the Mekong Delta) in the other LMB countries. Some sugar crops are mechanically harvested in Thailand and this practice will increase with improved farm gate prices. Other upland crops are all harvested by hand.

Table 3.10: Adoption of farm mechanisation in the LMB

Country	Tractor land preparation (%)	Mechanically harvested (%)	Machine threshed (%)	Machine milled (%)
Lao PDR	Less than 10	0	30	75
Cambodia	16	0	50	95
Thailand	95	50	100	100
Viet Nam	100	0	100	95

Most lowland rice in the LMB countries is machine threshed and machine milled. Upland crops of sesame, soybeans and dry peas may also be threshed and cleaned by machine.

In all LMB countries, engine-driven or electric pumps do most of the pumping of irrigation water. Hand or pedal-driven water pumps are still active in the poorer areas of Cambodia and Lao PDR, especially when supplementary water is supplied to rice seedling nurseries. However, this practice is in decline as the use of faster mechanical pumps spread across the countryside.

3.12 Marketing and agro-processing

Marketing of farm products is the main constraint to agricultural diversification in the LMB. In Cambodia and Lao PDR, access to markets is of primary importance to many of the rural population, while in Viet Nam and Thailand consistent demand of farm production constrains wider adoption of non rice-based production.

In Lao PDR, the marketing system remains undeveloped because of the large subsistence component of farming community (Nippon Koei, 2001). Most surplus produce is sold at local markets and interregional distribution is limited. Consequently, regional market prices vary considerably. This is, in part, due to the poor road infrastructure and part from the lack of market information service. The State Foodstuff Company (SFC) has a commanding share of the market for paddy, storage facilities and rice mills, reducing competition. Market retail outlets are also managed by the central government, provincial or district administrations. Processing of agricultural products to add value is very limited.

A developing open market system in Cambodia is constrained by poor rural infrastructure and poor access to international markets. Primary, secondary and tertiary rural road construction continues to open up the way for farmers to access required inputs and transport any surplus production to markets (OPCV, 2002). Until recently, high-quality rice mills were not available in Cambodia and much of the surplus rice was exported as paddy (ACI, 2002). The country lacks extraction plants for its oil palm plantations and rubber is exported under licence from Viet Nam. Grading facilities do not exist to ensure the sale of quality products from the uplands. For these reasons, Cambodian farmers received well below world prices for their products and were unable to access the timely, correct information from markets so they could take advantage of price fluctuations.

Road and canal access to markets and market information is better in Viet Nam than Cambodia and Lao PDR. However, low prices and a lack of storage facilities continue to hamper agricultural diversification in the Mekong Delta and central highlands. These issues are particularly prevalent with fruit and vegetable production (Dr Le Thi Thu Hong, pers comm.) where limited marketing information often leads to the sale of poor quality, low value products. Synchronous harvesting, coupled with a lack of processing, results in too

much fresh fruit entering the market at any one time and it is also difficult to service the large community of small farm holders. Most farms in the Mekong Delta range in size from 0.1-2.0 ha, but the average is only 0.5 ha.

The NE of Thailand has an excellent network of roads and food processing is well developed. There are 11 sugar mills in the NE, plus a range of rice mills, cassava processing and vegetable oil extraction plants, plus canning factories. Despite the well-developed infrastructure and reasonable information and input services, farmers have not diversified significantly into non-rice crops. Rising production costs and static or falling prices are tending to deter farmers from investing heavily in these activities on infertile soils in the NE of Thailand.

3.13 Credit

Credit availability for farm activities varies across the four LMB countries. In Cambodia and Lao PDR, family, friends and traders provide the main source of funds to rural households. Interest rates are extremely high, ranging between 40 and 80% per annum. Generally, these loans are taken out for family emergencies and not to purchase inputs or provide funds for capital improvements to the farm. Village revolving funds are also popular in Lao PDR and state-owned banks provide funds for rural infrastructure, but not for farming activities. Cambodian agriculture is assisted by an NGO-established bank, which provides assistance to a small number of farmer recipients.

In Viet Nam, rural investment loans are available through the Viet Nam Bank for Agriculture and Government run (often foreign funded) poverty reduction programs (Dr Doung Van Vien, pers comm.). Bureaucratic procedures limit access to these funds (MRC, 1998)

Thailand has a well-established rural credit facility through the Bank of Agriculture and Agriculture Cooperatives. Interest rates for farmers vary from 7.5% pa for proven creditors to 13.5% pa for farmers having a low credit risk but possessing a good plan for repayment (www.baac.or.th/th-baac/interest/loanrate). Despite the low interest rates, the use of credit is low as NE Thai farmers prefer to borrow from family members for agriculture investment (JICA, 1993). Credit is not considered to be a constraint for rural investment in Thailand (Euroconsult, 1998).

3.14 Irrigation water

3.14.1 Surface water

In excess of 19,000 irrigation schemes had been installed in Lao PDR by 2000, servicing an area of 295,000 ha in the wet season and 197,000 ha in the dry season (Nippon Koei, 2001). The majority of schemes are of the traditional weir type in the mountainous northern and central regions, while pump irrigation is concentrated in the south. Overall, more than half of the irrigated area is pump irrigated (DOI, 2001). Not all schemes are fully utilised because of high operational costs and low returns (Nippon Koei Co Ltd, 2001). Government figures indicate that approximately 92,000 ha of rice were harvested from the dry season irrigated area in 2000. Pump irrigation costs have increased in recent months due to higher electricity prices, reducing demand even further. Consequently, the area under irrigation is not likely to expand rapidly in the near future without heavy government subsidisation.

In NE Thailand, more than 750,000 ha of land has infrastructure installed for irrigation (WUP-JICA, 2002). Approximately 32% of the area is under large-scale irrigation schemes, 19% medium, 27% small scale and 22% pumping schemes. These schemes are primarily used for providing supplementary irrigation to wet season crops. In the dry season, either insufficient water is available for crop cultivation or it is uneconomical to grow crops on the infertile soils. In 1998, Euroconsult (1998) considered that the cropping intensity during the dry season was only 10-15% of the irrigation area in the Lam Praplerng and Lam Pao schemes. Less than 50% of farmers planted any crop at all because high labour costs or a complete lack of available labour made cultivation impossible. Of the remaining 50%, few cropped the whole farm, with most planting high value crops like chilli and watermelon on small areas.

Thai Royal Irrigation Department figures for 2001 indicate that 116,492 ha (16%) of the irrigated area were planted. In 2002 this figure had was reduced to 94,789 ha (13%). Sixty four thousand (64,000) ha was planted to rice, 17,470 ha to upland crops, 5,294 ha to vegetables, 2,065 ha to sugar, 342 ha to fruit trees, 666 ha to other trees and 4,334 ha was dedicated to fishponds (RID crop figures).

RID planned to install 92 ha of irrigation infrastructure in the NE of Thailand in 2003/4. These schemes are mainly in the Mun and Chi catchments. Economic considerations are not seen as a constraint to their installation as it is Government policy to provide as many opportunities as possible for population of NE Thailand to remain residents of the NE.

Cambodia has 946 operating irrigation systems that can service 256,120 ha of the two million ha wet season cultivated area. In the dry season, rice is grown on 255,000 ha and 143,490 ha of this can receive irrigation water from irrigation schemes. Hence, only 12% of the wet season rice is irrigable, the remainder being rain-fed. Just over half of the dry season crop is irrigated, the remainder being recession rice receiving supplementary irrigation from manually operated and diesel-driven pumps. Very few of the irrigation schemes are capable of irrigating all year round.

Most dry season rice is cultivated on land flooded during the wet season. Crops are transplanted as the floods recede in a similar manner to recession rice. They are then either gravity fed from upstream dams or water is pumped from irrigation canals. The latter is a common method south of Phnom Penh where most land is only five to seven metres above sea level and high lift pumps are unnecessary.

Fully irrigated crops receive approximately 10,000 m3/ha. Some irrigation engineers in Cambodia consider recession rice receives approximately 4,000 m3/ha of irrigated water (G. Himmel, pers comm.).

The number of surface water irrigation schemes in the central highlands of Viet Nam is small compared with other parts of Viet Nam. Schemes are found along the river and on valley floors irrigating approximately 50,400 ha of rice in all of the central highlands in 2001 (VSY, 2002). This compares with the 300,000 ha of coffee irrigated from groundwater sources (see 14.2 below).

A JICA (2003) estimate that approximately 1,479,000 ha of agricultural land was irrigated in the Mekong Delta of Viet Nam during 2001. This figure compares closely with those provided by Vietnamese research institutes. Estimates are that about 300,000 ha grows three crops of rice per year, 1,080,000 ha is double cropped and 200,000 ha is cultivated to upland crops (Tanh, pers comm.) Water is extracted from 2,500km of natural rivers and creeks and 3,000 km of canals (Binh, 2002). Some of this water is directed into acid sulphate soils in the Plain of Reeds and Long Xuyen–Ha Tien quadrangle causing problems with severely acidic

water being flushed along the same canals into more productive areas at the onset of monsoon rains.

Pump costs are high towards the north of the delta where flooded water levels may need to be reduced to cultivate two crops of rice during the dry season. In the fresh water alluvial zone it is possible to harvest 2-3 crops per year using high tides to irrigate paddy fields and low tides for their drainage. The use of tides for crop irrigation is more difficult along the coastal region and the Ca Mau peninsular. These areas are becoming increasingly used for fish farming. Saltwater incursion is a serious problem in parts of the Mekong Delta during the months of January-May when river flow rates are at their minimum.

3.14.2 Groundwater

Pattanee et al (2002) estimated that 75% of domestic water in Thailand was obtained from groundwater resources, serving 35 million people in villages and urban areas. The only region in Thailand irrigating crops from groundwater is in the north of the country. Groundwater studies suggest freshwater can be found among the numerous saline aquifers in NE Thailand, but there is not the volume for wide-scale irrigated agriculture (RID pers comm.).

Good freshwater aquifers are located along the mountainous region of Lao PDR and some of these are used to water the 42,000 ha of coffee located in the area (Bountiep Chounthavong, pers comm.). A small amount of extra water is used for domestic consumption.

Groundwater sources are often overextended in the support coffee production in the central highlands of Viet Nam. In 1989, for example, 11,357 ha of coffee was reported destroyed by drought (www.financialexpress.com/fe/daily). Regardless of problems, the area under coffee has increased dramatically over recent years in response to population resettlement programs. There are currently about 300,000 ha of coffee grown in the central highlands.

Recharge of aquifers is generally slow and farmers are known to dig horizontally from the base of wells to extract more water. Although groundwater levels are known to rise and fall with the season, water tables are declining over time (Dr Trinh Truong Giang, pers comm.). Water in these areas is applied to coffee over the dry season at approximately 50 mm each nine days (SRMP, 1999). This rate is equal to 65 cm (6,500 m3) per ha. Groundwater is also used for domestic purposes.

The Mekong Delta possesses six aquifers with depths ranging from 15 m-75 m and 275 m-400 m. Water reserves are considered to be large (Haskoning, 2000), but to exploit them care must be taken with location and drilling because much of the water is either brackish or saline and recharge characteristics are poorly understood. Water in the lower aquifers is 20,000-30,000 years old and not recharged from local rainfall, causing concern for its misuse. Some bores to the medium depth aquifers were artesian or sub-artesian sources 10-20 years ago, but are already suffering from overuse with water levels dropping rapidly. In part of the delta, shallow groundwater aquifers have been exhausted. Water levels are thought to have declined through both abstractions and by the extensive surface drainage system constructed during the 1990s.

The only major areas on the Mekong Delta consuming groundwater for agricultural production are located between and along the Bassac and Mekong rivers. Although the drawdown is significant during the dry season, when these areas take their water directly from the river, floods recharge the shallow aquifers during the wet season.

Extensive shallow groundwater reserves are known to exist around the Tonle Sap Lake and beside the Bassac and Mekong Rivers in Cambodia. Water levels in shallow wells and tube wells follow the river height for distances up to 30km each side of the Bassac River (CIAP, 1999) indicating the aquifers are constantly being recharged. Farmers in the provinces of Kandal, Takeo, Svey Rieng and Prey Veng have taken advantage of these reserves by installing cheap shallow tube wells to irrigate one to two ha of dry season crop. Unfortunately, the recharge rate is slow and in some intensively irrigated areas farmers run short of water during peak periods.

Dry season rice production in Prey Veng, and Takeo using groundwater during 2001 covered an area of between 5,000 and 10,000 ha (CARDI, pers comm.), up from zero in 1995. JICA (1999), estimated wells in the quaternary age aquifers of Svey Rieng, Prey Veng and southern Kandal can yield 500-800 m3 per day without causing adverse effects on the entire groundwater basin. Such pump rates would irrigate four to six ha of rice per well. The potential for irrigation from groundwater from these aquifers is therefore quite high if properly regulated to ensure minimal drawdown. There is insufficient recharge capacity in the aquifers for large-scale irrigation projects.

3.15 Water consumption by agriculture in the LMB

3.15.1 Consumption as a percentage of renewable resources

Mekong river water is utilised for irrigation, hydropower generation, domestic and industrial purposes. Much of the water emerging from hydropower stations is also consumed downstream for irrigation, domestic and industrial purposes. Irrigated agriculture is responsible for 80-90% of water abstractions from the basin (FAO from MRC, 2002b) and is utilised in the form of receding floodwater storage, diversion of water from streams and from ground water sources.

On a nationwide basis, the LMB countries do not fully utilise their renewable water resources. Renewable water resources are equal to the total precipitation in the country minus evapotranspiration. 'Irrigation water requirements' are an estimate of the amount of water required to water crops while 'water withdrawn for agriculture' is the amount used. The ratio between estimated irrigation water requirements and the actual withdrawal is usually referred to as 'irrigation efficiency'. Cambodia and Lao PDR use only 1% of their total renewable water resources for agriculture while Viet Nam and Thailand use 5% and 20% respectively (Table 3.11).

Based on these figures, an average Mekong river flow of 460 km3 each year can service the irrigation requirements of all LMB countries 11-fold. An annual Mekong river flow can also service approximately 64 million ha of fully irrigated rice, based on a consumption of 10,000 m3/ha (one metre of water) per crop. This compares with the 1999/2000 area of two million ha of dry season cropping in the LMB watersheds (Table 3.5).

Therefore, there is no shortage of water in the Mekong River to service agriculture in its watersheds if all water is captured and redistributed when required. This is, of course, not the case, with a majority of water flowing through to the ocean during the wet season when crops receive most of their water requirements directly from rainfall. Water shortages may occur (especially in the Mekong Delta) during the months of February to May when water flows in the Mekong River are at their lowest (see Figure 3.9). Crop irrigation is the major consumer.

Table 3.11: Renewable water resources used for agriculture in LMB countries

	Irrigation water requirements (km3)	Water withdrawn for agriculture (km3)	Water withdrawn as a % of renewable resources (%)
Cambodia	1.2	4.0	1
Lao PDR	0.81	2.7	1
Thailand	24.83	82.75	20
Viet Nam	15.18	48.62	5
TOTAL	42.02	138.07	7

Note: Source - (www.fao.org/ag/agl/aglw/aquastat/water/)

3.15.2 Crop water requirements

Irrigation water consumption for crops can be estimated reasonably accurately by employing the following FAO (www.fao.org/ag/agl/aglw/aquastat/water/) model:

IWR = Kc * ETO – P - ^S

Where:

IWR is the irrigation water requirement needed to satisfy crop water demand

Kc is a coefficient varying with crop type and growth stage

ETo is the reference evapotranspiration depending on climate factors

P is precipitation

^S is the change in soil moisture from the previous month.

Total water consumption in any cropped area will involve measurements of rainfall, evaporation, soil type, loss of water from canals and other structures, crop type, stage of crop growth, area of each crop, planting time, the irrigation method employed and crop duration plus a range of other factors. The Mekong River Commission's Water Utilisation Programme (WUP) has excellent programs for calculating water consumption of various cropping patterns in the Mekong River Delta. Abstraction rates vary considerably across different ecosystems.

3.15.3 Water requirements for cultivated rice

Rice cultivation is the largest consumer of irrigation water in the LMB. NEDECO (1991) calculated water requirements on the Mekong Delta in February averaged 0.8 l/sec/ha for rice (2000 m3/ha/month), upland crops at 0.6 l/sec/ha and perennial crops at 0.4 l/sec/ha. These rates are included in Figure 10 to examine water requirements of the major cropping systems used in the Mekong Delta. Other rates appearing in the literature for LMB countries include 10,000 m3 per irrigated rice crop (Cambodia), 12,000 m3 per irrigated rice crop (Thailand), 1 l/sec/ha (8,294 m3 for 120-day rice crop) (Mekong Delta), 19,600 m3/year/ha (Mekong Delta).

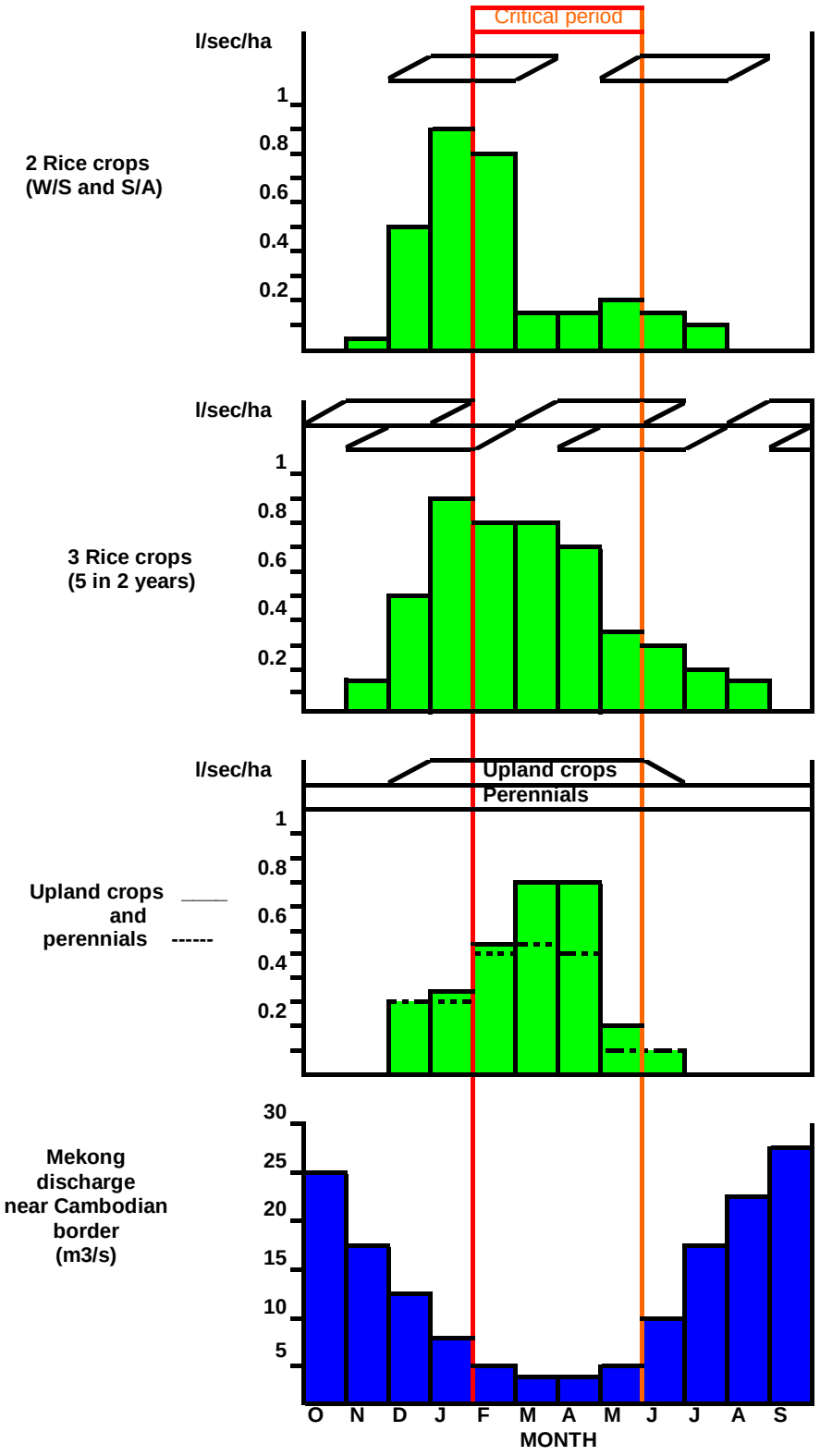
The consumption depends on a number of factors. Because it prefers flooded conditions, rice has a high water consumption compared with other crops. In the publication Rice Today (April, 2003.Vo 2 No 1), IRRI says that traditional irrigation techniques consume five cubic metres of water to grow one kilogram of rice. Dry-land crops produce the same amount of grain for one cubic metre and irrigated rice in Australia and the United States consumes approximately 1.2 m3/kg. If it is assumed that 10,000 m3 of water was used to produce one

hectare of dry season rice in the LMB during 2000, then average rice grain production used 3.3 m3, 2.5 m3, 3.0 m3 and 2.0 m3 of water to produce 1 kg of grain for Cambodia, Lao PDR, Thailand, and the Mekong Delta in Viet Nam respectively.

3.15.4 Irrigated upland and perennial crop water consumption

Upland crops including vegetables and perennials consume less water than rice. Commonly used crop factors are as follows: rice, 1.15; bananas, 0.9; maize, 0.75; groundnuts, 0.7; citrus, 0.65, melons, 0.65; vegetables, 0.65; soybeans, 0.65 (FAO 1998). Therefore, for water conservation purposes it would appear advantageous for farmers to grow more upland crops and less rice. As mentioned in sections 6.0, 8.0 and 9.0 there is only a limited amount of land in the LMB suitable for upland crops and vegetables in terms of soil nutrition and vulnerability to water logging and/or inundation. Cultivation of these crops needs to be restricted to either the higher, more fertile, well-drained soil types during the wet season or be fully irrigated during the dry season. Many rice paddies leveled to maximise the production of rice grain may need considerable earthworks in the form of raised beds or field gradients in order to cultivate such crops.

Figure 3.9: Average irrigation water requirements for main copping systems in the Mekong Delta, Viet Nam



Irrigated perennial crops include fruit trees, bananas and sugarcane in the lowlands and coffee and pepper in the mountainous regions. Fruit trees are occasionally irrigated using a permanently flooded ditch and dyke system (which is very expensive in terms of water consumption), irrigated by canal and ditches (intermediate water use), by pump and hose (low water use) or via trickle irrigation techniques (very efficient water utilisation). NEDECO, (1991) allowed 3,628 m3/ha for perennial cultivation in the Mekong Delta over the four-month critical period between February and May. In addition to direct abstractions from canals, the trees take up water from the shallow aquifers. As the perennial cropping intensity increases on the land suitable for upland and perennial crops, more irrigation may be required as the water table is lowered below the deep-rooted trees.

In the mountainous regions of Lao PDR and Viet Nam, cultivated coffee and pepper are replacing natural non-irrigated forest. Both cultivated crops need to be well watered during the months of January to March to induce flowering. Rates of 6,500 m3 per ha/year are abstracted from groundwater sources in the central highlands of Viet Nam (SRMP, 1999). Similar abstractions are expected from Lao and Cambodian coffee plantations.

3.15.5 Water consumption by animals and fisheries

Water consumption by animals is estimated at 50 litres per day (l/day) per head of cattle, buffalo and pig. Poultry and ducks consume a lesser amount. The estimated 24 million large animals in the LMB each consume 1.5 m3 per month (36 million m3/month for total herd). Over the four-month critical period (equal to one rice crop) consumption by animals is equal to 14,400 ha of fully irrigated rice at 10,000m3/ha.

Small areas of freshwater fish farms have been installed in Cambodia, Lao PDR and NE Thailand. However, the major aquaculture consumers of Mekong River water are the fish and shrimp farms on the Mekong Delta.

Freshwater fishponds are topped up to replace lateral and evaporative losses. Pond water is also changed before installing new fish batches. JICA (2003) estimated consumption of irrigation water in the Mekong Delta fishponds was at 34,000 m3/ha across the 119,560 ha pond area in 2001.

Fresh water is used in coastal shrimp culture ponds to top up water levels to prevent excessive build up of salt in the ponds. Addition of fresh water also reduces disease (Guttman, pers comm.). JICA (2003) estimates the area of coastal shrimp culture in the Mekong Delta during 2001 was 392,200 ha and each hectare consumed 4,600 m3 of fresh water per year. Some effluent is from these ponds is discharged into irrigation canals causing problems when the water is re-used by neighbouring enterprises (Guttman, pers comm.). Evaporation losses from open ponds are high.

3.15.6 Overall water consumption in the LMB

Fifty nine percent of the LMB watershed area remains uncleared (Table 3.1) and, agronomically, natural forest may still be the largest consumer of water in the basin. The forest receives all of its required water from annual rainfall and by tapping residual soil moisture plus water from shallow aquifers during the dry season. Overall water consumption decreases in land denuded of forest and cultivated with annuals, but there will be an accompanying change in seasonal flows into the mainstream and possible long-term climate change effects. Cultivated perennials consume more water in the dry season than annuals, especially if irrigated. Only small areas of perennial crops are grown in the LMB compared

with annuals (Table 5), although the area occupied by fruit trees has not been properly documented.

Abstractions from the Mekong River in the LMB are not limited during the wet season when flow levels are high. However, there may be constraints on water use during the dry season, especially in regional drought years. A rough calculation of water consumption by agricultural activities during the critical months of February to May for the LMB is presented below (Table 3.12.).

Table 3.12. Water consumption during the 'critical period', 2000

	Crop area ('000 ha)	Water consumption (m3/sec) Month			
		Feb	*Mar*	*Apr*	*May*
Cambodia					
Fully irrigated rice	55	44	44	44	44
Recession rice	200	80	40		
Upland crops	48	19	19	19	19
Fruit trees	164	66	66	66	66
Lao PDR					
Irrigated rice	87	70	70	70	
Upland crops	43	17	17	17	17
Coffee	42	17	17	17	17
Thailand					
Irrigated rice	67	54	54	54	
Fruit trees	381	152	152	152	152
Viet Nam CH					
Irrigated rice	51	41	41	41	
Coffee	300	120	120	120	120
Viet Nam MD					
Winter/spring rice	1,237	990	371		
Spring/summer rice	1,500			240	480
Three rice crops/annum	300	79	79	79	79
Upland crops	10	6	6	6	6
Fruit trees	300	120	120	120	120
Freshwater fish	100	230	230	230	230
Shrimp production	345	104	104	104	104
Sub-total Viet Nam MD	3,792	1,528	910	779	1,019
(Viet Nam WRP est.)		1,236	928	644	633
Sub-total other areas	1,438	679	639	599	435
LMB large animals	24,000,000	14	14	14	14
TOTAL		1,915	1,567	1,243	1,068

Notes: CH = Central Highlands, MD = Mekong Delta

The crop areas in this table are those shown in Table 3.5. To complete the table it was presumed that all fully irrigated dry season rice used water at a rate of 0.8 l/sec/month and

that crops were not fully cultivated each month (Figure 3.9). Different water utilisation rates were assigned to other crops, animals and fishing activities (Table 3.13).

Table 3.13: Assumptions for calculating water use in Table 3.12

Activity	Water flow (l/sec/ha)	Water req. (m3/ha/month)	Crop irrigation life (months)	Critical period consumption (m3/ha)
Irrigated rice	0.8	2074	3.5	7258
Upland crops	0.6	1555	4	6221
Fruit trees	0.4	1037	4	4147
Coffee	0.4	1100	4	4400
Recession rice	0.4	1037	3	3110
Freshwater fish	2.3	6000	4	24000
Shrimp production	0.3	800	4	3200
Animal production	13.9l/sec	1.5m3/head/month	4	144x106 m3 total

Figures presented in Table 3.12 do not accurately reflect consumption as indicated by the figures provided by the Viet Nam Sub Institute of Water Resources Planning (WRP) for the Mekong Delta region of Viet Nam (Table 12). The same institute also estimated the rate of consumption in the first 10 days of February 1998 as around 782 m3/sec for agriculture, 2.25 m3/sec for animal production, 24.7 m3/sec for fisheries, 14.6m3/sec for forestry, 13.5 m3/sec from canals, 123.7 m3/sec from general evaporation and 5.2 m3/sec from waste land.

More detailed measurements need to be made for each activity to refine the calculations. However, the indicative consumption rates in Tables 3.2, 3.3, 3.4 and 3.12 plus the cropping patterns presented in Figures 3.2, 3.3 and 3.9 demonstrate there is considerable latitude for maximising the effectiveness of abstractions from the Mekong river for agricultural production. It is also interesting to note that, using the assumptions in Tables 3.12 and 3.13, agricultural activities in the Mekong Delta of Viet Nam consumed twice as much water over the four-month period compared with the other four watersheds together.

3.15.7 Strategies to reduce the consumption of irrigation water

Strategies for limiting the consumption of water used for agricultural purposes in the LMB include timing of cropping systems to avoid high water consumption during the critically low water flow months and by reducing the amount of water each crop uses.

The lowest abstraction rates from the Mekong River occur when crops are rain-fed and not irrigated. Most rain-fed upland crops are grown in well-drained areas that are susceptible to neither flooding nor waterlogging. Rain-fed rice may be cultivated in areas susceptible to waterlogging and some low level flooding. Harvesting these crops (see Figure 3.2) takes place before the critical months of February-May. Water consumption by rain-fed crops can be decreased by improving their water use efficiency (efficiency of the crop to use water in producing total dry matter), increasing the varietal harvest index (percentage of dry matter harvested as grain) and reducing in the amount of transpired water (by selecting improved varieties). Ensuring the crops are properly fertilised will assist this process.

Soils can also be improved for the longer term. For example, some farmers in NE Thailand can afford to place bentonite to improve fertiliser and water availability for sugar cane production (Floether, pers comm). Land leveling reduces water losses and increases yields for rain-fed rice (CIAP, 1999) and installing raised beds reduces waterlogging and inundation for upland crops (CIAP, 1997). Other practices that decrease overall water use include the reduction of maturation period of HYV rice varieties through direct seeding (CARDI, 2000), employment of minimum tillage methods (Floether, pers comm.) to retain soil moisture and synchronous planting to reduce pest damage to plants. With mechanisation farmers have more time to plan their activities.

Effective water conservation techniques that can be employed during the wet season to reduce water losses include the installation of efficient water distribution systems, soil compaction of canals and fields to reduce percolation, land leveling, direct seeding, soil fertility improvement and the use of shorter duration varieties.

Supplemental watering of rain-fed crops through partial irrigation usually results in abstractions during the high river flow period. Local 'mini droughts' of a month or so are generally not reflected in the Mekong river height. In some cases, fields in Cambodia, Lao PDR and Thailand may suffer flooding at one end of the field and be drought affected at the other. Redistributing this water will not affect the overall accessibility of river water at critical periods. Supplemental irrigation during the wet season is especially effective with potentially high yielding crops.

Recession rice is planted into flooded soil and may or may not receive supplemental irrigation. In Cambodia, sowing crops takes place as early as November and harvested in February. Harvesting crops sown later may extend into the 'critical period' and these definitely require irrigation for reasonable yields. The cultivation of shorter duration rices during this period may avoid the need to irrigate later than February. Techniques that allow crop planting in deep floodwater at the beginning of the season will also extend the irrigation free period. Upland crops requiring less water cannot replace recession rice unless the fields are drained beforehand. LMB soils, in general, do not have residual soil moisture properties suitable for growing non-irrigated crops if the crop cycle commences when the surface of the soil is dry.

The planting of the winter-spring rice crops on the Mekong Delta as early as possible also takes advantage of flooded soil conditions. Some farmers sow directly into 20-50 cm of floodwater when turbidity drops sufficiently for sunlight to penetrate to the seed. In October through to December, irrigation of these crops uses water taken from the Mekong while the level of the river is high; the crops, however, are still able to benefit from high energy levels in January-February, a period when they mature (see section 7 for details). At the end of the flood season, some paddy fields may need pumping to reduce water levels before they are in a suitable condition for planting rice. This pumping increases crop costs.

Early dry-season crops are the most likely to achieve yields close to their potential because they mature in periods when energy derived from sunlight is at its greatest. There should also be sufficient water and the crop can take advantage of new silt deposits from the wet season floods. Direct seeding early maturing crops in leveled, properly fertilised, fields should maximise the potential gained from each unit of water.

Delaying the cultivation of the second crop (summer-autumn) will reduce water consumption at the beginning of the season and utilise rainfall later in the year. However, delaying planting may result in flooding of some second crops in the late season. Replacing rice with uplands for later planting is problematic because of the threat of flooding at the end of the season (July to September) – see section 6.3 for details. Growing faster maturing,

improved, varieties may reduce crop duration and water use efficiency. Percolation losses can also be limited through the selection of impervious soils for cultivation and by compacting soils to reduce losses.

Short (105-115 days) and very short (95-104 day) duration rice varieties are cultivated in localities where it is possible to grow three crops of rice in one year (or five crops in two years). At these sites, periods of deep flood do not reduce the total growing season and the soils are sufficiently fertile to permit continuous cropping. In some locations, upland crops may replace one of the rice crops, thereby reducing water usage. Suitable sites need to be properly drained and some land forming may also be necessary to achieve good yields sites

High crop factors (1.15 for rice and 0.7 for many upland crops) will result in the consumption of a large volume of water when any crop is cultivated and irrigated between February and May. In the Mekong Delta, the promise of high yields due to the high energy levels radiating on the crops currently offsets the possibility of water shortages. In future though, large water savings will occur if areas currently growing three crops per annum reduce their cropping intensity.

As mentioned, upland crops do not like waterlogged soils or inundation. Their cultivation is therefore restricted to the dry season and/or to well-drained soils. Planting of any fully irrigated upland crop should therefore be avoided when water shortages are predicted. If grown at all, fast maturing crops should be planted early and harvested before February. Perennial crops also use a considerable amount of water year-round for survival and growth. As data presented in Table 12 shows, any further expansion in the area of fruit trees or coffee will place greater pressure on diminishing water levels during the dry season.

The rate of fresh water usage in fish and shrimp ponds is debatable and needs proper measurement. However, replenishing evaporation losses from shrimp ponds with seawater is impracticable if salt concentration is a problem. Fresh water additions to ponds should therefore at least equal the difference between pan evaporation rates of 75 cm and precipitation rates of 25 cm over the four-month 'critical period' (i.e. 50cm). In addition, freshwater ponds need filling and occasional flushing. Aquaculture consumes large volumes of water and the expanding areas of ponds in the LMB, especially on the Mekong Delta, will result in a high demand on Mekong River water. Water losses from the ponds can be minimised by ensuring percolation losses from the ponds are low and through the employment of evaporation loss reduction techniques.

3.16 Water quality in the LMB

Potential water quality problems for LMB farming activities include excessive salt, pesticides, nutrients from fertiliser and other pollutants, acid water and solids.

Saline water is a problem for farmers using surface water from salt affected soils in NE Thailand and for periods of the year when salt intrusions occur from the ocean up the river and canal systems in the Mekong Delta (MRC-JICA, 2003). The incidence of rising salt can be reduced by lowering the water table through reafforestation of small hills in the flat plains in the NE of Thailand. The Thai Government is promoting this activity in some areas. Saltwater intrusions in the Mekong Delta are a regular occurrence in the dry season and are expected to intrude further up the river as abstractions increase for irrigation, domestic and industrial purposes (Xuan and Matsui, 1998).

Many aquifers in NE Thailand and the Mekong Delta are saline and their water may need mixing with fresh water before it can be used for agricultural purposes. Much of the

groundwater in all LMB watersheds may also contain high levels of iron, calcium and sometimes arsenic, reducing its usefulness for domestic purposes.

Nutrient pollution from misuse of chemical fertiliser is not a big problem for the Mekong River and is unlikely to occur unless use of fertiliser expands significantly above the current low application rates. The low exchangeable cation percentages in LMB soils will facilitate the rapid transfer of nutrients to the river if excessive fertiliser is applied.

Pesticide application rates are very low in Cambodia, Lao PDR and NE Thailand and chemicals from these countries are not expected to significantly pollute Mekong River water. Spillages occasionally occur in the Mekong Delta canals but the effects remain local. Pollution of pesticides and other toxic waste from fishponds has wider implications in the coastal and Ca Mao regions of the Mekong Delta where diseases are thought to spread from farm to farm through the re-use of polluted irrigation canal water. Preventing the spread of infection and toxic effects in these areas may require installing drainage systems. Localised pollution from human occupation has also led to high biological oxygen demands in some areas (WUP-JICA, 2002).

Flushing of acid sulphate areas in the Plain of Reeds and Long Xuyen quadrangle region of the Mekong Delta has caused problems for farms further along the canals system through the presence of excessive acidity, aluminium and iron in the water. This problem is expected to continue for 20 or 30 more years (Nghiem Dinh Tanh, pers comm).

Since the introduction of agriculture along the Mekong River approximately 4,000 years ago (in NE Thailand) and more recently on the delta itself (over past 300 years ago) farmers have relied on the annual silt deposits to fertilise their soil for crop cultivation. Recent information (Halcrow, 2003) indicates that denudation of forests in Lao PDR, Thailand and Viet Nam has increased river sediment loads. These are partly offset by the construction of dams along the river and tributaries withholding some of the load. A reduction in the river silt load will increase the reliance of Mekong River agricultural irrigators on chemical fertilisers to maintain crop yields.

3.17 Government policies and potential for agricultural development in LMB watersheds

Governments of each of the four countries making up the LMB have different approaches to the development of their respective Mekong watersheds.

Cambodia

The Cambodian Government aims to transform agriculture into a driving force to achieve higher national economic growth and reduce the incidence of rural poverty (OPCV, 2002). Major objectives of a public investment plan are to:

i) maintain a liberal market-orientated trade environment

ii) deregulate the exportation of agricultural products by removing unnecessary internal regulatory constraints and introducing effective licensing and registration

iii) develop agricultural standards by encouraging investment in appropriate infrastructure and facilities for post harvest handling, storage and processing and,

iv) establish appropriate commercial laws and institutional arrangements for efficient and cost effective market transactions.

The government will continue to invest in research and extension services to enhance the development of technologies and their transfer to farmers. Strengthening of infrastructure plays a major role in government policy. In the current five-year plan, emphasis is on the construction of a road network into rural areas. These roads have opened up farming land in many parts of Cambodia and settlement of tracts of land in the east of the country will rapidly follow. Future national focus is on the installation of irrigation facilities to reduce the effects of drought and flood. In order to do this, suitable sites need to be located and approved.

Economically viable sites have been difficult to find in the past because of the flat nature of Cambodia and the poor soils. However, over 10 million ha of gentle sloping and flat land (Class 4 and 5) are unutilised for agriculture (Tables 2 and 3), almost eight million ha of which is classified as irrigable (Class 5). Most (59%) of the area is on poor acrisol soils diminishing the economic viability of developing this land for irrigated agriculture. The remaining soils may be located in areas suited to irrigation if water is available. A majority of undeveloped land is to the east of Cambodia which is poorly serviced by rivers, but now that the area is being opened up for development, further investigations as to their commercial viability may be warranted.

Lao PDR

Lao government's policy for national development is based on the 5th Five-Year Socio-economic Development Plan for 2001-2005. National agricultural development priorities include (Nippon Koei Co, 2001):

i) ensuring food security,

ii) stabilising/reducing the area of shifting cultivation

iii) commodity production support

iv) irrigation development

v) agriculture and forestry research and,

vi) human resources development

Development of the lowlands is primarily through improving and diversifying farming techniques while the uplands will follow community based management practices. Data presented in Tables 2 and 3 show Lao PDR has over 3.5 million ha of gently sloping (Class 4) and potentially flat (Class 5) land which has not been developed for agricultural purposes. More than one third of the flatter land (Table 9) is composed of reasonably fertile soils (cambisol and fluvisols), which would be more economical to irrigate than acrisols if water was available. As 35% of the Mekong water originates from Lao PDR, there is considerable potential for such projects being implemented along river tributaries. Abstractions would increase accordingly. The implications on water availability and seasonal flows after clearing the forest need further study.

Thailand

The Thai Government's policies delivered to the National Assembly on 26 February 2001 emphasised the support the government would give to farmers to reform their debt structures, promote the practice of mixed agriculture and optimise the use of idle land. In the

development of domestic markets, the Government has undertaken to promote a 'one village, one product' philosophy, support improved marketing systems, strengthen cooperatives and improve its contribution to agricultural research. It also envisages that competitiveness on the international markets will be improved by increasing investment in agro-processing and upgrading quality standards. Government departments continue to promote development in the NE of Thailand to ensure its population has opportunities for advancement. Infrastructure investment continues.

Most of the Class 4 and 5 areas in NE of Thailand are already developed for agriculture that is presently based on risk-averse, low-input, low-yield technology, having evolved in response to erratic rainfall and infertile soils. Agro-processing is mainly associated with post-harvest processing such as sugar mills, rice mills, cassava processing plants, vegetable oil extraction and a few canning plants. Although irrigation offers potential for intensive cropping, so far, few crops other than rice have been found with market prospects and returns to justify farmers' investment in irrigation. Rising production costs and static or falling farm prices expect to "squeeze" farmers further (Euroconsult, 1998). Most observers conclude that, for the foreseeable future, agriculture in the NE will consist of the following components:

- Wet season rain-fed and irrigated rice in the most productive lower paddy fields
- Dry season rice on better soils in some irrigation schemes that have sufficient water
- Sugarcane production in the higher rainfall areas and on the better soils and on some irrigation schemes within transport range of sugar mills
- Maize production in better soils on higher rainfall areas
- Intensive fruit and vegetable production under irrigation
- Extensive cattle production on areas formerly cropped with cassava and other rain-fed crops
- Intensive cattle, pig and poultry feeding enterprises
- Tree crops such as rubber cashew, mango, eucalypts bamboo, neem and teak in areas formerly cropped with cassava and other rain-fed crops
- Irrigation schemes to make more efficient use of water in the dry season with higher value crops

Viet Nam

Viet Nam's agricultural policy has strongly influenced the shape of agriculture in both the central highlands and on the Mekong Delta. In the central highlands, heavy investment in the uplands has witnessed a large degree of immigration to the central highland provinces resulting in a rapid expansion in the agricultural area. More recently perennial coffee and pepper have replaced annual crops (Giang et al. 2000).

Heavy government investment in the construction of canals and dykes in the Mekong Delta to control flooding and for irrigation has been curtailed. No new canals are being constructed, just improvements to existing structures. Farmers are being encouraged by Government policy to diversify their farming systems to stabilise farm income. The Mekong Delta has been divided into a number of zones based on production costs and financial returns to facilitate planning. Different systems are then promoted in each zone. For example, farmers are not encouraged to grow rice in the South West corner of the delta

where the benefit cost ratios for rice are low. They are encouraged to convert their farms into shrimp production.

The Government would like to see a reduction of 200,000 ha in the area used for rice and an increase in the cultivation of other crops. It assists improvements in the quality of crops by subsidising seed production programs for rice, vegetables and upland crops. The Government also provides a floor price for paddy to help the poorer farmers.

Rice production is being encouraged in the centre of the delta where there is fertile soil and yields can average 6 tonnes/ha in the dry season and 4 tonnes/ha in the wet season. Adjacent to this zone, new settlements have been established on landfill provided by the Government to allow residents to remain near their farms during the wet season when the area is normally abandoned because of annual floods. An Giang province invested US$22 million in 2003 for 83 new settlements to house 13,155 households. Government officials envisage farmers will now invest in cages to raise fish during the flood season rather than leave the province to find work elsewhere. Acid sulphate affected areas will continue to be used for melaleuca forests or growing green pineapples.

Other government policies that assist farmers include low taxes on agricultural produce, the provision of funding for agricultural research and extension, education for rural children and subsidies on infrastructure construction.

The Mekong Delta has considerable potential for increasing agricultural productivity with continued Government and private investment. It is envisaged that the delta will remain a rice-based agriculture system with an increased level of aquaculture and fruit tree production (Dr Do Van Xe, pers comm.). It is projected that animal production will increase as export-based pork and chicken enterprises expand in number. Grain from upland crops is needed to supply animal feed requirements.

3.18 Research on water used for agriculture in the LMB

Returns to investment in agricultural research in LMB countries are considerable (Cox and Chhay, 2000) and all governments provide sufficient resources for the establishment of research centres into agronomy, forestry, animal husbandry and veterinary science plus fisheries. Traditional lines of investigation based on commodity and discipline are generally followed although the level of activity in each is closely correlated with GDP per capita and population size of the country.

Overall farm productivity may also be investigated through farming systems research divisions, but generally, these divisions may fall under a particular commodity. For example, research at the Cambodian Agricultural Research and Development Institute (CARDI) contains programs on plant breeding, agronomy and farming systems, soil and water science, plant protection, agricultural engineering and socio-economics. At the Southern Fruit Research Institute (SOFRI) in Viet Nam research divisions include biotechnology, fruit breeding, plant protection, horticulture, post harvest technology, fruit marketing and a separate division for vegetable research. In the latter institute, fruit and vegetable production are often viewed as a minor portion of the overall farming system.

Research on water used for agriculture concentrates on salt water tolerance for various crops (fruit trees at SOFRI, rice at the Cuu Long Delta Rice Research Institute CLRRI and NE Thailand research centres) drought tolerance (rice at CARDI and Ubon Research Station in

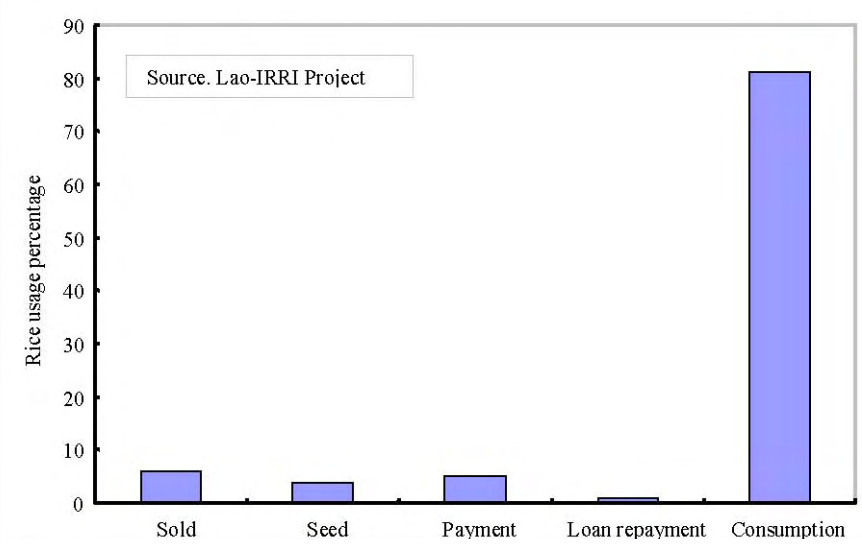
NE Thailand), acid water tolerance (CLRRI, SOFRI), flood tolerance (CLRRI, Ubon, CARDI), soil water retention (soil science divisions of most centres) and rice fish culture (CARDI and Thai institutes). General research on water use also includes studies on tidal irrigation, ground water resources, flood diversion, salinity prevention, maintenance of fresh water reserves plus other sectors.

Little or no research is conducted in reducing the amount of water used for crops by improving water use efficiencies, reducing percolation rates from fields and canals or improving soil water retention. In general, this type of research is restricted to shortening crop cycles through plant breeding and crop selection, farm mechanisation and cropping systems research. The small amount of work in NE Thailand to improve fertiliser retention by slotting bentonite below crop roots has successfully increased crop yields. Similar research to improve the utilisation of water will pay long-term dividends for farmers in all parts of the LMB.

3.19 Risk and adoption of new technologies

Risk aversion is of primary importance to most LMB farmers who either survive on a subsistence level or are very low-income earners. Rice farmers are generally the poorest farmers in the LMB. Trade in rice grain is minimal in Lao PDR and Cambodia where most farmers barely survive on their annual production (Figure 3.10). Although rice is the major export of the Mekong Delta in Viet Nam and from the NE of Thailand, farmer's income is quite small.

Figure 3.10: Rice uses in Lao PDR



Source: Lao-IRRI Project

When the farm-gate price was set at US$0.08 per kilogram for paddy, the total rice production in NE Thailand was valued at US$38 per person, the Mekong Delta of Viet Nam, US$80, Cambodia US$27 and Lao PDR US$34. Considering most of the population of the LMB countries are engaged in agriculture, total income from rice production is extremely small.

Crop returns from farms vary considerably across the region. Sareth, (2002) found that gross family income (Gross income minus cash and in-kind costs) equalled US$131 per ha in Takeo province for a single crop and US$119/ha/crop for double cropping. When farmer labour is charged to the budget, rice production was a loss making exercise with net incomes of minus US$103 and minus US$74 for single and double cropping respectively. Other crop budget summaries are presented in Tables 3.14 and 3.15 indicating the low level of rice farm income across the LMB. It is common for farmers to supplement their farm incomes by seeking labouring jobs nearby or in the cities.

Table 3.14: Crop budgets for NE Thailand, 1996/97

	Rice	Rice	Rice	Sweet corn	Canning tomatoes
Cultivation type	Rain-fed	Irrigated	Irrigated	Irrigated	Irrigated
Season	Wet	Wet	Dry	Dry	Dry
Variety	Local	HYV	HYV		
Operating costs US$/ha	98.4	118.0	110.0	128.1	260.9
Cash gross income US$/ha	96.9	119.7	130.1	279.2	713.1
Net crop income US$/ha	-44.0	-49.0	21.0	73.0	604.0

Notes: Source Euroconsult (1998). Net crop income assumes labour cost (hired or family) of US$2.5 per day

Table 3.15: Structure of average income of the farm households in 1992 in Cai Be, Tien Giang province and Thot Not, province, Viet Nam (% of total income)

Household livelihood	Rice	Aquaculture	Animal Husbandry	Orchards/ upland crops	Other income	Total income US$hh
Cai Be						
Mono rice	63	0	4	4	29	376
Rice fish	57	13	12	8	10	633
Thot Not						
Mono rice	54	0	0	0	46	1,170
Rice fish	43	36	5	6	10	1,234

Notes: Source Xuan and Mastui (1998)

Farmers wishing to change farming systems to improve their income need to take into consideration a number of factors. These include land and soil suitability for the new system, climate variations, location to markets, marketability of commodity, commodity price, storage, potential yields, pests and diseases, capital costs, labour availability, recurrent costs plus a range of other issues concerning knowledge, technical support and finance. Most importantly, the farmer must be able to make allowances for the risk of these parameters changing before, during or after implementing new systems.

Local research can do little to control prices on international markets for agricultural commodities. However, technologies can be developed to improve the quality of products available to the market place, agro-processing, storage lifetimes and the control of pests. New technologies may also help alleviate climate problems through better water control as well as increasing yields and reducing capital costs. It is also possible to reduce the need for labour through mechanisation, improving plant nutrition and reducing operational costs.

A few risks farmers face in the LMB that have direct or indirect impact on the water use from the Mekong River are presented in Table 16. Research into many of these issues is ongoing and significant advances have been made in resolving some problems. If demand for commodities changes and prices increase, a different set of risks may emerge and this will also influence research efforts. Until that happens, farming system diversification should continue within the boundaries discussed in section 17.

Table 3.16. Strategies for farmers to decrease risk

Risk	Strategy	Consequence	Research	Achievements
Drought/ lack of water	Supplementary irrigation, improve varieties, soil improvement, timing	Increased use of Mekong water in both seasons	Improve water use efficiency, plant breeding, soil improvement techniques, land reforming, other enterprises	Greater use of shorter duration varieties, improved variety selection, new farming systems
Waterlogging and inundation	Timing, flood control measures	Faster drainage to rivers. Increased irrigation	Timing trials, shorter duration varieties, mechanization, new species	Flood mitigation, greater mechanization, new varieties, changed cropping system
Plant nutritional problems	Improve plant nutrition	Soil, improvement, soil flooding, increased fertiliser	Plant nutrition, varietal selection, soil improvement, selective fertiliser recommendations	Plant nutrition, varietal selection, soil improvement, selective fertiliser recommendations
Soil and water acidity	Liming, water management, runoff control,	Higher productivity	Liming, plant selection, flushing, dykes	Expanded area of acid soil in use, acid water amelioration
Soil and water salinity	Reduction of salinity effects on crop growth	Reduction of area, adversely affected by salt	Salt tolerant crops, salt control in soil, tidal studies	Shift to saline (marine) production, higher yields in salt affected soils
Pests and diseases	Crop sequencing, pesticides, IPM	Possible decrease in pesticide use	IPM, targeted pesticides, extension, GMOs	Extension, targeted pesticides
Poor commodity storage	Upgrade market facilities	Decrease in price fluctuations and increase in adoption rates	Sealed storage bins. Refrigeration	Drop is storage bin prices. More long term facilities available
Lack of labour	Reduce need for labour at critical times	More mechanisation. Increased herbicide use	Development of appropriate machines and pesticides	Appropriate machinery sold. Contractors available. Direct seeding increasing. Herbicides frequently used
Uneconomic practices	Change practices, diversify, expand,	Increased investment, greater risk	Farming system research, improved marketing,	Adoption of new practices, diversification, land leasing, improved infrastructure

3.20 Conclusions

Rice cultivation dominates agriculture in the LMB for a number of physical, biological, social and economic reasons. The crop, however, does consume a large amount of water, and the area under cultivation may need to be reduced if irrigation water shortages become more serious. Average consumption across the LMB is close to 2.7 m3/kg of grain whereas soybeans use 56% of this amount. Constraints to overcome before suitable areas can be cultivated with non-rice crops include the low prices earned for other crops, poor storage facilities and quality control, poor marketing, pests, water quality and water stresses, a lack of labour and capital, poor plant nutrition and a lack of technical knowledge by farmers. Farmers are also reasonably risk averse when replacing their guaranteed family food source with a cash crop.

In the foreseeable future agriculture in NE Thailand is projected to consist mainly of low-input, low-risk, wet season, rain-fed and irrigated rice production in the lowlands. Sugar cane, maize and fruit production and tree crops will occupy higher, less flood-prone areas along with extensive cattle production. Water use is not projected to increase greatly until soil improvement techniques are extended or food commodity prices rise.

Lao agriculture is less developed than in Thailand and there is room for expansion in rain-fed and irrigated agriculture in the large areas of flat and gently sloping hills. Thirty five percent of the total Mekong river flow originates from Lao PDR and there are over 850,000 ha of potentially good soils on flatter land that may be irrigated. The remaining 1.37 million ha of less fertile acrisols may also be developed for less intensive agricultural activities.

Cambodia possesses 10 million ha of gently sloping and flat land that is currently unutilised for agriculture. Abstractions from the Mekong River will increase when this land is developed further, especially if the country continues to construct roads and provide other infrastructure to isolated areas. Although 59% of the Class 5 land in Cambodia is composed of infertile acrisols, there is still considerable potential for production increases on these and other soil types.

The aquifer system in the central highlands of Viet Nam appears to be overextended and new sources of water may be required to support an expanding coffee industry. The area of potentially irrigable flat land is quite small and composed of mainly infertile soil types. Room for expansion in the level of water abstractions from the Mekong River therefore appears to be quite small.

The Mekong Delta already faces water constraints during the dry season. Farming system proposals for different eco-regions of the delta will result in a reduction in the area of rice grown, but there is potential for increasing abstractions during the dry season if farmers significantly expand the area under upland crops, perennials and fish ponds.

Farmers in the LMB remain poor due to the low prices received for the major agricultural commodities. Rationalisation of the industry to achieve greater economies of scale is unlikely to occur in the foreseeable future because of the basic subsistence nature of a majority of farms. Already, farmers receive cash supplements from off farm activities to support their incomes. Farmers are therefore unlikely to pay for irrigation water. On-farm overuse or miss use of water may however, be reduced through the promotion of water saving techniques and the introduction of crops with higher water use efficiencies. This needs to be accompanied by a reduction in the risk farmers face in the adoption of new crops and practices.

River water pollution currently appears to be a minor problem in all watersheds excepting the Mekong Delta close to aquaculture enterprises. Management of all additives entering the river needs to be monitored, especially in the Mekong Delta.

3.21 Discussion and recommendations

Crop production in watersheds of the Mekong river is limited by flooding, poor soils, poor access to markets, high input costs, pests and diseases and insufficient labour. However, by far the greatest constraint to production overall is a lack of soil water. Drought is a serious problem for crops in Lao PDR, NE Thailand, Cambodia and parts of Viet Nam. If water were not a limiting factor in the rice paddies and upland areas of these countries, yields would initially increase by at least 50% without extra inputs and possibly double with applications of inorganic fertiliser. There is more than enough water in the Mekong River to provide the current watersheds' requirements year round. Excepting for the Mekong Delta in Viet Nam, water distribution systems are limited, but abstractions are increasing as riparian governments promote agricultural production by subsidising the installation of irrigation infrastructure. Planning for efficient utilisation of available water is therefore essential to equitably spread the benefits of this resource for the majority of the watersheds' inhabitants. Projecting the consumption of water by agricultural activities is a difficult task considering the poor database on which the calculations are to be based. Short, medium and long-term approaches are therefore needed to overcome these planning constraints.

Short-term activities

Short-term studies are required to improve the accuracy of calculating current water consumption rates. Recommended studies include carefully reviewing the government stated areas and yields of all crops cultivated in the LMB. The amount of water consumed by representative farming systems should then be physically measured.

1. Crop areas

Agricultural production is responsible for 80-90% of water abstractions, most of which is for crop production. Poor crop area measurements therefore restrict the degree of accuracy modellers with which can predict water consumption and the annual distribution of that consumption. More detail of when and where the crops are established will assist predictive measurements. For example, some crops are planted on non-irrigable land that cannot receive supplemental irrigation water, while other areas are planted within irrigation systems that can receive water if necessary. The question is what percentage of these areas receives irrigation water and what percentage of the irrigation area is cropped? This approach should be taken for rice, which has been shown to consume a large volume of water, and for upland annual crops and perennials, which are potentially large consumers during the critically low river level months of February-May.

2. Agricultural water consumption

Current crop water consumption estimates are made on predictive FAO models. These should be checked by physically measuring the water used by different crops, cropping systems and farming systems. It is possible to do this by installing simple measuring devices (V notches) at water inlet and outlet points on a field or farm level. Further measurements can be made by surveying typical farms to calculate the amount and frequency of water applied to coffee, pepper, fruit trees, freshwater fish ponds and shrimp ponds.

Medium term activities

Further expansion in the use of Mekong River water for agricultural purposes is constrained by a range of physical, economic and social factors. Sites must be identified and closely researched before installation of infrastructure. Economic viability from a farmer's perspective will rely on low cost access to water on fertile soils that have the potential for providing high crop yields. As illustrated in NE Thailand, farmers will not invest capital into cultivating crops when the rates of return are low. Inputs and markets must also be accessible and labour must be available.

3. Water availability and suitable soils

Successful irrigation projects possess both suitable reservoir sites and command fertile soils. Many of the irrigation schemes in NE Thailand are small and do not water good quality soils. Farmers are reluctant to cultivate large areas of these soils in the dry season because of low yields. In Cambodia, much of the land in highly populated areas is flat and dam structures often flood similar areas of land to what is irrigated. Now that land to the east of the country is being opened up with new roads, it may be possible to identify land that is both flat, fertile and has a nearby water source. When these areas are identified, future water consumption can be estimated.

Cambodia possesses over 11 million ha of Class 5 land that can be investigated for this purpose. Lao PDR has a higher degree of available water and 2.73 million ha of potentially suitable land, half of which is on reasonable fertile soils. The central highlands of Viet Nam are composed mainly of poor soils and the Mekong Delta is already fully cultivated. Therefore, identification of potential new sites from which abstractions from the Mekong River may increase should be concentrated on Cambodia and Lao PDR.

In addition to having high fertility, good irrigation soils should also possess low percolation rates. Little is known of percolation rates of many irrigation schemes in the LMB, making water consumption estimates difficult to calculate. These can be surveyed easily and included in soil suitability maps.

4. Farm economics

Problems of low yields may be, in part, offset by a high availability of labour and close proximity to markets for purchase of inputs and sale of product. This is the case in NE Thailand, where dry season farmers tend to grow high-value crops such as watermelons and chillies if nearby markets exist for the product. There is a need to conduct a closer examination of crop budgets in each of the watersheds. Based on the results of these studies, researchers will have a better understanding of the financial thresholds farmers need to cross before they take up the opportunities for expanding production of various crops in underused irrigation areas. The study results may also assist in the identification of new irrigation projects.

5. Labour availability and productivity at the farm level.

Crop budgets and the economics of various farming systems often depend on labour being available for farm activities. A study on seasonal labour constraints will help identify preferences of different farming systems.

6. Risk

Most farmers in the LMB are poor and suffer considerably when farming ventures fail, particularly when their family food source is put at risk. Risks faced by irrigated crop farmers include water supply breakdowns, floods, water salinity etc. Risk-coping strategies need to be taken into consideration in studies on farm economics and labour availability mentioned above.

7. Marketing

Access to markets is an essential component of successful farming enterprises. A short study of the markets for agricultural products in each riparian country will assist the identification of potentially new crop cultivation areas.

Long-term activities

Water use efficiency (WUE) is the efficiency of the crop to use water in producing dry matter. WUEs are different for a range of crops and for varieties within species. It may be possible to decrease the use of irrigation water by growing particular crops and selecting the correct varieties possessing high WUEs. Research to select crop and variety type with high WUEs is long term but worthwhile in locations where water shortages are severe.

Irrigation efficiency is the ratio between estimated water requirements and actual water withdrawal. Johl (1997) estimated water losses from the scheme he worked on were as follows:

Main canals 15-20%

Major and minor distributaries 6-8%

Field canals 20-22%

Irrigation distribution, deep percolation 25-27%

Utilisation by crops 28-29%

FAO suggests that the irrigation efficiency in Lao PDR, Thailand and Cambodia is similar at 30% and slightly higher for Viet Nam (from Table 11). Large water savings are therefore possible if these losses can be reduced. Indicative irrigation efficiencies need to be determined for major irrigation areas in the LMB and strategies suggested to increase efficiencies. These are long-term studies.

8. Potential crop yields

Little is known of the yield potential of the wide range of crops grown in the LMB. For this reason, it is difficult for agronomists to correctly predict responses for nutrient applications. The LMB spans across 12.5 degrees of latitude and yield potentials may need to be calculated for various environments.

9. Waterway pollution

Fertiliser and pesticide application rates on agricultural land in much of the LMB appear very low and losses from the field are predicted to be small. However, most of soils in the region possess low CECs and therefore may not retain nutrients and other applied chemical products. Levels of these pollutants entering canals should be monitored. Legislating

acceptable wastewater discharge contents from fish and shrimp ponds may also be required to protect the environment.

10. Groundwater availability for agriculture

The existence of groundwater in LMB countries has been studied to various degrees. The extent to which this water is available to agriculture is poorly understood. A report summarising the results of previous studies and speculating on the area of irrigation aquifers can support is required. This will assist planning for aquifer utilisation for both upland crops and irrigation of the lowlands.

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4 Future trends in agricultural production

by Harry Nesbitt, February 2005

4.1 Introduction

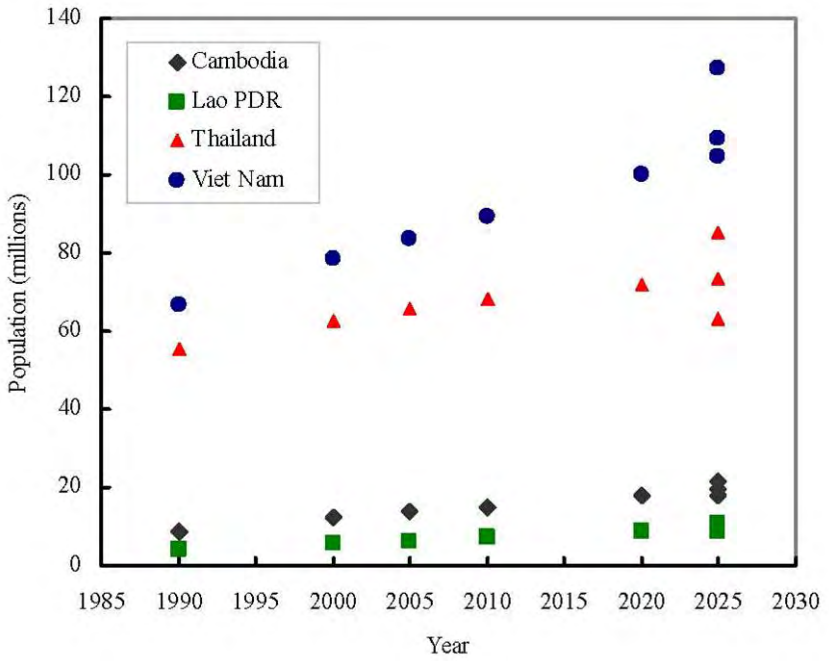
This paper considers the potential for expanding various agricultural activities and the effect this may have on the current agricultural system of the Lower Mekong Basin (LMB). It includes scenarios for expanding agricultural production to keep pace with population growth, an expansion in the area under production, productivity increases and the maintenance of an economic farm operation.

4.2 Population growth and agricultural production

4.2.1 Population growth

On a national basis, population growth rates for Cambodia, Lao PDR, Thailand and Viet Nam during the decade between 1990 and 2000 were 4.1% (an increase of 41% over the 10-year period), 3.1%, 1.2% and 1.8% per annum respectively (Figure 4.1, Table 4.1)[1]. The high growth rate of 4.1% in Cambodia includes the repatriation of over 300,000 post-war displaced persons who returned home during the early 1990s.

Figure 4.1: Actual and projected populations in LMB countries



[1] http://www.os-connect.com/pop/p2.asp?sort=2000 http://www.census.gov/ipc/www/idbpyr.html, http://www.world-gazetteer.com/home.htm, http://www.cnie.org/pop/conserving/appendix2hi.htm) (Johnston pers comm.)

Population growth rates in the LMB are predicted to decline in the future as family planning programs take effect. Between 2000 and 2020 it is expected that the rates will slow to 2.3%, 2.6%, 1.0% and 1.4% per annum for Cambodia, Lao PDR, Thailand and Viet Nam respectively (MRC, 2003). If these rates are used in the LMB, agricultural production will need to increase at the same pace to maintain a status quo food supply. There is some evidence that the population in the Mekong Delta and NE Thailand is increasing at a slower rate than the national average. The Viet Nam Statistical Yearbook (VSY, 2002) figures indicate that the population in the Mekong River Delta increased from 15,531,900 in 1995 to 16,344,700 in 2000, an increase of only 1% per annum. Between 1994 and 1999, the population in NE Thailand increased from 20,542,381 to 21,379,482, an increase of only 0.8% (TIF, 2002).

A major proportion of the rice growing areas in Cambodia and Lao PDR are in the Mekong catchment areas and it is reasonable to presume that the national population trends are representative for these areas. These figures suggest that for the next 20-30 years food production must increase at a rate of 1.25% per annum to keep pace with the current population growth in the LMB. The upper estimates of the required growth in food production are around 2% per annum.

4.2.2 Agricultural production

Rice is the staple food of the populations of all LMB countries and provides the bulk of their people's intake of calories. On-farm rice production is particularly important to livelihoods of the millions of subsistence farmers living in these countries. Before exporting any surplus rice production, these farmers must first guarantee their own food security. Off-farm sales may be consumed in other parts of the country or exported abroad.

In 1990, Lao PDR, Thailand and Viet Nam were net exporters of rice. Cambodia was a net importer. For Lao PDR, Thailand and Viet Nam, rice production needed to increase at the same rate as the population to maintain the status quo. A slightly faster rate of production increase was necessary for Cambodia to catch up to and keep pace with the growth of its population. Over the period 1990-2000 rice production outstripped population growth considerably, especially in Thailand and Viet Nam where rice production increased four times faster than the population. (http://apps1.fao.org/ , Table 4.1).

In 1995, Cambodia produced a surplus of rice and continued to remain in surplus from 1995 though to 2000; the country has potential to produce a 150,000-200,000 tonne surplus of milled rice in a good year using current farming practices. Lao PDR was also in surplus in 2000 and had the potential to export 200,000-300,000 tonnes of rice (Table 4.2). NE Thailand and the Mekong Delta in Viet Nam are major exporters of rice. One third of Thailand's exports originate from NE Thailand while all of Viet Nam's exports originate from the Mekong Delta after supplementing shortfalls in other parts of the country.

At the current rate of population growth, Cambodia will need to increase paddy rice production by 1.57 million tonnes if it is to feed its population in 2020. Lao PDR needs to produce an extra 620,000 tonnes. NE Thailand and the Mekong Delta in Viet Nam currently produce sufficient rice to feed annual population increases for another 45 years and 100 years respectively.

Table 4.1: Rice production and population growth

Country	Year	Paddy production (t)	Annual rice production increase 1990-2000 (%)	Annual population increase 1990-2000 (%)
Cambodia	1990	2,500,000	6.1	4.1
	1995	3,447,800		
	2000	4,026,092		
Thailand	1990	17,193,216	4.9	1.2
	1995	22,015,500		
	2000	25,608,000		
Viet Nam	1990	19,225,104	6.9	1.8
	1995	24,963,700		
	2000	32,529,500		
Lao PDR	1990	1,507,500	4.6	3.1
	1995	1,417,829		
	2000	2,201,700		
NE Thailand	1993	8,227,375	1.4	1.1
	1998	8,843,263	(1993-1998)	(1993-1998)
Mekong Delta	1995	12,831,000	2.4	1
	2000	15,970,000	(1995-2000)	(1995-2000)

Table 4.2: Rice consumption in the LMB

Country	Production (t)	Milled rice equiv (t)	Consumption (kg/pers.)	2000 Population	2000 consumption (t)	Surplus (t of milled rice)
Cambodia	3,623,483	2,174,090	162	12,212,000	1,978,344	195,746
Lao PDR	1,981,530	1,188,918	170	5,497,000	934,490	254,428
NE Thailand	7,958,937	4,775,362	120	21,379,482	2,565,538	2,209,824
Viet Nam M D	14,373,000	8,623,800	165	16,344,700	2,696,876	5,926,925

Note: (1) Assumption made that all production in Cambodia and Lao PDR included. (2) N Thailand and Viet Nam central highlands excluded from calculations (3) Production has 10% deducted for seed. (4) Conversion rate of 06 (or a 60% return of polished grain) is low for Thailand (5) NE Thailand production 1998 figures (6) Consumption national figures except for NE Thailand which carries a 20% weighting (7) Population in NE Thailand 1999 figures

Upland crop areas in the LMB increased over the period from 1990-2000. However, the upland crop area in the LMB under irrigation remained fairly static. This is a reflection of the low returns from upland crops on land suited to paddy rice production. Non-irrigated upland areas in NE Thailand, which formerly produced large tonnages of cassava for export to Europe as tapioca animal feed, are being converted to grazing land as subsidies and prices drop. Conversely, non-irrigated sugar areas are increasing as bentonite is injected into the soil to improve nutrient and water exchange. In addition, where markets permit (especially in the Mekong Delta in Viet Nam) the area under fruit is being expanded. Fishpond areas are also on the rise in the Viet Nam delta. However, rice remains the largest agricultural water consumer in both the wet and dry seasons by a considerable margin.

4.3 Trends in agricultural production and consumption in the LMB

4.3.1 Cambodia and Lao PDR

Agriculture in both Lao PDR and Cambodia remains in a reasonably undeveloped state at the beginning of the 21st century. There is considerable scope for increasing both the area being farmed and the farming intensity in those provinces of these two countries within the LMB. Both countries' current five-year plans include rural poverty reduction through ensuring food security. This is being achieved in Lao PDR by stabilising/reducing the area of shifting cultivation and through commodity production support (Nippon Koei Co, 2001).

In Cambodia, support for agricultural reform is more in the areas of liberating markets and deregulation of export and import controls. Cambodia also has a policy of expanding the rural road network to open up the east of the country. Under the country's new five-year plan, emphasis will shift from road construction to focus on expanding the area under irrigation (Overseas Project Corporation of Victoria, 2002).

The Lao Government would also like to expand the area under irrigation to increase crop production. The success of both countries in increasing the area under productive irrigation depends on the selection and development of fertile land near water resources and transport. These issues are discussed later in this paper.

Although both Cambodia and Lao PDR are currently in an annual rice production surplus, a majority of the farm households exist on a subsistence level. Rice consumption is expected to remain high for the foreseeable future until GDP/capita increases considerably. Little well paid alternative work is available in either country to provide additional financial support for the farm.

4.3.2 NE Thailand and Mekong Delta of Viet Nam

Both NE Thailand and the Mekong Delta of Viet Nam are major producers and exporters of rice.

Farms in NE Thailand produce all the country's high quality jasmine rice and its cultivation earns farmers, in this area, a small premium. The Thai Government supports production in the region, but also realises that the farmers remain poor. For this reason, the government injects considerable funds is into the NE to support irrigation projects, promote increasing the value of agricultural products through processing and to encourage decentralisation of manufacturing from Bangkok to the rural areas. Although NE Thailand is a major rice exporter, the income it generates is relatively small compared with what farmers can earn in the increasingly prevalent local industry. Labour is expensive and many farmers seek off-farm jobs to support their families.

Total harvested rice areas in NE Thailand increased by approximately 4% over the seven-year period between 1990/91 (4,795,870 ha) and 1997/98 (4,971,432 ha) (TIF, 2002) and little land remains to be cleared for agriculture. Overall, the total area used for irrigated dry season agriculture remained fairly static (Table 4.3). Although grain yields have increased at a rate of 3% nationally (Table 4.4), yields in the northeast of the country have grown at a slower pace, if at all, in both the irrigated and rain-fed areas (Table 4.5).

Increased rice production in the NE of Thailand (Table 1) originated from both a slightly expanded area under cultivation (4% over the seven-year period from 1990-1997) and small increases in yield (Table 5). WUP-MRC data (Table 3) indicate that the area of crop receiving supplemental irrigation in the wet season increased steadily at a rate of 4.5% annually between 1990 and 2000. Such supplemental irrigation should take the risk out of crop production and yields should have increased accordingly. That, over this period, this did not happen in NE Thailand may be an indication of poor soils and the lack of attention farmers paid to their crops in recent years as they sought an increased cash income from industrialised centres. Irrigated dry season rice areas did not increase during the decade from 1990 – 2000 (Table 4.3) and little increase is projected for the future unless it is possible to improve returns from irrigation. However, as the GDP per capita in Thailand increases the consumption of rice is expected to decrease as dietary preferences change.

Table 4.3: Growth rates of rice areas in LMB

		Area irrigated with rice ('000 ha)											Annual increase
		1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*(1990-00)*
Cambodia	Dry season irrigated	148	148	142	154	169	213	227	239	216	231	251	6.9 %
Lao PDR	Dry season irrigated	11	12	12	12	13	13	18	27	53	87	92	71.2 %
Thailand (NE plus N)	Dry season irrigated	80	88	106	87	19	31	59	68	89	80	107	3.4 %
Thailand (NE plus N)	Irrig wet season rice	1,036	1,089	1,129	1,209	1,222	1273	1319	1350	1369	1352	1500	4.5 %
Vietnam MD (SP/W)	Dry season rice planted November harvested in March. Needs full irrigation	752	820	927	967	1,010	1,036	1,152	1,254	1,349	1,450	1,521	10.2 %
Vietnam MD (AUT)	Dry season rice planted April harvested in July. Needs full irrigation	908	1,058	1,120	1,218	1,251	1,398	1,620	1,510	1,776	1,934	1,882	10.7 %
Vietnam MD (WIN)	Wet season rice planted July harvested in November.	920	928	878	808	777	757	671	716	636	603	544	-4.1 %
Vietnam MD (AUT2)	Wet season rice used in triple cropping planted August harvested in November.	2	43	34	98	104	194	278	165	312	362	215	885.0 %
Total Vietnam		2,580	2,807	2,925	2,993	3,038	3,191	3,443	3,481	3,761	3,987	3,946	5.3 %
Vietnam CH		21	22	22	24	25	25	26	29	30	33	37	7.6 %
Total irrigated in LMB		3,876	4,166	4,336	4,480	4,486	4,745	5,092	5,195	5,518	5,769	5,932	5.3 %

Note: Source, WUP-MRC data, MD = Mekong Delta, CH = Central Highlands

Over the past 10 years, Vietnamese farmers in the Mekong Delta have slowly converted their land from growing rice during the wet season to dry season production (Table 4.3). This has led to a concurrent increase in cropping intensity during a period when potential yields and subsequent gross margins are higher. The area set aside for cultivating wet season rice decreased at a rate of 4% per annum between 1990 and 2000 (Table 4.3). Over the same period, areas of autumn and spring crop increased by 10% per annum. This is a significant change in the farming systems adopted in the Mekong Delta and demonstrates the pursuit of greater production and profitability. Similarly, the total area under rice cultivation in the LMB increased from 2.59 million ha to 3.95 million ha – a rate of 5.3% per annum and the rate does not appear to have leveled off. Yields appear to have peaked over the past 10 years at around 5.3 t/ha for the dry season crops and 3.0 t/ha for crops grown in the wet season (Table 4.5) despite overall productivity increases nationally (Table 4.4).

Table 4.4: National rice yields 1990-2000

Paddy yield (t/ha)	Year											Per annum
	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Increase*
Cambodia	1.6	1.6	1.6	1.5	1.6	1.8	1.8	1.8	1.8	1.9	2.1	3.1 %
Lao PDR	2.3	2.2	2.3	2.3	2.6	2.5	2.5	2.8	2.7	2.9	3.0	3.2 %
Thailand	2.0	2.2	2.2	2.2	2.4	2.4	2.4	2.4	2.5	2.5	2.6	3.0 %
Viet Nam	3.2	3.1	3.3	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	3.1 %

Table 4.5: Yield increases in LMB for rain-fed and irrigated rice

Yield increase			
Rain-fed	1990	2000	% increase pa
Cambodia	1.5	1.9	2.7
Lao PDR	1.7	1.9	1.2
NE Thailand	1.6	1.7	0.6
Viet Nam MD	2.9	3.1	0.7
Irrigated	1990	2000	% increase pa
Cambodia	2.5	3.1	2.4
Lao PDR	2.7	3.2	1.9
Thailand	2.8	2.6	-0.7
Viet Nam	5.2	5.3	0.2

Even though there is a very large surplus of rice production in the Mekong Delta, farmers remain poor compared with many of those in metropolitan areas, as the returns from rice production are very low. While rice consumption will not diminish for some time, farmers, when possible, will convert to growing crops with greater cash returns. For this reason, the area under fruit trees and fish farms is increasing rapidly (Nesbitt, Johnston and Solieng,

2003). The areas under these systems were reasonably small in 2000, but have the potential to increase further if the gross margins remain high.

If farmers are to improve their incomes their options include increasing the area cropped, lifting yields, reducing costs or increasing the product value.

The total area under rice production increased significantly in the decade between 1990 and 2000 even though the cultivated land surface area and yields remained reasonably static; therefore, most of the productivity gains were due to an increase in cropping intensity. Rice in the Mekong Delta has a potential yield of 8-9 t/ha per hectare with current plant types and many farmers are reaching this target (if their farms are producing an overall yield of 5.3 t/ha). However, unless there is a scientific breakthrough producing a more prolific rice variety, farmers will achieve only slightly higher overall rice yields.

Costs continue to rise, especially for fuel, fertiliser and other agricultural inputs. If farmers are to boost their incomes, they must increase the value of their grain, grow alternative crops or convert their rice farms into fishponds or other more profitable farming practices. An increasing number of farmers are growing fruit trees, but, in the Mekong Delta, only a limited area will support such cultivation and market forces remain weak for perishable goods.

In conclusion, farming in the Mekong Delta is in a transitional period during which farm profitability cannot be increased simply by expanding farm area and there is little potential to raise yields significantly. Conversion of farming land to growing potentially more profitable upland crops including fruit trees or installing fishponds will consume extra water during the dry season as will increased cropping intensity. During this period, water shortages become critical as seawater incursions up the rivers and irrigation canals become more frequent. Increasing abstractions upriver during the dry season will exacerbate water shortages in the Mekong Delta.

4.4 Potential for increasing farming and irrigation areas

As mentioned previously, there is little, if any extra land available for clearance for agricultural purposes either in NE of Thailand or in the Mekong Delta. It is possible that very small areas of land could be brought into production in the catchment areas in north Thailand and the Central Highlands, but this would be insignificant compared with the area available in Lao PDR and Cambodia.

Cambodia possesses 11,200,000 ha of flat and rolling land (MRC Class 5 classification) of which 6.6 million ha (59%) is covered in acrisol soils. Cambisols cover about 150,000 ha of the Mekong floodplain in eastern Cambodia. There are also approximately 75,000 ha of vertisols and farralsols around Snuol in the southeast and around Ban Luong. In southern Cambodia, most of the region's 290,000 ha of cambisols and 25,000 ha of fluvisols are located on the Mekong floodplain, much of which is flood prone. In the Tonle Sap region over 350,000 ha of luvisols are located around Battambang and more than 750,000 ha of cambisols west of Battambang, north of Samroang and north of Siem Reap.

Most cambisol and fluvisol soils are located in flat areas possessing limited scope for irrigation. They are either isolated (north of Samroang and north of Siem Reap) or on flat regions which are prone to floods. However, there is a need to fully describe and document

sites possessing soils that are suitable and have the potential for irrigation for planning purposes.

Lao PDR has approximately 2,700,000 ha of Class 5 land that could be utilised for agricultural purposes. In the 2000 wet season, the total area under production from this Class 5 and steeper land was estimated to be approximately 900,000 ha (see Table 3a in Nesbitt, Johnston and Solieng, 2003), of which 720,000 was rice. An estimated 50% of the soils in this land-use type are reasonably infertile acrisols, but there are nearly one million ha of more fertile cambisols and luvisols (Robyn Johnston, pers comm.).

The central plain contains in excess of 400,000 ha of cambisols and more than 120,000 ha of luvisols; these are mainly on floodplains of the Mekong tributaries. Fifty thousand hectares are on the Savannakhet plain and more than 30,000 ha on the Mekong floodplain between Thakek and Savannakhet and on the Vientiane floodplain. The southern regions of Lao PDR hold about 400,000 ha of cambisols and 70,000 ha of luvisols; these are mainly around Saravan and Khongsedone (bordering Thailand and Cambodia) and on the Sekong floodplain downstream from Attapeu.

Irrigation systems installed on fertile cambisol and luvisol soil types have greater potential to achieve a reasonable economic return than do those on acrisols, so sites containing these soils should be targeted first, but their accessibility to sources of irrigation water must be examined closely.

NE Thailand contains over 750,000 ha of luvisols, mainly on the Mun River valley and east of Khan Kane, plus 250,000 ha of fluvisols along the Mun-Chi system and the Songkram system. The Royal Irrigation Department targets many of these sites for improvement. Some of the more than 100,000 ha of luvisols and 20,000 ha of cambisols in N Thailand are currently developed for irrigation.

4.5 Can the Mekong River irrigate all the flat land in the LMB?

The MRC–WUP estimate the total area of the LMB under irrigation increased from 5,178,000 ha in 1990 to 8,256,000 ha in 2000. This estimate includes partially and fully irrigated rice and upland crops grown throughout the year. The increase of 59% over the 10-year period is equal to 5.9% per year. This is a similar increase as the area under irrigated rice cultivation (Table 4.3).

Assuming that the current crop area consumes 4% of the total volume of water in the Mekong River there is sufficient water to irrigate all MRC Class 5 land, totalling 29.8 million ha, (Table 1 in Nesbitt, Johnston and Solieng, 2003) if the water is stored and re-distributed. Extending this assumption, there should be sufficient water in the Mekong River to irrigate all of the MRC Class 5 land in the LMB three times per year. This is unlikely to happen. However, there is increasing pressure on available water resources, especially during the dry season, and a number of developmental scenarios based on current trends follows.

4.6 Scenarios for water consumption in the LMB 2000-2020

Scenario 1: Irrigated area in LMB continues to expand at an average of 59% every 10 years.

This will result in a 120% increase in the irrigated area from 8,256,000 ha to 18,163,200 ha by 2020.

Probability: This scenario is very improbable considering that between 1990-2000 Viet Nam's Mekong Delta was the largest contributor to the gains in area. Water consumption during the critical months of February to May is now nearing the capacity of the system. and a significant expansion in the area used for spring and autumn rice crops will be difficult to achieve. Government officials are also encouraging farmers away from double and triple cropping of rice in the delta.

Scenario 2: Supplementary irrigation during the wet season continues to increase by 24% in 10 years

This will lead to an increase in area from 3,948,000 ha in 2000 to 5,843,000 ha in 2020.

Probability: An increase in the rice area receiving supplemental irrigation during the wet season makes a great deal of economic sense. It reduces the risk of farmers losing their crop and raises the potential seasonal yield. The total harvest area and resulting production will increase, assisting not only the farmers, but also the national economy. This scenario will not impact on the river level during the critical period.

Scenario 3: Dry season irrigated crop production increases significantly in Lao PDR and Cambodia and to a lesser degree in Thailand and Viet Nam.

Probability: This scenario is highly likely considering both the Lao and Cambodian Governments have made a conscious decision to increase the irrigation areas in their countries. The very high increases in area expansion are unlikely to continue because, all countries are now starting from a higher base and infrastructure in non-delta areas will be expensive to install. If both Cambodia and Lao PDR were able to double their dry season areas (from 250,000 to 500,000 ha and 132,000 ha to 262,000 ha respectively) during the next 20 years an extra 382,000 ha of dry season production would have a very little effect on the flow of the Mekong River during the critical months of February to May. Most of the water required to irrigate this increased area would need to be stored from the wet season.

Dry season cultivation in NE Thailand appeared fairly static during the 10 years from 1990 to 2000 and the economics of production need to improve considerably before the irrigation areas are used to their fullest potential or expanded. Both Cambodia and Lao PDR have large areas of reasonably fertile soils on which irrigation schemes can be established if water is not a constraint (see Section 4.0).

Scenario 4: Cultivation of annual upland crops in the dry season expands at the expense of rice.

Probability: This is an unlikely scenario considering the poor history of irrigated upland crop production in the LMB (Appendices 1 and 2). The annual growth rate in cereal demand in SE Asia is also expected to halve during the 1993-2020 period compared with the 1990-1997 period and world food prices are expected to fall further over the next 25 years (P. Pinstrup-

Anderson, 2003). However, the expansion in the area under cultivation of vegetables should keep pace with population growth (1-2% per annum).

Scenario 5: The LMB will experience an increase in the area planted to fruit trees, sugar cane and other higher value crops.

Probability: More frequent planting of higher value perennials and semi-perennials in the LMB is very probable. Although these crops are not irrigated they still consume water all year round. Planting fruit trees on the more fertile, levee banks in the Mekong Delta that are less susceptible will result in deep root abstractions from the water table, thereby lowering of the river levels.

Scenario 6: Large animal livestock numbers will continue to increase in LMB.

Probability: Annual growth rates of the number of cattle between 1990 and 2000 were 3.1%, 1.7%, 0.3% and 3.3% for Cambodia, Lao PDR, Thailand and Viet Nam respectively (FAO from MRC, 2003). Numbers of Buffalo decreased but there was a significant increase in the number of pigs in each country, except Lao PDR, over the same period. It is very likely that large animal numbers will continue to increase significantly over the next 20 years as crop production increases and meat prices improve. Animal production is not a large consumer of water compared with crops and increasing numbers will not strongly influence river flows. Animal husbandry is, however, a very important component of LMB farming practices that provide a source of cash wealth for most farmers in the region.

Scenario 7: The area devoted to open pond fish production will increase substantially.

Probability: The area devoted to aquaculture in the Mekong Delta more than doubled between 1994 and 2001 from 231,000 ha to 511,760 ha and is expected to expand further, especially saline shrimp culture (MRC-JICA, 2003). High prices of fish products may stimulate a large expansion of aquaculture practice in Asia (P. Pinstrup Anderson, 2003). Therefore, it is highly likely that the area devoted to fish culture will expand in the Mekong Delta and other parts of the LMB. Fishponds consume large volumes of fresh water to keep pace with evaporation and for flushing.

Scenario 8: Agricultural production will exceed population growth.

Probability: Increasing rice production greatly exceeded population growth rates between 1990 and 2000 and should continue to do so for at least the next 20 years. A similar scenario should also be evident for upland crops. Production increases will come from:

a) Expansion in the area, particularly for rain-fed upland crops in Cambodia and Lao PDR.

b) Improvement in grain yields (in the range of 1-2% per annum for the next 20 years).

c) Expansion in the irrigation area, especially in Cambodia and Lao PDR (see Scenario 3)

d) An increase in cropping intensity through both irrigation and utilisation of shorter duration crops in rain-fed and irrigated systems.

Scenario 9: Irrigation water quality will deteriorate significantly over next 20 years.

Probability: This scenario is unlikely except in isolated cases in the Mekong Delta. Current causes of water pollution in the Mekong River include silting, salt, fertilisers, pesticides, acid water, contamination from industrialised sites and toxic discharge from fishponds. Between

1985 and 1992, the level of Total Soluble Solids decreased in 23 monitoring sites along the Mekong River and increased in six sites (MRC, 2003). A similar trend is predicted for the future unless there is widespread land clearing in the interim.

Concerns about pollution caused by saline runoff from salt-affected soils in NE Thailand have not realised to date; few monitoring sites show any increase in salt levels. This possible source of contamination will require monitoring in the future. If the problem does escalate as some speculate, it may be necessary to take some land out of production.

Nitrogen levels in river water on the Mekong Delta have steadily increased over the past 20 years and are now a cause for concern (MRC, 2003). With present water nutrient levels, algal blooms could develop in the Mekong Delta if river flows are restricted. These nitrogen concentrations in irrigation water will benefit crop production unless toxins develop during algal blooms. Phosphorous levels are also increasing in the Mekong Delta. Nitrogen and phosphorous levels appear to be declining or have not changed in Lao PDR, NE Thailand and Cambodia and potentially (assuming judicious management of the use of fertiliser) under control in Viet Nam.

The MRC does not monitor the concentration of pesticides the river water. However, their use is on the rise in all the riparian countries (MRC, 2002). Pesticide applications are low in Cambodia, Lao PDR and NE Thailand as there is less intensive agriculture in these regions. Use is so low in Lao PDR, the Ministry of Agriculture, Forestry and Fisheries is touting the export of large quantities of 'organic rice' at premium prices (Bountiep Chounthavong, pers comm.). Pesticide use in the Mekong Delta has matched if not exceeded the national increase of 300% between 1989 and 1999 (FAO, 2001) and is of concern for the welfare of farmers in this region.

Acid water and aluminium contamination are both problems in the Mekong Delta and will continue to be so, at least on a localised basis, for many years to come as acid sulphate soil areas are drained. If the existing river flow prevails, these problems will remain localised. Toxic discharges from fishponds will also continue to be a local problem, but this could change if strong river flows dilute the problem on a wider scale.

Industry and urban development account for approximately 5-6% of total water usage in the LMB (MRC, 2003). There is considerable concern among MRC members about the increasing level of contamination through the discharge of untreated or partially treated sewage, garbage and industrial waste directly into the river and the pollution of underground water reserves. Contamination originating from the larger cities such as Phnom Penh, Vientiane and the increasingly industrialised northeast of Thailand needs to be contained.

Scenario 10: Most likely scenario.

Probability: The most probable scenario for agricultural development in the LMB over the next 5-20 years will include a combination of the following:

a) Expansion of agricultural land area. Expansion the area of land under agriculture is not possible in the Mekong Delta or NE Thailand. Forest clearance in Cambodia and Lao PDR may increase the cropped area. Cultivation of rice, the most common crop, in Cambodia increased in area from 1,855,000 ha in 1990 to 1,903,159 ha in 2000 a rise of 3% over the period (http://apps1.fao.org/). In Lao PDR, the increase in acreage used for rice cultivation over the same period was higher at 8%, rising from 663,000 ha to 719,000 ha. In both countries, the transport infrastructure to these isolated sites is improving, particularly to those areas where large tracts of potentially arable land are available (see section 4). The area under agriculture could

increase by 20% over the next 20 years – an addition of over 500,000 ha. However, only a little of this land will be irrigated, as preference will be given to installing irrigation schemes on currently cultivated areas.

b) Expansion of irrigated areas. A number of irrigation schemes are proposed for Cambodia, Lao PDR, N and NE Thailand (possibly also the central highlands of Viet Nam). In these regions, dry season irrigated areas increased from 322,000 ha to 575,000 ha between 1990 and 2000 – an annual increase of 8%. An increase of 5% per annum (non-cumulative) from 2000 to 2020 would result in an irrigated area increase of 575,000 ha. Water to service the schemes would need to be stored from the wet season for use during the dry.

c) Intensification of dry season cropping. In addition to an increase in the area mentioned in b, cropping factors in the Mekong Delta are escalating because farmers are growing an increasing number of crops in one year. This is difficult to segregate from the expansion of the area under irrigation during the 1990s. However, presuming the rice area expansion during the five-year period from 1995 to 2000 was due to intensification, the Mekong Delta rice area increased from 3,386,000 ha to 4,162,000 ha – an increase of 4% per annum. A further 20% increase over the next 20 years is possible agronomically, enlarging the irrigated area of the Mekong Delta by an extra 800,000 ha. It is questionable whether there is sufficient water in Mekong River to service this expanded area and only a small increase may actually occur.

d) Supplementary irrigation during the wet season. As suggested in Scenario 2, it is likely that supplementary irrigation during the wet season will continue to increase by 2.4% per year, leading to an expansion from 3,948,000 ha in 2000 to 5,843,000 ha in 2020, an increase of 1,895,000 ha. Some of the water required for supplementation will originate from stored water in large irrigation schemes. However, most will come from on-farm resources such as farmers improving their farming systems to include water storage. Neither system is expected to impact on Mekong River water shortages during the dry season.

e) Increasing yields. Yield increases in both the wet and dry season will have a small, but significant, impact on national production in all LMB countries. Rice yields of 1.9-2.0 tonnes/ha in difficult environments (such as found in Cambodia, Lao PDR and NE Thailand) represent the current the upper end of expectations. These may increase if farmers employ improved farming practices. Such practices include the use of better quality seed, targeted fertiliser applications, supplemental irrigation and improved weed control. Increases of 2.7% per annum such as those found in Cambodia between 1990 and 2000 will not occur because the yields are now relatively high. However, it is possible for farmers to lift yields by 20% over the next 20 years across the LMB. Similar yield increases are also expected for the wet season crops on the Mekong Delta and in all dry season crops.

f) Fishponds. The area occupied by fishponds in the LMB may double over the next 20 years from today's figure of approximately 500,000 ha. Much of this will be on the Mekong Delta where saline shrimp production is gaining in popularity. Recent technological advances will also allow more effective pond culture of the giant freshwater prawns (Macrobrachium rosenbergii). MRC (2003) estimates that approximately 6% of farmers in NE Thailand and 60-70% of farmers in Viet Nam are involved in small-scale aquaculture. An expansion in the area relies on good infrastructure to allow transport of the perishable product. For this reason, farmers in the Mekong Delta and NE Thailand will be those initially adopting such schemes.

Those on the Mekong Delta will compete for dry season water resources, while in other countries the water will most like be stored from wet season rainfall.

g) Perennial crops. The estimated 950,000 ha of fruit trees in the LMB currently service more than the just the population of the LMB and there is potential for them to expand further creating opportunities for export to other parts of the respective riparian countries and even abroad. Perishable goods remain a problem to transport and for this reason, the area under fruit trees may expand at approximately the same rate as the population increases. Most crops are not irrigated directly.

Coffee production in the central highlands of Viet Nam is currently suffering water shortage problems during the dry season but the area under coffee may expand quite rapidly in the Eastern part of Cambodia and parts of Lao PDR. These crops will consume underground water from aquifers in the uplands.

h) Deteriorating water quality. As mentioned in Scenario 9, the quality of the Mekong River water used for agriculture will slowly deteriorate unless controls are placed on the discharge of agricultural fertilizers, pesticides, industry and urban pollution, salt water and acid runoff into the river and canal system.

4.7 Marketing and farming systems in the LMB

The majority of farmers in the LMB choose to grow rice in preference to other crops. The primary advantages for rice are the crop's capacity to grow in waterlogged and flooded conditions, the fact that rice is the staple crop in the region and because it is financially more economic to grow than upland crops. Cost/benefit ratios do not currently support the cultivation of upland and industrial crops in many of the LMB lowland areas suitable for irrigated agriculture. Projected food prices remain reasonably static or drop (P. Pinstrup Anderson, 2003) and it is unlikely that the present cost/benefit ratios for crops grown currently will change significantly in the next 20 years. For this reason, it is likely that the composition of crops in the lowlands will remain stable, except where high value crops can be cultivated, e.g. chillies, vegetables and fruit. The areas dedicated to animal husbandry and aquaculture will also increase at the expense of crops.

Factors influencing trade and economic development in the LMB are discussed fully in The Economics of the BDP: Macroeconomic Overview of the LMB and BDP Project Cycle (MRC, 2002). Inclusion of all countries in the World Trade Organisation, Association of South East Asian Nations, Asia-Pacific Economic Cooperation and the Greater Mekong Subregion will promote closer economic relations and trade.

Some LMB countries have also recently formed beneficial agreements for greater cooperation in trade and investment, agricultural and industrial production, transport linkages, tourism and development through the Bagan Declaration on Economic Strategy and through bilateral trade pacts with neighbours. None of these trading relationships is likely to exert strong influence on international food prices. However, a reduction in tariffs may reduce the cost of agricultural inputs including fertiliser and pesticides, thereby improving profitability of crop production. Closer cooperation should also lead to a greater exchange of improved seed and technical information that will benefit the region as a whole.

Some economists working in Cambodia (Tony Ryan, pers comm.) believe that local marketing conditions are more important to the farmer than free trade agreements. They generally agree that farmers will derive greater return from their farm output if farm-gate prices increase and with improved processing of their products. For example, most farmers

in the LMB receive nine to 10 US cents per kilogram of quality paddy rice. In the market, the same, but milled, rice sells for 35 US cents per kilogram. This is a large mark-up for milling, transport and marketing.

In a similar way, improvements to local mills would increase the percentage of high quality grain returned to farmers. Although the standard milling rate [1] is considered to be 0.6 (or 60%) in the LMB, the percentage is often 50-55% or lower in local mills. The millers retain broken grain and bran; therefore, it is not in their interest to improve mill output rates. A new method of payment for milling and a training program for millers would improve on this inefficiency.

4.8 Summary

The Mekong River is capable of servicing all the agricultural needs of the Lower Mekong Basin if the water flow were even year round. However, the river flow is highly seasonal, flooding large tracts of land in all riparian countries during the wet season. There are also indications that water shortages may soon occur during the dry season. The months of February to May are the most critical months for agriculture in the Mekong Delta.

Agriculture in the LMB is rice-based and likely to remain so for the next 20 years or more. Past increases in productivity and existing crop potentials indicate that production will improve over the next 20 years sufficiently to outstrip population growth. Improved crop production will come from an enlarged cultivated area, increased farming intensity, more area under irrigation and small increases in grain yield. The area devoted to higher value crops, such as vegetables and fruit, will expand at the expense of rice, but will remain a small proportion of the total and irrigated agricultural area. Forecasts predict that the number and surface area under fishponds will expand significantly.

Forecasts also anticipate that wet season rice and upland crop production will be the cause of much of the expected increase in consumption of water from Mekong. In order to cope with this increase new irrigation schemes in Cambodia and Lao PDR should include on-site storage systems. It will not be possible for consumption in the Mekong Delta to increase significantly above current levels despite pressure for farmers to raise cropping intensity, change to dry season crops and to install fishponds. Government control may be required to mitigate water shortages.

Without the placement of adequate controls of discharge of agricultural, domestic and industrial waste into the river introduced, water quality in the Mekong River is destined to deteriorate.

4.8 Recommendation

There is currently too little information to formulate scenarios for agricultural development on a BDP sub-area basis. The areas suitable to develop economic irrigated agriculture are those with reasonably fertile soils situated beside water sources. Planning on a broad scale could utilise an existing Geographic Information Systems (GIS) generated soils map. Detail

[1] Milling rates are the ratio of whole grain polished rice resulting from milling rice paddy. If the mills are in excellent order the percentage of polished whole grains of white rice should be about 70%. Thailand possesses a large number of efficient rice mills and an average 60% millout is too low. In Cambodia however, the rate is probably only 55% from their small inefficient mills (a loss of 45%).

of potential areas for further expansion may be restricted to areas of flat land and rolling hills (MRC Class 5) situated beside rivers or below potential water catchment areas. Overlaying a water resources inventory on a map of soil types using GIS may provide some answers to this question.

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5 Water, poverty & livelihoods in the Lower Mekong Basin

by Peter Chaudhry and Muanpong J. , January 2005

Executive summary

This working paper has been prepared as an input to Basin Development Plan (BDP) of the Mekong River Commission (MRC) It is intended to identify and analyse key transboundary water issues that impact significantly upon poverty and livelihoods within the Lower Mekong Basin (LMB). The paper adopts a Social Development perspective, and so is concerned with understanding both broad processes of social change, and specific ongoing processes of exclusion and marginalization, poverty, vulnerability and conflicts around existing water governance modalities in the region.

The paper is intended to set a regional context to water related poverty, and provide a perspective on how to engage with these issues through the institutional mechanisms of the BDP participation process, and Social Impact Assessment (SIA) methodologies. The paper also suggests practical preliminary BDP project activities which would promote 'pro-poor' water uses in the LMB. It is an assumption that the Social Development perspective in this paper (in BDP analytical and planning process) is a fundamental requirement in meeting the sustainable development objectives underlying the 1995 Mekong agreement.

The lower Mekong basin is one of the most ethnically, culturally and ecologically diverse places on earth. The Mekong River runs through the region, and is an important life source sustaining all aspects of this diversity.

Approximately 54 million people reside in the lower basin, in regions as diverse as the northern Lao highlands, where predominately ethic minority peoples practice traditional forms of agriculture and foraging in the river's high watersheds; to the flat and flood prone delta region, where Vietnamese farmers can produce three rice crops a year, where rice output is critical to the food security and economic prosperity of the whole of Vietnam. Despite this regional diversity, livelihoods throughout the region share a close and direct dependence upon the natural environment and its resources, particularly water.

Considerable debates continue around the definition of poverty, and the identification of poverty groups. Poverty definitions determine poverty populations, as well as policy prescription to address the poverty identified. Poverty is, therefore, a politically loaded concept. Despite the considerable differences in perspectives, it is clear that the most intense levels of poverty (in the sense of lack of basic subsistence needs) are in the two poorest countries of the region; Laos and Cambodia. It is here where livelihoods are strongly linked to the health of the Mekong, through small scale fishing and farming. Livelihood vulnerability and conflict here and elsewhere in the basin are driven by a number of key interlinked factors, which include:

Increasingly insecure tenure and rights of access of the poor to natural resources, such as land, forests and rivers. This process of alienation and marginalisation has been driven in part by policy reforms paradoxically intended to legitimise rights to land, through privatization and individual holdings. These reforms have resulted in the poor being excluded from land, forests and rivers to which they previously had common access. The reforms have given power to elites, and concession holders to close off resources that were previously shared, and communally managed. Competition is becoming increasingly intense this context, around the Tonle Sap great lake in Cambodia for example, and increasing the risks of serious conflicts.

The predominance of subsistence based agricultural practices, particularly in rice production. The vast majority of farmers in the LMB, outside of the delta and Korat plateau regions, have limited access to irrigation, credit and farming inputs. They so rely upon producing

rice primarily for household consumption. Opportunities for diversification into higher value crops are limited, as are the economic returns from rice. Small scale agricultural producers therefore have few alternatives, and are locked into subsistence based poverty

A regional inland fisheries sector under increasing pressure from multiple sources. Wild, capture fisheries are critical for food security, nutritional well being and seasonal income generation for a vast number of people throughout the LMB. However, wild fisheries in the LMB are increasingly under stress as a cumulative result of changes to river based ecosystems resulting from hydropower development on major Mekong tributaries, and fish habitats are being destroyed through infrastructure and other river based developments (such as blasting of rapids) In addition, more people are fishing in more intensive ways; smaller fish and less diverse fish species are being caught, though the catch requires an increasingly greater effort. Fishing concessions, river enclosure and the development of aquaculture effectively exclude the poor from traditional fishing spaces. The long term impact of wild fisheries decline will affect the poorest first and most intensely, as they have few livelihood alternatives.

The eradication of upland farming systems upon which minority peoples depend. Traditional forms of shifting cultivation are " mono-causally" blamed for upland degradation, which in turn affects watershed health. Resettlement and other policy measures have often intensified poverty for minority peoples, and have adversely affected cultural identities. These are intimately linked to the management of the land. Recent research suggests there is nothing inherently degrading about traditional forms of agriculture, in fact quite the reverse, and that the causes of watershed degradation may lie more with the large scale logging (both legal and illegal) currently taking place throughout the basin.

The eradication of upland farming systems upon which minority peoples depend. Traditional forms of shifting cultivation are singled out for blame for upland degradation, which in turn affects watershed health. Resettlement and other 'environmental' policy measures have often created or intensified poverty for minority peoples, and have adversely affected cultural identities, which are intimately linked to the management of the land. Recent research suggests there is nothing inherently degrading about traditional forms of agriculture, and in fact the causes of watershed degradation may be more complex and multi-dimensional i.e land closure policies with these traditional shifting cultivation practices. Large scale logging is currently taking place throughout the basin, and is a primary cause of upland watershed degradation.

Processes for hydropower and infrastructure development which adversely impact those with the least stake, or voice, in the national development 'project'. Hydropower generation offers significant opportunities and benefits for the region as a whole, particularly for Laos, which has a mountainous and relatively sparsely populated hinterland. However, those who are most severely affected by this development (through resettlement and the subsequent loss of river based livelihoods) are those who benefit least from the electricity generated. Though often consulted, they seldom participate actively in the development of these hydropower schemes. Dam projects, road projects, and other infrastructure developments which change the natural environments in which people live, often result in the complete dislocation of traditional communities which are ill-equipped to adapt rapidly to the change/ new realities. They suffer greatly as a result, both materially, and through cultural loss.

The paper recognises the significant and fundamental changes that have taken place in the region, and the progress that governments have made in improving lives and reducing absolute levels of poverty. Those who remain in poverty, though, are often the victims of development processes for the 'general good'. Some of the policy conflicts and trade-offs associated with water governance in the region are therefore identified and discussed in this

paper. A set of principles to advocate " pro-poor" development approach to Mekong water governance are offered for further articulation in planning. These principles include the following:

- Improving water access for the poor;
- Promoting equity, as well as growth;
- Promoting sustainable long term development options;
- Reducing vulnerability and risk, particularly for the poorest;
- Considering only water use options that do not result in significant social dislocation for any particular group;
- Identifying water use options that actively reduce the potential for conflict; and
- Promoting inclusive and participatory development processes

The paper concludes with outline *'pro-poor'* water use scenarios that could be facilitated by BDP, and suggests some preliminary BDP projects to support these alternative development scenarios.

5.1 Introduction

Much has already been done to describe existing social and livelihood conditions in the Lower Mekong Basin (LMB), both from within the Mekong River Commission (MRC), and by outside agencies active in the region. Work has also been carried out into predicting and analysing possible outcomes of ongoing, and potential future, water related activities in the region.1 This paper seeks to synthesise some of this descriptive and analytical material into a concise working paper that will be useful to the Basin Development Plan (BDP) in the ongoing processes of strategy formulation, scenario analysis, and BDP project formulation. The paper does not set out to be a definitive compendium of socio-economic and socio-cultural detail. Nor does it seek to explore every potential social dimension to rural livelihoods in the basin. Rather, it looks to profile rural livelihoods in the LMB in the context of water, and explores trends and themes considered to be particularly relevant to the BDP, in having a transboundary, basin wide significance.2

The working paper seeks to identify and analyse transboundary water issues from a 'Social Development' perspective.3 Social Development is concerned with understanding the dimensions to, and causes of social change, through analysis of processes of social exclusion and marginalization, poverty, vulnerability, and conflict. Social Development is concerned with disaggregating impacts upon different social groups, and understanding interactions taking place between groups. In the context of the BDP, this perspective is considered useful in furthering understanding of existing structures and processes at work in the LMB, that are

1 MRC's 'Social Atlas of the Lower Mekong Basin', and the BDP sub area studies, are notable MRC publications in this regard.

2 The paper draws upon the work being carried out through the sub area studies. It is hoped that the working paper can be viewed as a rolling 'work in progress'; challenged, updated and revised as the BDP process evolves through Phase 2.

3 For a full discussion of the role of Social Development in the BDP planning process, please see 'Report of the Short Term Social Impact Assessment Specialist to the BDP' (April 2004) and the Orientation Paper for BDP NMCs, 'Social Development & Social Impact Assessment in the Basin Development Planning Process', (July 2004)

of region wide relevance to the poor, marginalised and vulnerable, as well as the populace at large. It is also useful as a step in the assessment process for future possible development activities, in understanding the full range of possible human outcomes to different water use activities.[1] Predicting social impacts is not an exact science. Unlike impact assessment methods that deal with the natural sciences, Social Impact Assessment (SIA) considers human agency, which is neither predictable, nor always rational. Variables are in a constant state of negotiation and flux. It is hoped that this paper can provide a perspective, no matter how rudimentary, upon the dynamism of livelihoods in the region, as a grounding for strategic and impact assessment activities to follow.

The report is divided into six sections. Following this brief introduction, section 2 gives an overview of the peoples of the lower basin, and the activities through which their livelihoods depend. Section 3 then considers poverty in the region; through discussing the centrality of poverty reduction to regional and national policy, then through defining some of the methodological difficulties involved in measuring poverty, and finally by profiling poverty against different macro level indicators, and considering the linkages between poverty and the environment. Section 4 considers key 'drivers' of poverty and vulnerability in the basin, which have a close water-livelihoods linkage. Section 5 then discusses different policy perspectives in relation to water use and livelihoods basin wide, and considers the instruments available to the BDP in reconciling competing policy perspectives. The conclusion section considers possible future 'pro-poor' water use scenarios and suggests BDP project activities to support them. Social dimensions to the hydrological scenarios developed by the BDP are included in appendix 1, and appendix 2 contains summary analysis tables for select sub area studies.

5.2 The Lower Mekong Basin, its people & their livelihoods

5.2.1 Characteristics of the Mekong and the Lower Mekong Basin

Table 5.1 gives an overview of the characteristics of the lower basin, by sub area, the spatial demarcation used by the BDP for planning purposes. The table shows the relative contribution of each sub area to Mekong flow, the size of the catchments, the number of provinces covered in each sub area, and the population.

[1] Two preliminary Social Impact Assessment screening tools have been developed for this purpose; a matrix of issues to consider at project long ands short listing stages; and a framework for project level SIA activities. These are contained in the 'Report of the Short Term Social Impact Assessment Specialist to the BDP' (April 2004) quoted above, and also in summary form in the Orientation Paper prepared for BDP NMCs (July 2004).

Table 5.1: Characteristics of the lower Mekong basin

Sub-area		Catchment	Water contribution to Mekong		Provinces	Population
		(land area, km²)	*(MCM & percentage)*		*in sub area*	*(millions)*
1L	Northern Laos	83,000	45,000	10	9	1.3
2T	Northern Thailand	17,000	11,000	2	3	1.6
3T	Songkam River	50,000	34,000	8	10	5.0
4L	Central Laos	86,000	100,000	22	9	2.4
5T	NE Thailand	120,000	34,000	8	15	15.6
6C/ 6L	Main Stream: Southern Laos /Nth Cambodia	19,000	21,000	5	4	0.5
7C/ 7L/ 7V	NE Cambodia, SE Laos, Central Vietnam	79,000	88,000	20	12	2.7
8C	Mainstream: Kratie	20,000	12,000	3	3	0.3
9C	Tonle Sap	83,000	60,000	13	15	4.4
10C/ 10V	Mainstream: Sth Cambodia & Delta	36,000	42,000	9	18	19.0
Total		593,000	447,000	100	98	52.8

Sources: various, data compiled by the BDP team, MRC secretariat

* note: The slight discrepancy in population data between Tables 5.1 and 5.3 is due to the different methods used in compiling the statistics for each; table 1 population figures are drawn only from provincial data, and have been adjusted to estimate populations living within the provincial basin area.

5.2.2 Peoples of the Lower Mekong Basin, and a profile of their livelihoods

The description which follows is not an exhaustive list and description of peoples in every sub area. Rather, information from sub area studies has been used to build a profile of four geographical regions of the LMB, which share similar characteristics and where people face similar opportunities and constraints in their use of, and access to, Mekong resources.

The four regions are: the northern highlands, covering northern Laos and northern Thailand; the central plateau and highlands in the Mekong middle reach, including central Laos, upper Esan of Songkram river basin and the Mun Chi sub basins of Thailand; the southeast highlands of Laos, the Vietnamese central highlands and north eastern Cambodia (the Se San, Sre Pok and Se Kong sub basins covering) and the southern region of the Mekong basin (eastern Cambodia, the Tonle Sap, southern Cambodia and the Vietnamese delta). [1]

5.2.3 Northern highlands

The northern highlands area of LMB is sparsely populated. The predominant residents are members of ethnic minorities, living in small scattered communities throughout the mountainous terrain of the region. There are approximately 3 million people living in the region, spread almost evenly between Thailand and Laos. The proportion of minorities

[1] The analysis of the four zones relies heavily upon materials prepared by Muanpong Juntopas (BDP team, MRC Secretariat) for a joint MRC/ Murray Darling Basin Commission training course in integrated river basin planning, October 2004.

amongst the population in Laos is as high as 80% in places, and up to 20% on the Thai side also being minorities. Although the population density is low, rates of population increase is high amongst minority groups . More than half of the Lao population in the region composed of children under 14 years of age.

The proportion of households living in poverty in northern Lao provinces is high, at between 50-71 %, with Oudomsai, Huapan, and Pongsaly being the poorest 3 province in Laos. This is significantly above the national poverty rate of approximately 40%. Many in the region face seasonal food insecurity; only about 30% have access to a safe drinking water source, and even less to safe sanitation (15-20%). Infant mortality is highland approximately 40% of Lao children aged 1-5 in the region are malnourished. Throughout the region, diverse cultures and identities are intimately linked to the natural environments in which peoples live.

About 80% of Laos population live in rural area, and they depend heavily river and forest for food, fuel, fibre, and shelter. On average NTFP constitutes 40 % of poor family income, but this constitute up to 90% of the poorest. The livelihoods of upland people in the region rely heavily upon traditional forms of agricultural production, including rotational cultivation of rice, maize and other staples, and vegetables. Rain-fed paddy cultivation takes place in lowland areas and valleys, but this is not widespread, and there is little irrigated rice production. Market integration in the region is limited, and upland communities rely heavily upon natural resources for their subsistence; forests for foraging, and rivers for subsistence fishing. Forests provide wild foods (such as shrubs, mushrooms and game) and also firewood, building materials, animal feed and materials for traditional handicrafts. A decline in forest coverage in northern Laos, from 70% - 47% over the past 50 years, has significantly impacted livelihoods, as peoples of this region are acutely sensitive to changes in ecosystems and natural environments. Plans for further dam development in the region would significantly impact upon livelihoods in this regard.

5.2.4 Central plateau and highlands

This is a large area of the lower basin, covering an area of 206,000 km2 and with approximately 23 million people. Approximately 2.5 million of these inhabit the central region of Laos, including the main lowland areas of the country where the majority of the national irrigated rice production takes place. The Isan region of Thailand is well developed in agricultural production, with relatively extensive irrigation systems and good infrastructure provision. This area, along with the delta region in the south, is the main rice producing region of the lower basin.

The central region of Laos has the lowest national incidence of poverty, at approximately 33%.But since the central region hold the largest proportion of the country population the number of poor is highest in this region. However, rates of infant mortality and particularly malaria infection are still high, and access to safe drinking water supply, sanitation, and electricity is low. Poverty and health indicators worsen significantly in upland provinces of the region, away from the main fertile and agricultural plain areas that adjoin the Mekong. Population density in central Laos is far lower than in neighbouring Thailand, but population growth is higher. Central Laos is inhabited by both lowland and upland Lao people's, with minorities primarily living in the highland areas that form the upper lip of the central basin. Minority peoples are approximately 40% of the total population of the region, but live outside of the plain areas and urbanised centres of Vientiane and Savannakhet.

Lowland Lao groups practice sedentary rainfed or irrigated rice production, and raise livestock along the Mekong and in the valleys and lowland areas of the floodplain. Upland

Lao groups also cultivate rice, using shifting cultivation practices on the slopes, and paddy production in valleys. Small scale production predominates, and diversification away from rice to more profitable crops is limited. This is due to poor irrigation facilities, most of which are small scale. Subsistence based agriculture is supplemented by capture fisheries from rivers and during the Mekong's flood season, along with foraging in upland areas for forest products. Fish constitute at least half of the protein intake of people in this region. Forest based livelihoods are under threat from significant illegal logging taking place in the central region.

In Isan, livelihoods are relatively more diversified, though agriculture still engages approximately 60% of the labour force. The region is more urbanised, industrialised, and is connected with the Thai hinterland. Remittances from family members working in Bangkok and other areas of the country are an important part of household income. Despite this, Isan is still amongst the poorest parts of Thailand, with 62% of the nation's poor people living in the region, and average incomes only one third of the national average. Rural livelihoods rely heavily upon fishing Mekong tributaries, and Thailand represents an important regional market for the lower basin's fish catch. Fish conservation groups and networks are developing, to pressure river development schemes, and fish and the river play a central role in the symbolism and rituals of the region.

5.2.5 Southeast highlands

This zone stretches across north eastern Cambodia, the south eastern Lao highlands, and parts of the central highlands of Vietnam. The dense network of Mekong tributaries, and associated wetlands and lowland flood plains provide an important habitat for fish, upon which livelihoods throughout the Mekong depend. Many diverse Mekong fish species migrate through this region, including many of the rarest and largest kinds, as well as providing habitat for fresh water dolphins and other culturally important species. The diverse ecosystem of the region includes rocky rapids, riverine forests, flood plains, and upland wooded areas from which many of the Mekong's powerful tributaries spring, such as the Se Kong, Se San and Sre Pok.

The total population of this relatively sparsely populated area is approximately 3.2 million people. Upland areas of Vietnam and Laos have significant populations of minority peoples, practicing forms of subsistence shifting cultivation of rice and maize, and rely heavily upon the forests and rivers for fish and forest products, wild game, as well as raising livestock. Minority peoples in the region have a close and symbiotic relationship with the relatively pristine ecosystems and environments in which they live. This is under threat from forestry loss, with approximately 7000 ha. per year logged from Vietnam in 2000 for example, 50% of the total national timber cut.

Irrigated cultivation has been established upstream in the Vietnamese Se San and Sre Pok valleys, with some production of perennial and other cash crops taking place as a result. Cotton, sugar cane, soya, tobacco, pepper, rubber and coffee are all exported from this area of the Vietnamese central highlands. Some aquaculture development is also taking place. In contrast, development of river resources in Cambodia is limited, with little irrigation infrastructure developed, little aquaculture development, and low average incomes. The river and forest resources are primarily used for subsistence, and peoples in the lowland areas rely heavily upon the seasonal flood cycle for fishing, and for crop production upon river banks.

Peoples in southern Laos and Cambodia collect many different aquatic products in addition to fish, including snails, crabs, insects, wetland plants and grasses. They use these products for a variety of subsistence and cash income generation purposes, including food, costumes,

crafts, and building shelter. In addition, fish caught in the region are often exported to nearby north eastern Thailand, where there is both a significant local market, and where fish are also traded on to Bangkok and other locations. The area has hydropower potential, but impacts resulting from past developments have raised important regional water governance concerns. Unannounced releases of water from Vietnamese dams upon the Se San resulted in the flash flooding and inundation of downstream communities in Ratnakiri province, Cambodia, with significant loss of life and livelihood. The planned large scale expansion of hydropower in the region is likely to significantly affect the regions people and ecosystems.

5.2.6 Southern region

The southern floodplains, Tonle Sap wetland and delta regions are the most densely populated parts of the lower basin, containing the largest settlement area (Phnom Penh) and the highest density of population, particularly in the flood prone areas of the Cambodian and Vietnamese delta (sub areas 10C and 10V). The population of the region is nearly 24 million people. In Cambodia, livelihoods of the predominantly Khmer lowland people are based around small holder agricultural production, and seasonal fishing and wetland foraging dictated by the Tonle Sap and Mekong River flood pulse. In the delta, irrigated rice production predominates, with the Vietnamese delta in particular generating a significant part (35%) of the country's total rice needs, through up to three rice crops per year. Incomes in the Vietnamese delta are higher than elsewhere in the basin, and significant development of aquaculture is beginning to take place.

Around the Tonle Sap great lake, small scale sedentary agriculture gives way to more nomadic and insecure livelihoods, based upon fishing and foraging. Floating villages dot the Lake's landscape, as communities respond to the flood pulse and engage in highly adaptive livelihood strategies required to capitalise upon the fishing opportunities that the annual great flood provides. Significant pressure is being placed upon the great lake, as important fish habitats like the flooded forests that ring the lake disappear. Fisherfolk report less abundant fisheries as a result, with fewer large species caught and an increase in the net effort required to catch fish. Increased competition and over fishing in the lake is also straining fisheries resources, with some evidence reported of a disappearance of fish further along traditional Mekong fish migratory routes.

Peoples of the Cambodian delta region also rely heavily upon seasonal floods, to clear fields of pests like rats, and to supplement their annual rice production with fish and other aquatic resources. Capture fisheries is of critical importance to the nutritional well being of the rural poor throughout the region, and food security relies heavily upon the extent of the seasonal flood. This importance is reflected in festivals and cultural activities of the region. The main areas of irrigated rice production in Cambodia are around Phnom Penh; elsewhere there is little developed irrigation infrastructure. Livelihoods of those in Phnom Penh and its environs are more diverse, with the approximately 1 million people of the city engaged in manufacturing and service industries, and providing an important source of remittances to poor communities around the country.

Peoples of the Vietnamese delta are overwhelmingly ethnically Vietnamese, though there is a significant Khmer group living in the remoter parts of the delta, bordering Cambodia. Despite a small average per capita landholding size (0.5 ha) productivity is extremely high through the extensive systems of canals and irrigation infrastructure that crosses the delta. Rice production predominates, though the Vietnamese government is now encouraging farmers to shift to high value aquaculture development. A major threat to livelihoods in the lower delta is saline intrusion, which is likely to increase if significant water abstractions take place further up the Mekong River.

5.3 Poverty profile of the Lower Mekong Basin

5.3.1 Poverty as a core issue for regional governments, and the MRC

Reducing poverty is a priority goal for all four of the lower Mekong basin countries. It is also the stated intent of both multilateral agencies like the World Bank and Asian Development Bank (ADB), and bi-lateral agencies active in the region. The national government's of Laos, Cambodia and Vietnam are committed to Poverty Reduction Strategies (PRS), and all of the LMB countries are committed to the Millennium Development Goals (MDGs), the overarching objective of which is to halve world poverty by the year 2015. Poverty reduction is therefore an important objective in both national planning, and regional development terms.

For MRC, the stated vision of the organisation is for *'an economically prosperous, socially just and environmentally sound Mekong River Basin'.* (MRC, 2001) The three interlinked concepts of economic development, environmental management and social justice form the basis for a sustainable development approach to Mekong water governance. Social justice here strongly implies a concern with equity of access to resources and decision making about the waters of the Mekong, for all residents of the basin, irrespective of their social or economic status. Poverty reduction is an often stated objective of the MRC, and therefore forms a central pillar in MRC's own sustainable development rationale, as well as being a central element to policy for both national government's and international agencies working in the basin.

5.3.2 Methodological issues in defining and measuring poverty

Accepting poverty reduction as a core concern for the LMB is straightforward, but defining and agreeing upon exactly what poverty means, how it can be measured, and who is poor, is considerably more difficult. There is no one universal and objective definition of poverty, and ultimately perspectives on what it is to be 'poor' are conditioned by an individuals own moral and political beliefs, and value judgements as to what constitutes a 'just' society. Academics from different disciplinary backgrounds frequently disagree over poverty levels and poverty groups, because they have different methodological concerns, criteria and thresholds of 'objectivity'.1 Consequently, different methods of measuring poverty often point to different people as being 'poor', and so have different implications for targeting, and policy.

Broadly speaking, conceptions of poverty fall along a sliding scale from 'material' measures, such as a lack of monetary income, a lack of consumptive ability or a particular condition of health, to more 'relative' measures, such as a lack of opportunity, a susceptibility to vulnerability, low capabilities, insecurity, powerlessness, social exclusion and a lack of choice. The former measures are often described as 'objective' or 'absolute', in that they can be measured and collected across countries without particular reference to the prevailing social context, but are relatively static, in that they do not take account of human agency or milieu in their definition. In comparison, more 'relative' measures of poverty are more context specific, less easily generalised across countries, but more relational and dynamic in seeking to understand some of the context and causality behind conditions of deprivation.

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1 A recent study by Laderchi, Saith and Stewart compared four different approaches to the definition and measurement of poverty, and found that in two countries, half the population identified as being in one kind of poverty ('monetary' poverty) are not in another ('capability' poverty), and vice versa. (Laderchi, Saith & Stewart, 2003)

Both absolute and relative measures of poverty matter in the transnational decision making context of the LMB. The LMB is recognised as one of the most culturally, physically and biologically diverse places on earth, and here, more than anywhere, a sensitive and multi-dimensional approach to understanding poverty is important in order to better understand the variety and complexity of the region. Upland minority communities may, for example, rely upon forest products outside of the standard 'food basket' measure of consumption used in setting national poverty levels, and monetary income definitions of poverty themselves suggest particular measurable policy responses, such as employment creation, which are not sensitive to the regions cultural and spatial diversity, or to the reality of complex rural livelihoods as they are lived in the LMB.

As another example, the case of Thailand and the Vietnamese delta can be used to argue that, in absolute poverty terms, incomes of farmers in both regions are significantly higher than for farmers elsewhere in the region, and that consequently poverty reduction measures should be concentrated elsewhere. However, using more relative measures of poverty, it can be argued that, although per capita income in Thailand and parts of the Vietnam delta may be higher than elsewhere in the LMB, farmers in these regions are subject to different kinds of vulnerability and depravation, through integration into markets and susceptibility to price fluctuation, for example, indebtedness or environmental pollution damaging health. Although materially better off in absolute income terms, they may be equally 'poor' relatively, when a broad and multi-dimensional definition of poverty (including vulnerability and well being) is used. Poverty issues faced here may also therefore require quite different policy responses than elsewhere. The range of policy conflicts and 'trade offs' involved in transnational decision making around the Mekong, and the consequences in terms of decision making and action, are discussed further in section five.

The examples given here have been used only to demonstrate how important an issue the definition and measurement of poverty becomes in the context of the LMB and basin wide planning across several countries, with very different physical, environmental and social conditions. Clearly, in the LMB, both 'absolute' and 'relative' approaches are important, at different levels of aggregation, for different analytical purposes. Indicators of income, health and consumption, regionally adjusted, are important for cross boundary comparison and for benchmarking change. More relative, 'relational' poverty measures are important in understanding local contexts, the interrelationship of causal factors to change, and the dynamism of change. Combining both approaches is important in building a holistic understanding of poverty in the LMB, to fully inform future policy options in regard to the use of the waters of the Mekong. Poverty for many in the LMB is experienced as a complex, multi dimensional phenomenon combining many factors, as this quote from a recent Participatory Poverty Assessment in Cambodia demonstrates.

Poverty was described as *'the inability to be certain that one can use as much of local resources as necessary for household purposes or to be able to sell to purchase basic necessities. It is also the inability to be certain that the land one occupies truly belongs to your family and that no one can take it away from you. If you can't be certain about these two things then you cannot be certain that you will have enough food to feed the family'* (ADB PPA, quoted in ICEM Cambodia PAD 2003, 75)

5.3.3 Poverty, inequality and environmental resources in the LMB

In most part of LMB area, the poverty gap1 is less than 10%. Most of the poor are clustered near poverty line. This means economic growth and policy change can readily contribute to improving income and living standard of the poor to above poverty line. On the other hand, since most of the many households consumption are just little above poverty line, they are vulnerable and can easily fall into poverty as the results of major flood, prolong draught, economic slow down/shocks, major policy shifts, or other adverse effects.

Enormous changes have taken place in the LMB over past decades, with the riparian states significantly reducing rates of absolute poverty amongst their populations. At the same time, however, it is acknowledged that rates of inequality are also rising. A key question arising from this trend is whether the increase in aggregate material well being off-sets the increases in inequality amongst peoples. Inequality is itself an important dimension to poverty measurement, as people gauge their well-being in comparison to others around them. Understanding who the 'winners' and losers' in these processes are is also important. In Thailand, enormous progress has been made in reducing the percentage of people in the population below the poverty line, but at the same time, the gap between the incomes of the top 20 percent and bottom 20 per cent have increased dramatically too. In Vietnam, indicators of income often show relatively low levels, but levels of access to education and health services are comparatively high. National poverty and inequality indicators for the four riparian countries are presented in the table below.

Table 5.2: Poverty in the Mekong region: National poverty and inequality indicators

	Poverty (headcount) % of population			*Inequality*	
	Total	*Urban*	*Rural*	*Income ratio*	*Gini*
Cambodia	35.9 (99)	25.2 (99)	40.0 (99)	4.7 (99)	0.2 (99)
Lao PDR	38.6 (97-98)	26.9 (97-98)	41.0 (97-98)	5.7 (97-98)	0.36 (97-98)
Thailand	13.0 (2001)	5.5 (2001)	16.6 (2001)	14.9 (2000)	0.53 (99)
Vietnam	37.0 (98)	9.0 (98)	45.0 (98)	5.6 (98)	0.35 (98)

Source: adapted from Mingsarn Kaosa-ard, in Kaosa-ard and Dore (eds) 2003, page 83`2

* Source years are in brackets

* Income ratio refers to highest earning 20% of the population divided by the lowest earning 20%.

* The Gini coefficient has a possible range from 0 to 1. It is a measure of inequality in income distribution in a population. 0 equates to perfectly equal. 1 would equate to perfectly unequal.

Table 5.3 below shows estimated poverty figures for the basin region, against recent national poverty and population estimates. Around 15.5 million basin residents are classified as 'poor', about 28% of the total basin population. However, this overall figure disguises significant levels of poverty in Cambodia and Laos, which have far higher rates of between 40 – 45%, meaning nearly half of the residents of the basin in these two countries are living in poverty, according to official statistics.

1 Poverty gap measures the depth of poverty- referring to the distance the poor people are living under poverty line. (expressed as percentage of poverty line)

2 Mingsarn Kaosa-ard reinforces the importance of poverty definitions by demonstrating that, using a different methodology of nationally adjusted purchasing power for each of the 4 LMB countries, very different poverty rates are arrived at for each. (Kaosa-ard in Dore & Kaosa-ard [eds] 2003)

Table 5.3: Poverty populations in the Lower Mekong Basin

	Total	Cambodia	Laos	Thailand	Vietnam
	(millions)	*(millions)*	*(millions)*	*(millions)*	*(millions)*
Total population	158.5	12	5.5	62	79
Total poverty population	45.8 (29%)	4.3 (36%)	2.2 (40%)	9.3 (15%)	30 (38%)
Basin residents	54.7	9.8	4.9	23	17
Basin Poverty population	15.5 (28%)	4 (41%)	2.2 (45%)	5.8 (25%)	3.5 (21%)

Source: Complied by M. Juntopas, MRC secretariat (from MRC Social Atlas, national sector overview reports, and reports of National statistic offices 2003). Figures corroborated against ADB's 'Selected Poverty and Related Indicators' 2001 (www.adb.org)

A further complication in quantifying trends in poverty reduction comes through the dynamic of population growth. Cambodia, for example, has reduced the proportion of people in the population who are in poverty, but at the same time the absolute numbers of the poor have increased, due to increasing population. Whilst population growth is predicted to decline in the next 25 years in Mekong region, the regional population will have almost doubled in that time, putting enormous strain upon the natural resource base.

In the LMB region, the vast majority of people live in rural areas, and livelihood strategies depend overwhelmingly upon the management and use of natural resources. The poor of the region share the features of being rurally based, engaged in subsistence agriculture, with low levels of literacy and education, a high care ratio in the household, and usually live far from established transport and communication networks. Their reliance upon the natural environment and local resources is therefore high, but they often lack formal or recognised access rights to these resources and consequently live in a state of permanent insecurity. This vulnerability is not reflected in the aggregated statistics shown above.

The Mekong region is amongst the most ethnically diverse places on earth. 'Ethnic minorities' are classified by ADB as: 'indigenous peoples with a social or cultural identity distinct from the dominant or mainstream society, which makes them vulnerable to being disadvantaged in the processes of development'. (ADB 1998: Policy on Indigenous Peoples). Within the LMB, Laos in particular has a significant part of its population classified as being ethnic minorities and minority groups are a significant part of the population in the Vietnamese central highlands. Minority peoples are highly reliant upon natural resources for subsistence and livelihood, and are more likely to rely upon traditional land management practices, forest gathering, and shifting cultivation. Incidences of poverty amongst minority peoples are disproportionately high across the region. Using government sources, Kaosa-ard observes that in Vietnam, they are 14% of the total population, and 29% of the poor. (Kaosa-ard in Dore & Kaosa-ard [eds] 2003 Pg 94). They are therefore twice as likely to be in poverty, than dominant ethnic groups. Still, little has been done to measure poverty amongst the regions minority groups. They are often outside of mainstream state development processes, with their knowledge and cultural capital undervalued, and effectively rendered 'invisible' in regional development discourses.

Understanding the poverty - environment nexus is critical to understanding the livelihoods of the poor in the LMB, and in understanding the opportunities and threats for future policy making for poverty reduction and environmental management. The waters of the Mekong are critical to this understanding, as the river and its tributaries dominate the region, and are central to both existing livelihood strategies (such as agriculture, forestry, fisheries) and to

future development scenarios of the states of the region (through hydropower development, and navigation improvements).

5.4 Key drivers of poverty and vulnerability in the LMB

This section discusses some of the key factors related to water that are driving poverty and vulnerability across the lower basin.

5.4.1 Contested rights of access to natural resources, and conflict

Many rural households in the LMB face significant restraints to attaining long term security of tenure to land, or in ensuring access rights to formally common property resources are respected. This is particularly the case in Laos and in Cambodia, where the registering of land rights and the implementation of land and property laws has been slow and inconsistent. Most vulnerable are rural households reliant upon land they may have farmed for many generations, but to which they have no formal title and which are now in dispute through competing claims, particularly from large scale outside investors and powerful elite interests. Also vulnerable are households that have traditionally been reliant upon accessing common property resources, like forests and rivers, for the collection of non-timber forest products (NTFPs) and for capture fisheries. Increasing pressure upon land and resources often pits these more marginal producers engaged in subsistence activities, against powerful local interests and the state, leading to serious impoverishment and increasingly intense conflict in rural areas.

Many of the difficulties of lack of access rights to land and resources can be seen clearly around the Tonle Sap great lake, in Cambodia. The MRC/ Government of Finland WUP-FIN study report observed how livelihood insecurity increases amongst communities close to the lake, where land tenure is insecure and constantly contested, and where there are high incidences of landlessness. The study contends that people living closest to the Tonle Sap: 'are generally poorer, less educated, have fewer livelihood options, do not own agricultural land and depend strongly on common property resources such as water bodies and flooded forests for their livelihood' (WUP-FIN pg 55).

In Cambodia, some observers claim the costs of land titling are exorbitant, effectively dissuading the poor from participating in land titling schemes. The current approach and legislation is also criticised for not recognising the importance of communal lands, upon which many of the poor depend. Chou Meng Tarr, in a recent publication, relates how the privatisation of fishing rights in the Tonle Sap not only transferred fishing resources from the communities to well connected and powerful concessionaries, but caused both conflicts and deaths. (Chou Meng Tarr in Dore & Kaosa-ard [eds] 2003 Pg 347 - 369)

Those around the lake who rely upon traditional and communal access rights for foraging, fishing and temporary cultivation are often in conflict with more settled agriculturalists farming rice, and this conflict increases under the pressure of increasing population in the region. In Cambodia, it has been estimated by ICEM that 31.5% of the population are recent migrants, and 70% of them migrants from rural to rural areas. Rural to rural area migrants usually move in search of better land, better access to natural resources, or to escape population pressure elsewhere. (ICEM Cambodia PAD report, pg 35). The combination of landlessness, contested rights of access to resources, and increased local populations is a powerful cocktail for poverty and conflict throughout the region.

Land tenure reform measures have been promoted throughout the region in recent times, and have often been justified upon poverty reduction grounds. Reform measures, such as the Land and Forest Allocation Program in Laos, emphasised the individualisation of resources, but the net impact upon the poor of these processes is not always self evident.

> *'Land tenure reform that both formalises rights and commodifies land as a saleable resource can have simultaneous progressive and regressive impacts …. An outstanding question is to what extent property rights clarification responds to local needs and agendas, and to what extent it is driven by foreign investment requirements that may threaten quite different sorts of resource appropriation from the rural poor'* (Mekong update Vol 4. No 4 2001, editorial).

Land reforms for the redistribution of land, or for guaranteeing access rights of the poor, have often been conflated with land reform for the guarantee of property rights, which does not necessarily promote poverty reduction, and often actively promotes the alienation of the poor from traditional lands to which they have had access, but which are now essentially 'privatised'. Vandergeest, writing on this issue in relation to Thailand and Laos, observes that 'a lack of attention to inequality means that current land tenure reforms may in fact often produce the opposite result: increased polarization and impoverishment of already marginalised people' (Vandergeest, 2001, pg 2). He notes that land redistribution can produce conflict within villages, and that the levels of absentee control of rural lands has increased in both countries following major reforms. 'Land titling clarifies individual or private property rights, with no attention to providing corresponding protection for common property resources' (Vandergeest Ibid 2).

Issues of tenure security and access to water, land and collective resources for the rural poor are important throughout the region, and relate to both upland areas, (forestry, traditional swidden lands and pastures) and lowlands too, where enclosure and conflict is taking place around fisheries, collective pastures, agricultural lands and groundwater resources. Conflict takes place between the poor and powerful individual interests, amongst the poor themselves, and between the poor and commercial enterprises, promoting the enclosure and exploitation of formally communal fishing areas, for example, for private shrimp farming development. As Vandergeest concludes, 'the exclusive focus on the clarification of individual/ household property rights without attention to local inequalities and the common property rights of communities may have harmed rather than helped the rural poor'. (Vandergeest Ibid 2)

5.4.2 Subsistence based rice production, agricultural livelihoods and poverty [1]

Water for agriculture accounts for 80-90% of all water abstractions in the LMB, and rice dominates the agricultural sectors of all LMB countries. During the 1990's Vietnam and Thailand's rice production increased four-fold over the increase in population, so that by the mid 1990's Vietnam was the world's 5th largest producer of rice, and Thailand the 7th (www.irri.org). Significant agricultural potential is being realised; the total cultivated rice area in the LMB increased from 2.59 million ha. to 3.95 million ha. between 1990 – 2000, with the area under production in the delta increasing by 10% during the same period. However, despite all four riparian countries being net exporters of rice, significant levels of food

[1] This section relies heavily upon information and analysis contained in the BDP Working Paper 17 and Nesbitt's paper from February 2005, included as Chapter 4 in this volume.

insecurity still exist in Laos and Cambodia. IRRI estimate that more than 85% of rice production in Laos is still for household consumption, with less than 7% sold on the market.

Rice based subsistence level livelihoods rely upon production in small family units, and most rice producers in the LMB, in Laos and Cambodia particularly, are either surviving at subsistence levels, or just above. Cropping practices for rice vary throughout the basin, from up to 3 irrigated rice crops per year in the delta, to shifting dry land cultivation in upland areas of Laos and Vietnam. 'Rice farmers are generally the poorest farmers in the LMB, and trade in rice grain is minimal in Laos and Cambodia where most farmers barely survive on their annual production' (BDP 017 Pg 43). Rice production provides relatively poor economic returns (Nesbitt) but has a food security and cultural value in excess of its economic return, and rural livelihoods throughout the region involve a complex set of seasonal household coping strategies as a result, including seeking labouring opportunities and work in urban centres to supplement farm incomes during non-critical rice farming periods.

A major constraint to agricultural development in the region is lack of irrigation, and analysts suggest that currently, land suitable for irrigated agriculture in the basin is hugely under-developed, except in the delta. There is also significant potential for better yields. Most governments in the region have plans to expand irrigation facilities and diversify agriculture (see appendix 2), particularly into higher value sectors. The Government of Vietnam, for example, is persuading farmers to convert existing paddy cultivation to shrimp production, particularly in the south-west corner of the delta where benefit cost ratios for rice are low. Coffee production is also being encouraged in upland areas, along with the development of other high value perennials.

Poor farmers, though, are considered particularly 'risk averse' and are often reluctant to risk their food security by diversifying into other crops when the markets and returns are not clear. Shifts in cultivation also often require capital intensive investment, particularly for brackish fish cultivation, and this too represents a significant barrier to agricultural diversification to higher value crops. Nevertheless, agricultural diversification represents a major goal of national governments seeking to raise agricultural sector revenues and reduce poverty in rural areas.

Farm mechanisation is a means historically of adding value in agriculture through increasing productivity and improving production. However, in the LMB, and outside of north eastern Thailand in particular, there is little evidence of a trend towards increased mechanisation, or of the land consolidation that often accompanies it. Rather, agriculture remains primarily small scale, organised on a household, or sometimes a traditional farm unit basis. An important reason for this is that mechanisation is capital intensive, and none of the states in the LMB are currently at a point where labour substitution is a viable option, with few large-scale opportunities outside of agriculture. Only in NE Thailand is there any evidence of a lack of available farm labour driving mechanisation. Seasonal agricultural labouring still represents an important livelihood activity for the landless poor in Laos and Cambodia particularly, and with no shortage of available labour, there is little need for large-scale investment in machinery to prepare agriculture land. In the delta, the small size of plots and intensity of production methods make mechanized harvesting impractical.

In a paper prepared by Nesbitt for the BDP on future trends in agricultural production, the following conclusion is drawn:

> *'Agriculture in the LMB is rice based and likely to remain so for the next twenty years or more. Past productivity increases and existing crop potentials indicate that production will improve over the next 20 years sufficiently to outstrip population*

growth. Improved crop production will be derived from an enlarged cultivated area, increased farming intensity, more area under irrigation and small increases in grain yield. The area devoted to higher value crops such as vegetables and fruit will expand at the expense of rice, but still remain a small proportion of the total and irrigated agricultural area. The number and surface area under fish ponds is predicted to expand significantly' [1]

The majority of farmers in the lower basin are likely to remain poor, as livelihoods continue to rely upon subsistence based rice production on small family units. Significant barriers to increasing the value of their crops remain, including poor marketing linkages, poor cropping technology, a lack of irrigation, insecurity of land tenure, a lack of access to cheap credit, and risk aversion to new potentially higher value crops, where significant capital investment and extension are missing.

5.4.3 Wild fisheries, fishing rights and regional food security

The basin is one of the most biologically diverse freshwater ecosystems in the world, with annual fish catches of 1.5 million tonnes plus per year, and fisheries play a crucial part in all aspects of life for a large part of the 55 million people of the lower basin. Fish are caught along the length of the Mekong mainstream year round, from tributaries and other major waterways in the lower basin, and from large natural and artificial water bodies and reservoirs, especially during the seasonal flood period in southern Laos, Cambodia and Vietnam. The Mekong fisheries are critical for food security; it is estimated that they provide up to 75% of the animal protein intake in rural Cambodia (Van Brakel 2003 p16), and contribute significantly to rural incomes too. Irrigated rice systems also provide a habitat for fish, which are caught from rice paddies and provide a major source of protein for farming communities in Laos, Cambodia and north-eastern Thailand. Paddy fish are caught from canals and flooded areas in the delta during the wet season too, and are important for nutrition, with half of the Vietnamese protein intake coming from fish, 15% of which is caught in the delta.

The seasonal flooding of the lower Mekong is critically important for most poor rural households. Despite the recent development of aquaculture in the lower basin, wild capture fisheries still account for the vast majority of all fish caught, and these fisheries are particularly important to the rural poor. Access to fisheries is often a collective or customary right, but these rights are increasingly under pressure through river enclosure and the granting of fishery concessions, in Cambodia particularly, but also elsewhere. Enclosure of fisheries increases vulnerability and livelihood insecurity particularly for the landless or near landless, who have few alternative sources of either subsistence or livelihood.

In many cases, the poorer people are, the more dependent they appear to be upon aquatic resources to satisfy basic needs. This is particularly the case with chronically food insecure communities in the Tonle Sap basin and lowland areas, and the poorest parts of Vietnam in the central highlands. Friend and Funge-Smith observe: 'It is becoming increasingly evident that securing rights of access to, and control over, common aquatic resources are of fundamental importance to many of the marginalized poor' (Friend and Funge-Smith in van Brakel, 2003, pg 5)

Whilst the size of the Mekong catch does not appear to have declined, a number of significant changes have occurred. Cambodian fisheries have witnessed a constant decline in

[1] Nesbitt's paper is included as Chapter 4 in this volume

the catch per unit effort, (the amount of time and effort expended on catching the same amount of fish) and thus in the net value of the catch.1 There has also been a perceived change in the types of species caught, with a long term shift taking place from the capture of larger, long lived species, to smaller, more short lived species. (ICEM).2 Studies using participatory research methods report a perception amongst fisherfolk of more people now engaging in fishing, increasing competition and contributing to the long-term decline of the regions wild fishery resources. More intensive, and sometimes highly destructive fishing practices have also emerged, such as dynamite fishing, further pressuring fish stocks, and fish habitats are changing under pressure from an expanding agricultural frontier and other river developments, with a steep decline in the area of flood forest, for example, around the Tonle Sap lake in Cambodia.

Another significant pressure upon wild fisheries and river based livelihoods is the development of hydropower facilities along the Mekong's major tributaries. In the three rivers region of southern Laos, north eastern Cambodia and the Vietnamese central highlands, upstream damming of the Se San River in Vietnam has reportedly severely affected fisheries and aquatic resources for downstream communities in Cambodia. Villagers and local NGO's have reported significant river turbidity and frequent fluctuations in water levels, which affect fish spawning and upset the natural environments upon which local people heavily depend. The proposed large scale development of Vietnamese dams on the Se San, and plans for the development of the neighbouring Sre Pok and Se Kong rivers, require far more careful analysis than has taken place so far, in order to fully understand the consequences upon local environments and livelihoods of large scale dam development. Those who know the rivers best are the communities that rely upon them on a daily basis, and their knowledge and experience should be utilised when hydropower schemes for the region are considered.

Some observers are optimistic about the future potential of aquaculture resources for poverty reduction, particularly in the lowland rainfed areas of Cambodia and Vietnam where the potential for development is highest, and where aquaculture could be used to complement existing river and floodplain fisheries. Aquaculture is seen as a potential way of increasing income diversification for the poor, and perhaps providing alternative livelihood opportunities for those who are excluded from access to fishing areas. Whether this is a viable long term strategy for the poor remains to be seen, particularly given the high relative start-up costs for aquaculture ventures, and the importance of some security of tenure to be able to invest in this kind of development. In practice it is usually prosperous investors, and those with the influence to secure fishing concessions, that are able to benefit from establishing fish culture schemes.

5.4.4 Upland land use, shifting cultivation & 'watershed degradation'

Upland watersheds of the LMB are recognised as critical for the long term health and stability of the basin. Forests and land provide important water retention and soil stabilisation properties, and significant changes to established eco-systems threaten the future security of the Mekong's waters, upon which so many depend. Upland areas have traditionally been used by minority peoples for shifting forms of agricultural cultivation. The practice is applied to an extensive area of land, left fallow to recover over a period of time.

1 Information from the completed BDP Cambodian sub-area studies.

2 ICEM advocate fisheries management plans, the demarcation of collaborative management practices, zoning and proper enforcement, prohibition and allowed uses, and a clear definition of roles as the means of preserving Mekong fisheries.

These practices and the rights of swidden1 cultivators to the land they use have been in dispute with state authorities in those areas where they are widespread, namely northern and southern mountain areas of Laos, the Vietnamese highlands, and north eastern Thailand's upland areas. Shifting cultivation is often solely blamed for deforestation and watershed degradation, and as a result shifting cultivators are facing shortened fallow periods, declining productivity and increased poverty as a result of the twin pressures of state 'environmental' policies and control measures, and increasing populations.

State policy responses to shifting cultivation include the granting of private land concessions, and control measures to restrict swidden cultivation. The government of Laos, for example, has set a target of 2010 for the eradication of all shifting cultivation, but alternative livelihood and resettlement measures, and new property rights regimes, have not proved effective, resulting in increased poverty, vulnerability and food insecurity for the predominately minority groups still highly reliant upon this form of subsistence production. A recent JICA/ Ministry of Agriculture and Forestry Report for Laos observed the following:

> *'Whilst the majority of upland families have now been allocated land, they have been unable to adapt their farming systems as rapidly as their access to land has decreased. As a result they have not maintained productivity and living standards under the shortened fallow regimes. It is evident that many upland farmers are now caught in this vicious circle of decreasing production and increasing poverty. Therefore many families are forced to continue swidden rotations on unrecorded greater areas than they are allocated'.* (Quoted in BDP sub area study report 4L)

Shifting cultivation and traditional environmental upland management practices have been the focus of much recent debate. Research from the region now suggests there is nothing inherently unsustainable about traditional forms of forest and upland management, and that indeed many traditional practices are highly sensitive to issues of sustainability, and ecosystem and biodiversity conservation, and have been successfully practiced for many years.2 Instead, it is often the juxtaposition of these traditional practices with new management policies resulting in land enclosure that trigger cycles of degradation.3 State policies for resettlement of minorities and shifting cultivators, and other state policy responses, are not sensitive to existing realities and so often seem to exacerbate, rather than solve, the problems of degradation that they seek to address. Meanwhile, large scale commercial and state sponsored logging, both legal and illegal, continues throughout the regions upland areas, and may be a more significant factor in watershed degradation than the traditional forms of subsistence livelihood practiced by upland minority communities.

Those who practice these traditional forms of upland cultivation are the poorest, most marginalised in society, usually members of ethnic minority groups outside of mainstream state development discourses. They often have few alternative livelihood opportunities, with forests in Laos, for example, continuing to provide livelihood to 80% of the population. As a result of the pressures upon cultivators from land closure, and the cycles of poverty observed, many upland cultivators are being driven into migration and, as Kaosa-ard observes: 'shifting cultivation policies are effectively forcing migration and substantial change in agricultural production systems'. (Introduction in Dore & Kaosa-ard [eds] 2003 Pg 11).

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1 'Swidden' refers to an area cleared for temporary cultivation by cutting and burning vegetation

2 See for example the October 1999 edition of watershed magazine on swidden rotational cultivation, 'In defence of Swidden'. (Watershed Vol 5, No. 1, published by TERRA www.terraper.org)

3 See recent research from Yunnan Province, PRC, with which the author is associated. 'A Typology of Environment – Poverty Linkages'. DFID funded 'Yunnan Environment Development Programme' report, Dec 2001

In north eastern Thailand, the allocation of former forest department land is a major land reform mechanism, with upland communities allocated lands, and the forests that remain effectively closed off and made into protected area or plantations. Access is curtailed for communities who may previously have had customary and collective rights to resources in these areas, upon which they depended. As Vandergeest observes, 'reform as the allocation of household land rights in former forest reserves may help many farmers, but its collorary – the consolidation of forest department control over remaining forest land – has the potential of further marginalizing those who are already most marginalized'. (Vandergeest pg. 3) As a result, upland ethnic minorities have often found that restrictions on swidden which come with the land reform process do not provide tenure security, but rather new forms of insecurity as their agricultural practices become illegal. (Vandergeest).

Ethnic minority groups in Vietnam, Laos and north eastern Thailand are over-represented amongst the regions poor, and have the least voice in current development processes. They are reliant upon traditional forms of agriculture, such as shifting cultivation, and rely heavily upon accessing common property resources, such as forests, for foraging. The upland environments in which they live, however, are often the target of wider policies and control measures for either water extraction, or watershed preservation. Upland minority communities are the first people to experience impacts, yet have little influence in decision making processes about the governance of water and natural resources in their immediate environments. The inadequacy of policy and compensatory measures to stop shifting cultivation practices is likely to result in both increased poverty, and continued swidden cultivation. There is also an additional, unquantifiable loss occurring from the eradication of traditional farming practices and associated impacts - cultural identity is being eroded through pressures of migration and forced livelihood adaptation, and this will detract from the rich heritage and traditions of the Mekong, impoverishing traditional cultures and societies, and negatively impacting upon the regions identity as a whole.

5.4.5 Wetlands, protected areas and the poor[1]

Protected areas have been described as the critical 'quiet partner' in water management in the region (ICEM Cambodia PAD 2003 pg.16). Protected areas play an important role in: water storage & natural flood regulation; water supply (irrigation, drinking water supply, hydropower); instream and estuarine fishing; flushing of pollutants; transportation and navigation; recreational water use (including tourism); and the regulation of microclimate impacts on surrounding areas. (ICEM ibid pg.18). There is a close link between protected areas and the poor. Protected areas are often in areas of extreme poverty, and the poor are most likely to be reliant upon common forest and aquatic resources that the protected area is seeking to conserve. Protected areas and dependent poverty populations are also usually located in remote areas, where there are few development alternatives. Maintaining and enhancing protected area's natural assets, then, will bring the greatest returns in both poverty reduction, and the long term sustainable management of the basin's environmental resources.

The poor rely upon protected areas in a number of different ways. Agriculture is particularly important, with the poor and landless migrants often using land in protected areas for cultivation. Fishing is also important, illegal fishing in protected areas for subsistence, and for sale. Larger scale fishing using destructive methods and equipment also takes place. Protected areas provide a resource for the poor for hunting, and for the collection of

1 This section relies heavily upon the ICEM 'Protected Areas and Development' reports, completed for all four of the Lower Mekong countries, and particularly upon the Cambodia country report.

fuelwood, charcoal, NTFPs, and logging for local use. These activities all threaten biodiversity preservation and can result in large scale degradation of protected area resources.

The ICEM Cambodia country study report estimates that, for the Ream National Park, US$1.24 million dollars worth of economic benefits are generated each year to the 5,000 households near the park that use it, through fishing, harvesting forest products and farming. That would amount to US$233 annually from Ream for each household, contributing more than two thirds of the average family income of about US$316. (ICEM ibid. pg. 77). Without access to the resources and opportunities the Park provides, many would find it difficult to survive, as they lack access to other sources of livelihood.

Protected areas are often located in areas of low, but rapidly growing populations. The existence of protected areas can be a major draw for rural migrants, looking to escape more densely populated rural areas where they have no land or access rights, and encouraged by the 'agricultural frontier' nature of these less densely settled areas, where resources are pristine and 'free'. Protected areas offer significant development benefits to the poor, and migration to protected areas can be either 'sedentary' or 'nomadic' (ICEM ibid pg. 77), and either permanent, temporary or seasonal in nature.

Protected areas are clearly crucial to the livelihoods of local people around the parks, then, and there has been a recent recognition in policy thinking around protected areas internationally, that protected areas are part of wider socio-economic landscapes and that the 'exclusion model' is not working in the face of an expanding agricultural frontier, migration and resettlement. Now, it is recognised that protected areas can't simply be ring-fenced and secured away from dependent local populations, that in fact they are extremely important to the livelihoods of local people, and that the poor must be engaged in park regulation and management, if sustainable resource development is to be achieved.

Collaborative management tools required to safeguard the future sustainability of protected areas in the LMB include: comprehensive impact assessment and management plans; policies for securing land tenure rights for the poor; and effective decentralisation measures, which transfer budgetary control and political and administrative decision making to local area authorities, as the organisations best informed about local conditions and best able to respond flexibly to local needs. There is also a recognition that those who use resources and develop protected areas must also contribute to local communities poverty reduction, in parallel with initiatives to define rights of tenure, access and use – to give poor resource users an interest in sustainability. This includes user fees and also transfer payments to the poor, to compensate local communities for the degradation of resources upon which they depend. The poor must be integrated into local and regional economies as genuine stakeholders, if the long term security of park areas is to be achieved. Measures to promote this might include tourism development, and NTFP commercialisation. As ICEM conclude, 'the most fundamental concern is how poverty in the vicinity of protected areas can be reduced while maintaining the natural systems and the goods and services they protect'. (ICEM ibid pg. 80)

5.4.6 Hydropower development and resettlement

Social impacts associated with hydropower development are amongst the most emotive, and controversial in the region. The waters of the Mekong and associated tributaries represent a major asset for the riparian states, particularly for Laos, which is relatively undeveloped, with a high potential for hydropower development, and a relatively low population. The demand for electricity is also growing in the region, from the relatively more developed centres of Vietnam and Thailand, from urban areas of Cambodia and Laos, and from China, which has major hydropower plans for the Upper Mekong basin to feed the demand of China's rapidly

expanding cities and industries. Annual growth rates in hydropower consumption to 2000 show a 22% increase in Cambodia, 12% increase in Laos, 7% increase in Thailand and 13% increase in Vietnam (MRC BDP Hydropower Regional Sector Overview 2002).

Hydropower development schemes for the Mekong region are currently large scale and extensive, and threaten the livelihoods, cultures and environments of predominately minority upland groups living in remoter upstream areas. Reservoir inundation threatens their existing forms of livelihood, from forests, fisheries and agriculture, and the resultant resettlement undermines traditional cultures and societies of the regions poor, many of whom have been engaged in the same way of life for generations and who are least well equipped for a quick adaptation to new realities. Hydropower schemes do not only result in the direct resettlement of whole communities, but also the loss of environments and 'space' upon which many more people depend, for foraging, forest products, shifting cultivation, firewood collection, and fishing. So whilst there is a clear 'national' or state need to generate more electricity for development, there are consequent losses to cultural and environmental habitats which are borne by those, the rural upland poor, who are least integrated into the national development project, and who have least voice in discussions over development alternatives.

Major hydropower schemes planned for the LMB include Nam Ngum 2 and 3, and Nam Theun 2 in Laos, all of which potentially have major resettlement components. Nam Ngum 2 alone would require the resettlement of approximately 6,000 people. There is currently no consolidated MRC data on how many people may be directly and indirectly affected under proposed hydropower schemes. However, given the scale of proposed plans, and the high likelihood that significant hydropower development will take place in the LMB over the next 20 years, it is safe to assume that thousands of people will be directly affected through resettlement, and tens of thousands indirectly affected by loss of livelihood habitat, through reservoir inundation in Laos and the central Vietnam highlands. This must, of course, be set against the potential national benefits in terms of revenue generation and electrification. But determining the trade-offs and understanding fully the likely impacts requires thorough social analysis, and processes of information sharing and participation which fully engage from the outset those most likely to be severely affected by hydropower development.

Thailand has already ruled out future large scale hydropower development to meet energy needs, because of social and environmental concerns advanced in part by a relatively strong and articulate local civil society. However, Thailand's strong regional and economic position means that, in practice, Thailand's electricity demand drives development in poorer, neighbouring countries like Laos, which does not have a similarly strong indigenous civil society. A moratorium on hydropower development in the Mekong region may shift the focus of national governments and IFI's to other, less visible river systems, like the Salween, or may promote more regional fossil fuel extraction, resulting in other kinds of environmental and social damage. Hydropower development is not, therefore, exclusively a national issue, but rather a region wide, and basin wide concern.

Whilst hydropower development is likely to continue to feature in Mekong government's development plans, there are alternatives to the large scale schemes currently envisaged, particularly those with significant resettlement components. There are also alternative modalities in managing hydropower development, which ensure that significant benefits from hydropower schemes accrue to the local people and local economies most directly affected, and not just to urban consumers under projects promoted as being in a 'national interest'. More could be done in exploring the potential of small scale hydropower alternatives in the basin, particularly the development of micro-hydro as a form of transfer payment to local communities affected by development schemes. Finally, the World Commission on Dams have clear principles and guidelines for hydropower development, which are frequently ignored or sidelined by the very actors (such as the World Bank) who

were originally instrumental in the commission's establishment. Adherence to WCD guidelines would do much to protect the rights and interests of the region's poor.

5.4.7 Socio-cultural impacts of infrastructure development, river navigation, & tourism

Much of the discourse around the development of the Mekong region has emphasised infrastructure, the potential for river based trade in the region, and tourism development. Infrastructure development is an important enabling condition to facilitate communications, trade and production, and is an important element to poverty reduction in the region, through fostering the generation of employment, enhancing access to state and other services, and promoting regional integration. Infrastructure development includes investment by national government's and IFI's in road networks, railways and airports, electricity networks and other related capital intensive projects. In the Mekong basin, the development of flood control embankments is seen as an important measure in regulating the flow of the river, and protecting sedentary agriculture and urban areas from the impact of seasonal floods. IFI's like the ADB have also lent heavily for the promotion of cross border trade, and for the development of infrastructure to promote tourism development in the region.

Whilst investments in infrastructure have done much to facilitate national development, they are not without significant socio-cultural impacts, particularly for those groups not targeted as beneficiaries of particular infrastructure development schemes. For example, flood protection embankments benefit urban areas and may promote investment by large landowners in irrigation development, if irrigated areas are better protected, but they also change and regulate the seasonal flood upon which many people in the lower Mekong depend, for fisheries and other related water livelihoods. Changing the nature and flow of the river often has significant consequences for those who are not the intended beneficiaries or 'end users' of investments, and results in significant and unforeseen socio-cultural and economic impacts.

Measures to improve river navigation in the upper LMB have also had significant impacts upon local communities and their traditional practices. The blasting and clearing of rapids and the filling in of deep pools with the debris changes fish habitats, and so affects the livelihoods of those who depend upon the fish. Little attention is currently paid to this aspect in EIAs undertaken for schemes for the clearing of rapids, and no opportunity given by the governments of Laos, Burma and China for the articulation of grievances by affected communities. The poor consequently bear the cost of a wider development 'project' to improve regional trade, from which they are unlikely to benefit.

Much infrastructure development is undertaken to facilitate 'pro-poor' tourism. The region undoubtedly has significant tourism potential, and the unique cultural diversity of the basin is recognised as being an important draw card in the future realisation of tourism plans. Final discussions are taking place around the Laos National Tourism Authorities Strategy for 2004-2010, for example, and the conservation of cultural heritage forms an important part of the plan (Vientiane Times Nov 30 2004). Where tourism development is genuinely small scale and localised, benefiting local people and managing environments in a sustainable manner, then the poverty reduction impact could be considerable. However, tourism development is likely to be concentrated around areas of historical and cultural significance, or scenic sites which are easily accessible. This is likely to preclude development, at least in the short to medium term, in remoter areas, and these areas, such as upland Laos and the Vietnam central highlands, are the areas with significant concentrations of the poor. There is also the danger that tourism pockets are created wherein indigenous cultures become a 'show' for tourists, and communities become separated from the lived everyday reality of

their local culture. Future sensitivity to the promotion of the tourism potential of indigenous minority cultures is therefore required, if significant socio-cultural dislocation is to be avoided.

Mass tourism will undoubtedly continue to increase in the region, with increased numbers of visitors both from the subregion, and internationally. This will generate both jobs and spin-off service sector opportunities, for tour operators for example, transport providers, gift manufacturers and restaurants. Potential negative impacts may include the outsourcing of jobs excluding local people from opportunities, poor environmental management of developments, rendering them unsustainable and impacting adversely upon the local lived environment, and a rise in human trafficking and prostitution.

5.4.8 'Globalisation': The backdrop to poverty and development in the Mekong basin

The concept of 'globalisation' provides a lens through which to view and make sense of processes of change currently taking place in the Mekong region today. Globalisation manifests itself in many different spheres of life: the cultural, economic, social, legal, regulatory and institutional. Globalisation can be seen in the way agricultural processes are being transformed, with new crops, production methods and markets; in the unprecedented movement of peoples, in response to new economic opportunities in cities, declining economic potential from agriculture and new opportunities from industry, and new and cheaper means of transport; in the revolution in communications and information technology, through mobile phones, the internet, an almost universal connectivity to communication networks, and the prevalence of 'global' brands and cultural mediums. Globalisation can also be seen in regional governance processes, from ASEAN to the World Social Forum.

As well as bringing new opportunities, globalisation processes also bring new and heightened risks and vulnerabilities, particularly for those least able to adapt to new modalities quickly. Globalisation consequently fuels increasing inequalities in the region, as Mingsarn Kaosa-ard observes:

> *'globalisation opens new windows of opportunities for which there are no existing rules. Consequently larger gains will accrue to the ruling elites who can create new rules and benefit from these new opportunities while the risks are shared by all, including the poor.'* (Kaosa-ard in Dore & Kaosa-ard [eds] 2003 Pg 82).

Parallel processes can be seen to be at work then, of increased and unprecedented opportunity, alongside heightened risks of increased poverty and vulnerability. As cultures of 'modernity' spread, more traditional ways of life which are linked intimately to local environments and cultures are eroded, changed or disappear completely. One important manifestation of this comes through the notion of individual property rights, which has permeated policy around the governance of natural resources in the region, replacing traditional 'open access' regimes and communal management of resources. This has had a significant effect upon the regions poor, as we have seen. (Sections 4.3 and 4.4 above).

Another way in which globalisation impacts poverty is through what has been described as a 'feminization of poverty' (Introduction in Dore & Kaosa-ard [eds] 2003 Pg 6 and chapters by Rayanakorn & Chaw). Observers of development processes in the region argue this manifests itself in both urban and rural environments; women often provide the labour that underpins the feminization of trade and production, through providing a flexible and cheap workforce in factories and emergent enterprises in urban areas, and also bearing the load of

increased household and productive tasks when men migrate to urban or other areas, temporarily or seasonally, in search of work. Women in new industries are provided with opportunities, through for example working in garment processing and assembly, and being able to work in relatively secure environments for good salaries, which may make them less prone to subordination in future family and relationship situations. But they are far more vulnerable (along with children) to being exploited in these work relationships, with no employment rights and working in unsafe or hazardous conditions. Women and children too are vulnerable to forced transborder migration and trafficking for prostitution or exploitative labour, with women from minority populations more vulnerable to this than women from majority ethnic groups.

The region is witnessing an unprecedented movement of populations, and as communications and transportation links improve further, so will the future mobility of the people of the LMB. Migration patterns are complex and not straightforwardly characterised. As well as a clear rural to urban dynamic, there is also significant rural to rural migration, as the poor extend the agricultural frontier of Cambodia and Laos in search of opportunities and land. There is also migration across regional borders (from the Vietnamese delta to the Cambodian delta region, for example) and migration out of the region, to urban metropolises such as Bangkok, Hanoi and Ho Chi Minh City. These movements generate new tensions and potential for conflict, and frequently subject migrants to new environments for which they are ill prepared.

Rates of both migration and urbanisation will continue to rise, changing the population profile of all of the riparian states. This is likely to have a significant impact upon future water demand, and the water policy priorities of states. More water demand will come from provincial and national cities and urban areas, for both domestic consumption, and for industrialisation and service sector development as economies grow. This is likely to have an impact upon rural water needs, and may compete particularly with water needs for agriculture, which currently accounts for more than 90% of all water abstractions, and which is still overwhelmingly the source of livelihood for the poor.

5.5 Competing policy & planning perspectives on water governance

Policy options for water use basin wide are driven by the particular planning perspectives adopted by national governments, transnational authorities, or other local, regional and international stakeholders. The following sections discuss some of the current conflicts between perspectives, and how these conflicts can be reconciled and trade-offs between perspectives made, through the BDP process and in particular through the full implementation of the BDP public participation process and through the application of Social Impact Assessment as an integral planning and monitoring tool.

5.5.1 Competing perspectives on the use of the waters of the Mekong

Equity between countries

A first order consideration in determining water use is the relative allocation between countries in the lower Mekong basin. Should water use rights be allocated equally amongst the countries, or should they be divided relative to each countries water contribution to the Mekong? Should water rights be allocated according to the needs of agriculture and industry in each country, or according to the potential each country has in making use of the water,

determined by national planning priorities? Should water be allocated according to the population of each country, on a per capita basis, or according to the nationally defined poverty head count? Adopting one or more of these perspectives would result in very different water use scenarios between each country.

A further consideration is that different countries in the LMB appear to accord different degrees of political or national importance to Mekong governance. Arguably the national 'stakes' are higher for Cambodia and Laos; they are poor countries heavily reliant upon the Mekong right across the country. In contrast, Thailand and Vietnam have larger and more diversified economies, and have only part of their countries in the Mekong region. Their interests in the Mekong, therefore, may not have the national importance that they have for their poorer neighbours. National priorities and interests are a major policy driver in all discussions around water use in the LMB.

Equity within countries; local versus national priorities

The notion of social justice is enshrined in the Mekong agreement, as one of the three pillars to sustainability underlying water governance in the region. Equity within countries, between different water groups, can therefore be assumed to be as important as that between countries. Primary users of water and associated resources include farmers, domestic consumers, those who rely upon natural resources through subsistence activities, consumers of electricity from hydropower, and there interests may be represented as effectively through civil society groups mobilised, as through government bodies. MRC would therefore appear to have a responsibility to gauge as wide a spectrum of opinion as possible before modelling water resource allocation scenarios, which would be used in decision making processes.

National water use priorities could conflict with local priorities in a number of ways. Taking Thailand as an example, national priorities on the waters of the Mekong may involve inter basin transfers of water for irrigation and industrial development, which may impact negatively on the development potential of the Isan region. Similarly hydropower developments in the highlands of Vietnam may have downstream effects upon the Mekong delta region, and could potentially impact negatively upon salination levels and irrigation efficiency in the Vietnamese delta. The situation in Cambodia and Laos is slightly different, with both countries relying more heavily upon the Mekong throughout their respective countries. Nevertheless, the potential for conflict between local and national priorities is real, with hydropower potential in the north of Laos, for example, potentially impacting upon irrigation practices in the central lowlands, and the needs of subsistence fishers around the Tonle Sap Lake in Cambodia competing for water with farmers in the south.

Urban versus rural priorities

Another important dimension to the discussion on priority setting within countries is that of urban versus rural water needs. As the pace of economic development and urbanisation accelerates in the region, so demand for water grows, both for domestic and industrial purposes, and for water for electricity through hydropower. National 'modernisation' and economic development plans often focus upon urban based activities, and urban recipients of benefits and services, at the expense of rural peoples. This may well reflect shifting economic values associated with the rural and urban sectors, but questions remain as to the social equity and 'justice' of projects that urban consumers may benefit from (such as hydropower development) but which rural, poor and usually minority populations in the basin may ultimately 'pay' for, in terms of dislocation and loss of traditional livelihood, culture, damage to natural environment and increased immiseration and poverty. Although most hydropower schemes have compensation mechanisms, these schemes are often

presented as fait accompli's by the state, with minimal engagement in discussion processes by affected communities, who are often outside of mainstream discourses in any case and on the margins of the state. Similarly, diverting Mekong water for urban use over rural use because the relative value per cubic metre is higher discounts the subsistence, livelihood and cultural importance of rice production and agriculture throughout the region, and the importance of agriculture to livelihood reproduction. Fundamental considerations of equity and social justice exist, then, in considering urban over rural water uses.

Needs of the rich versus those of the poor

Rich versus poor is another important perspective to water allocation, both within countries, and across the region. LMB countries have poverty reduction strategies and a commitment to the millennium development goals which places poverty reduction at the centre of national policy making priorities. Many development activities are promoted to facilitate economic growth, but although economic growth is a necessary component to poverty reduction, it is not a sufficient condition in itself. Similarly, utilitarian arguments for development that promotes the 'greatest good for the greatest number' may have unacceptable trade offs for those, usually the poor, who are not beneficiaries of the process, in terms of loss of biodiversity, cultural heritage and social deprivation. Promoting poverty reducing water use could therefore be described as an objective in itself, in that secondary poverty reduction impacts from activities seldom occur as intended. Elements to a 'pro-poor' water use scenario are discussed further in section 6. It should be remembered that many of the most vulnerable in the LMB are outside of the national development 'project' of the respective states, with little voice or authority to influence development processes. Through their reliance upon natural resources, though, they are often the people most keenly affected by developments along the Mekong.

International versus national priorities

Many observers and international agencies active in the LMB have emphasised the importance of the Mekong as a global river of importance. The lower Mekong basin is one of the most culturally and environmentally diverse places on earth, and the preservation of biodiversity and ecological balance in the region has significance far beyond the immediate circle of interest of the four lower Mekong countries themselves. There is though, an inherent tension between national and international priorities, with states more keen perhaps to maximise water use for economic purposes, and international advocates more concerned with environmental and cultural preservation particularly.

5.5.2 Managing conflict and facilitating trade-offs through the MRC, and the BDP

The 1995 MRC agreement provides an overarching sustainable development framework as a basis for managing the tensions and conflicts inherent in the transboundary governance of the Mekong. The Basin Development Plan too, and its associated process, is particularly well situated to take a lead in reconciling competing policy perspectives, and in managing conflicts which may arise. Doing so requires the right institutional tools, and two key components in the BDP 'toolkit' are discussed below.

BDP public participation strategy

The public participation strategy is integral to the BDP planning process, and to the work of the MRC overall. The strategy and its component modalities are the means through which

civil society and user group perspectives and needs can be built into the MRC strategic and decision making process. The public participation process is also the means through which technical workstreams and country needs can be brought together in an integrated planning process. This is important for the BDP, because the plan should reflect the needs of as broad a spectrum of stakeholders as possible, in order to mitigate the potential for conflict and to reconcile the perspectives discussed above, through working towards formulating 'win-win' scenarios. Civil society 'voice' is therefore central to the BDP planning process.

Experience in implementing the public participation strategy during phase 1 of BDP has been variable. Sub area forums have been held, but much of the work to date could be better described as consultation, rather than full participation. Attendance at the sub area forums by civil society stakeholder representatives, such as NGOs, has been limited. Country and regional forums are planned for before the end of Phase 1 of BDP, and establishing the public participation process now as an integral part of the BDP planning process is important, in order that the principle and mechanisms are institutionalised, understood and accepted by NMCs in advance of the anticipated phase 2 of BDP.

Social Impact Assessment

Social Impact Assessment (SIA) is an important tool and method for building in a consideration of 'social' and poverty related aspects to the planning process, and includes within its scope data collection and analysis methods, and stakeholder participation. A discussion paper outlining the principles and approaches in SIA was prepared in April 2004, and an orientation paper for NMCs in SIA prepared and circulated in July 2004.1 Both papers included SIA checklists for BDP project long and shortlisting, and an outline for an SIA project framework, to serve as a model for development once more is known about the nature of possible BDP projects. SIA gives the BDP an alternative perspective in evaluating possible basin developments, and is a part of an integrated basin development planning 'toolkit' to enable decision makers to consider social, economic, environmental and institutional aspects to water planning in a holistic way. As an example, all approaches are necessary in order to consider the relative benefits of water allocations for subsistence farming against those for hydropower development, which involve quantifiable economic benefits, but also social and environmental costs for different communities and ecosystems.

Compiling good, up to date information is integral to an effective social impact assessment process. MRC has compiled a 'Social Atlas of the Mekong Basin', which provides accessible information in a highly visual format, down to provincial level. This information could usefully be supplemented with the indicators outlined in appendix 3 as a poverty and livelihoods supplement for future planning processes. This information would be useful by sub area, and ultimately down to district level, if this is relatively easily accessible from each of the countries. Future BDP investments will require the establishment of a more locally specific database of social indicators as a means of tracking, and evaluating, social change and of managing identified risks resulting from project activities.

1 'Report of the Short Term Social Impact Assessment Specialist to the BDP' (April 2004) and the Orientation Paper for BDP NMCs, 'Social Development & Social Impact Assessment in the Basin Development Planning Process', (July 2004)

5.6 Conclusion: Possible 'pro-poor' water use scenarios to support poverty reduction, reduce vulnerability & conflict

This section builds upon the previous discussions on the people of the basin and their livelihoods, key drivers to poverty in the region, and the competing planning and policy perspectives at work in regard to the governance of the Mekong's water resources, to formulate possible future scenarios that would support poverty reduction and reduce vulnerability and the potential for conflict in the LMB. These scenarios, (and possible initial, small scale BDP projects to support their development) are outlined, following and initial outline of key principles behind the scenarios

5.6.1 Key principles behind the development of 'pro-poor' water use scenarios

Pro-poor water use scenarios for the next 15-20 years would look to mainstream the critical aspects of a social development approach within an overall sustainable development approach; of a balance between economic, environmental and social concerns. This balance is critical for the well being of the regions poor, who are a significant transboundary group, and who share a close relationship with, or reliance upon, natural resources, and for whom water availability and access is crucial.

- *Improving water access for the poor:* For the poor, water use is as much about access as availability. Legislative and regulatory environments are therefore important in promoting 'pro-poor' water use scenarios;

- *Promoting 'growth' with equity:* Promoting economic growth in the region is clearly a priority, given population projections of a doubling of the regions population by 2020. Inequality is a feature of poverty, and water use options that are not relatively equitable are likely to erode consent and exacerbate poverty in the region;

- *Promoting sustainable long term development options:* Water use scenarios should be sustainable in the long term, to ensure effective long term management of water resources upon which the poor depend;

- *Reducing vulnerability and risk, particularly for the poorest:* A critical feature of poverty is vulnerability, and water use scenarios should be evaluated in light of their impact upon vulnerability for the regions poor. If vulnerability increases significantly, then perhaps the scenario developed can be considered undesirable;

- *Considering only water use options that do not result in significant social dislocation for any particular group:* Even if the group involved in a particular development scenario are relatively small statistically, they should not be asked to bear the burden of development for others, particularly if they have not been fully involved in decision making processes around development options, are not satisfactorily compensated through a process which they fully understand and take part in from the outset;

- *Identifying water use options that do not promote conflict, or which actively reduce conflict:* Conflict often results through a lack of consent and participation in decision

making processes, or where options promoted are inequitable, or severely impact particular groups. Wherever possible, therefore, the potential for conflict should be a consideration in deciding which water use scenarios are most desirable;

- ***Promoting inclusive and participatory development processes:*** Decisions around water use in the basin in the future are likely to have both positive and negative impacts for particular stakeholders, and the challenge is to mitigate disbenefits whilst simultaneously maximising benefits for as wide a spectrum of people as possible, particularly the regions poor. A participatory process for decision making and development is critical for this, in order to maintain consent in the process, reduce any conflict potential, and to ensure all feel included in regional water governance processes.

5.6.2 'Pro-poor' water use scenarios & possible preliminary BDP support projects

Subsistence agriculture: An expansion of irrigation support to small-scale agriculturalists, particularly in Laos and Cambodia, would significantly improve food security for the poor. Irrigation infrastructure, however, is not sufficient in itself, and a number of complimentary conditions would be required in order to make a significant impact upon poverty reduction. These include: support to small scale producers in securing or formalising land tenure rights; improvements in irrigation management, with greater development of water user associations and groups, and a process of empowerment of these groups in taking responsibility for water management; effective agricultural extension support to raise productivity, and flexible credit mechanisms to extend investment opportunities to poor producers too, whilst limiting their exposure to risk.

Possible preliminary BDP projects:

- Documenting of successful establishment of water user associations, local water user groups in each country, and sponsorship of cross learning exchanges for local government and community representatives
- Preparation of materials for dissemination in each country on the rights and responsibilities of local government agencies in land tenure regulation, and alliance building and support with local NGO's working on these issues

Cash crop production and 'value added' agricultural processing: The economic returns of rice, the main agricultural product of the region, are limited. Both governments and farmers in the LMB recognise the potential for expanding into the production of cash crops, such as vegetables, coffee, rubber, fruits and other perennials. Also important in raising the value added in primary production, and therefore the income potential to households, is on-farm or localised processing for farm products and natural products, for national markets, and even for regional and international trade. Examples include the local processing and marketing of organic coffee and fruits, production of handicrafts from local materials, and furniture and wood processing using traditional methods and designs. Promoting both cash crops and value added processing would offer significant poverty reduction opportunities to poor communities, if supported on a long term basis with extension and credit facilities.

Possible preliminary BDP projects:

- Sponsorship of research into the market potential for primary organic products in the region, and preparation and dissemination of guidance on requirements needed to meet regional and international certification standards
- Support (through a pilot demonstration project) in establishing direct linkages between rural producers of traditional handicrafts, and regional and international buyers under a 'fair-trading' agreement

Upland watershed management: Upland areas of the basin are critical to the ecological and environmental health of the region as a whole. National governments have taken steps to conserve upland watersheds by restricting what are seen as destructive traditional swidden agricultural practices by ethnic groups. These have had poverty inducing consequences for upland minority groups. Large scale deforestation and damage is also caused by logging, both legal and illegal, and there is nothing inherently unsustainable about traditional practices that have been in operation for centuries. An effective poverty reduction scenario in upland areas would require a more sensitive engagement with upland communities in seeking to ensure more effective watershed management practices, and a recognition of the role state land closure policies are having in upland areas on poverty for minority peoples. Traditional upland management practices do offer considerable potential for sustainable land, forest and watershed management practices, particularly if other harmful practices, such as large scale logging, can be restricted, and support can be provided in offering traditional cultivators supplementary opportunities for livelihood enhancement.

Possible preliminary BDP projects:

- BDP sponsored conference to discuss the role of human agency in watershed degradation, to be attended by civil society representatives, academic authorities, and government representatives
- Sponsorship of a joint MRC/ civil society cross boundary bulletin on upland management issues, with research and policy updates (to be compiled by an appropriate regional university)

Capture and culture fisheries: Fisheries are immensely important to livelihoods in the region, and any measures that significantly curtail wet season water availability are likely to impact upon millions of the rural poor in the lower basin. Many fishing communities rely upon traditional or informal rights to common resources, but these rights are increasingly under threat from enclosure by private interests, and the sale of fishing concessions. Extending rights of access for rural communities to fishing areas would make a significant impact upon poverty, as would the promotion of community based aquaculture initiatives.

Possible preliminary BDP projects:

- Sponsorship of a joint transboundary research project between the MRC fisheries programme, and interested local civil society groups and NGO's, into issues of fishing rights and conflicts in the LMB
- Alliance building activities with civil society organisations, such as joint MRC/ government and NGO/ civil society exposure visits to areas with significant fisheries conflicts.

Hydropower: A 'pro-poor' hydropower scenario would involve developing only those schemes which would not significantly impact large numbers of people. Also important would be the development of effective and genuine processes of participation in decision making around hydropower development, with those who will be primarily affected playing a full role in discussion and decision making processes. Upland communities affected by reservoir inundation are often outside of mainstream discourses on state development, and become the 'objects' of development, rather than partners in development processes. Instead of providing cash compensation measures, another form of 'transfer payment' might be the development of micro-hydro schemes for upland communities who stand to lose land or livelihood opportunities. Micro hydro and smaller schemes offer the best safeguard against large scale resettlement and dislocation of vulnerable communities.

Possible preliminary BDP projects:

- Investigation into the feasibility of micro-hydro in the region, and documenting of successful case studies from elsewhere in Asia
- Co-sponsorship of a regional conference, with interested civil society and regional organisations, on experience with hydropower development and resettlement.
- Development of a comprehensive MRC database mapping current and future hydropower development schemes for the basin, with associated anticipated social impacts and affected communities

River navigation and transport: Improving river navigability opens access to markets for rural producers, and enables remote rural communities to access the services of the state. Improved navigation, though, also requires improved river transportation. There is a high correlation in the region between poor communities and remoteness from communications networks, and so improved navigation and transport offers the potential for poverty reduction in the region, if it is targeted at improved access for the poor. At the same time, current practices of rapid clearing in the upper basin are being conducted without adequate EIAs, and without the participation of affected riverside communities, whose livelihoods are being destroyed by changes in river ecosystems resulting from the blasting of rapids.

Possible preliminary BDP projects:

- Compilation of a manual of planned river navigation improvement schemes, for public distribution
- Preparation of best practice guidelines for environmental and social impact of river clearance schemes, and establishment with local civil society groups of a monitoring network

Water borne health: Provision of safe drinking water supply and sanitation, to rural areas of the LMB particularly, would have an important impact upon health, quality of life, and thus poverty, for many of the regions poorest people.

Tourism: Promoting tourism, and particularly small scale and 'eco-tourism', offers a significant poverty reduction potential. National governments throughout the region recognise the economic potential that tourism development offers and, where benefits can accrue to rural communities particularly, tourism development could play an increasingly important role in decision making around water, through for example the protection of scenic sites of interest along the river, and the preservation of the minority cultures of people living in the upper basin.

Possible preliminary BDP projects:

- Training and transboundary exposure visits for officials and village representatives to successful micro and 'eco-tourism' ventures with significant poverty reduction impacts
- Sponsorship of a transboundary 'pro-poor tourism' development organisation

Flood protection: Seasonal flooding has always been a feature of the lower basin, and livelihood strategies have evolved over centuries to adapt, and take advantage of this. Wet season flooding is particularly important for capture fisheries in Cambodia, and southern Laos. Flood protection measures may protect poorer farmers from the worst excesses of flooding, through preserving irrigation infrastructure, but may also harm the livelihoods of those who rely upon the flood. Any significant changes in the flood regime resulting from developments are likely to have a detrimental impact upon the livelihoods of the poor, and so should be avoided.

Possible preliminary BDP projects:

- Poverty and livelihood mapping of frequently flood affected areas, with an inventory of flood dependent livelihoods
- Sponsorship of public participation forums around significant planned embankment and flood protection schemes

Social protection policies for vulnerable groups: Increased prosperity, migration, mobility and off farm work opportunities in the region offer substantial opportunities for all, but also a heightened level of risk for those of the region's poor who are least equipped to take advantage. These include rural migrants with low levels of education and training, and young rural women and children particularly who may be prone to being trafficked or exploited. Protection against trafficking and associated ills for vulnerable peoples resulting from improved communications and development in the region would be an important component in any regional 'pro-poor' development scenario.

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6 Macroeconomic overview of the Lower Mekong Basin

by Keith Ward, October 2002

6.1 Introduction

The purpose of this paper is to present an overview of current, and possibly emerging, major economic conditions in the Lower Mekong Basin (LMB) as an input to the early stages of the Basin Development Plan (BDP) process. The paper concentrates on identifying and summarising major economic characteristics and trends observable in the LMB, especially as they may be expected have implications for future water and other resources use and planning. The paper

- firstly, summarises and considers major macro-level and national/provincial economic conditions in each of the individual respective riparian countries' economies, drawing out similarities and differences in economic activity and structure across the LMB,
- secondly, attempts to consider (by outlining major factor and product characteristics, and patterns in trade, investment and labor mobility etc), the economic circumstances of LMB as a whole, by both considering the implications of the co-existence and interaction of four economies in one geographical space and also of the LMB within a specific subregional context, and
- lastly (and on the basis of the earlier sections), attempts to identify a few major emerging development trends (some of which have been called 'drivers' of development in previous BDP papers) within the LMB whose implications should be made apparent to the BDP process.

(The paper does not deal with the detailed economic characteristics of particular sectors - e.g., agriculture, forestry, tourism - as these are being or will be covered in depth by other sources).

It may be useful to note at the outset that the emphasis in the paper is fundamentally *economic* rather than *planning* in nature, i.e., it concentrates on description and analysis of existing and possible future economic conditions rather than on individual countries' development plans (which may be largely economics-based but which may or may not come to fruition).

The document also deals with the mechanics of specifying a number of indicators by which the suggested emerging economic trends in the LMB may be monitored within the BDP process, including the identification of particular data items and the documentary sources from which assessments of future economic performance may be made as the BDP process continues.

References for this paper are major statistical sources and also those sources listed at the end of the whole document. It should be noted that, as far as possible, international sources (e.g., World Bank and ADB country economic reviews, country strategies etc) rather than national sources are used as the prime sources for macroeconomic data; this is to ensure greater comparability across countries, especially in situations where international and national estimates (e.g., of GDP, growth, poverty) may differ. Because national figures are typically published before international ones there may appear to be a lag in some quoted estimates, and it is also the case that not all countries are covered by multilateral agency reports in all years; despite these undoubted disadvantages, the advantages of methodological comparability and greater objectivity are deemed to be greater.

6.2 Background

The LMB comprises nearly all (97%) of Laos PDR, about 86% of the Kingdom of Cambodia, some 36% of the Kingdom of Thailand (i.e., the whole of the northeast region and some of the northern region) and about 20% of the Socialist Republic of Viet Nam (i.e., the Mekong Delta and Central Highlands). Thus for the Cambodian and Lao areas of the LMB their national economies and entire geographic circumstances are largely synonymous with their constituent parts of the LMB, while for both Thailand and Viet Nam only (quite distinctive) parts of their economic and geographic space are included in the LMB.

While the LMB may therefore be seen as a natural physical and geographic planning unit, its economic logic and analysis may be somewhat more complex. In particular,

- the fact that the Thai and Vietnamese parts of the LMB have more in common economically (i.e., in terms of prevailing policy regimes, prices, administrations, regulations etc) with other parts of their respective national economies means that they cannot really be considered in isolation from those circumstances, and (consequently)
- the LMB economic space can really best be seen as a subset of the regional economic space created by the whole national economies of Laos, Thailand, Cambodia and Viet Nam.

The importance of a wider (i.e., essentially subregional) setting for the LMB is also strengthened by the fact that

- all constituent/riparian countries within the LMB are to some extent following export-oriented growth models, and
- all constituent/riparian countries within the LMB are formally committed to increased subregional integration, not only through the ADB-sponsored Greater Mekong Subregion (GMS) program, but through membership of AFTA (and its CEPT tariff provisions), though participation in various ASEAN fora ('10 Years of the Mekong'), by involvement in various investment promotion schemes (e.g., AIA, AICO – explained in next section) etc.

In sum, the economic space of the LMB will most fully and properly be defined in terms of all of the following:

- the constituent individual national parts of the basin, plus
- (in the cases of Thailand and Viet Nam) the relationship these specific national parts of the basin have to their formal economic hinterlands, plus
- the consequences of co-existence and interaction between four economies within one geographic space, plus
- the relationship of the economic space of the LMB to the wider subregional (i.e., GMS) economy and the rest of Asia and the world.

6.3 A summary of national-level economic conditions in the riparian countries

This section provides a summary of major macroeconomic features (such as gross domestic product, economic growth, activity composition etc) for each of the riparian countries - with an emphasis on those features of most relevance to national activities within the LMB -, and also includes a summary of broad regional economic circumstances for each of the two countries having only part of their economies in the LMB.

Cambodia

At just under $200 (1993 constant dollars, or some $1200 in purchasing power parity terms) Cambodia's GDP is low, and even recent GDP growth at around 5% for the years 2000 and 2001 combined with a national population growth rate of some 2.5% can only have a modest impact on overall levels of poverty (currently about 35%). Only about 37% of Cambodians are literate and life expectancy is 54 years; partly as a result, the country's overarching development goal is to move the country out of the ranks of least developed countries by 2020 (a new long-term national development plan for 2002-2020 is presently in preparation – 'SEDPII'), and for this to be achieved primarily requires that the growing labor force can be absorbed in the context of rising labor productivity and real wages across all sectors. SEDPII incorporates major themes of 'good governance', 'balanced growth', 'poverty reduction', and also a range of strategies for agriculture, forestry, fisheries, rural development, industry etc. Of all the national planning documents reviewed for the current study, SEDPII is most notable for its reference to the 1995 Mekong Agreement and the recognition of its importance for the country.

National physical infrastructure (particularly roads) in the country is in a dilapidated or destroyed state, sanitation covers only 20% of the population, irrigation covers only 10% of planted areas, and civil society is still in transition to a settled and democratic context. More generally typical of an economy at very early stages of development, agriculture currently generates about 30% of GDP and engages some 76% of the employed population, while industry (three quarters of which is manufacturing, including production of textiles) generates some 25% of GDP and accounts for only 8% of the employed population.

A major feature of the economy in the last two to three years has been notably unbalanced growth across different sectors of the economy, with agricultural productivity growth generally remaining low - and with the agriculture sector as a whole experiencing severe shocks in the form of major floods (e.g., 2000) - and with simultaneous rapid expansion of urban-based industries (such as textiles, construction, hotels, services etc) in the wake of continuing political stability (industrial value added in 2000 grew at double digit rates). This situation contrasts markedly with the position in 1998-99, where it was crop value added that grew by over 9%.

Within agriculture as a whole, it is true that years of floods adversely affect crops and livestock but simultaneously increase fisheries production, thus tending to keep overall sector product levels stable, but it also remains true that a national inability to mitigate flood damage tends to make investment in anything other than low input-low output, single crop, rainfed, subsistence, rice cropping virtually impossible. Low irrigation coverage also means that areas of the country can be affected by seasonal droughts while others are flooded (it is estimated in September 2002 that only a third of the rice crop has been planted in some areas, for example). The net effect is that average rice yields at 1.8 tonnes per hectare are

among the lowest in Asia, and only about 25% of domestically-consumed vegetables are produced within Cambodia (some are collected wild, about half are imported). Cambodia's inland fish catch (estimated around 430,000 tonnes annually) should be by far the most productive in the region, but past over-exploitation has reduced current catches.

Despite these problems and the other major civil discontinuities which have occurred in recent years, it is perhaps surprising that areas and production of crops such as peanut, soybean, sesame, sugarcane and tobacco have increased at all, let alone to the extent that they have (notably largely at the expense of corn, which has declined in area and output terms). Because of physical and marketing discontinuities within Cambodia, many crops produced in border provinces are sold to traders from Thailand and Viet Nam – rice, soybean, sugarcane, as well as live animals and fish all cross the country's porous borders for consumption and processing elsewhere in the region; domestic supplies of such products do not seem to reach Phnom Penh in any quantity. SEDPII includes objectives to improve finance and marketing of agriculture, introduce sustainable technologies, promote community management, link to eco-tourism, etc.

As regards other traditional sources of GDP, with the crackdown on illegal logging, passage of a forestry law and falling world prices, forestry's contribution to GDP is shrinking; on the other hand, tourism is now a major national industry, with growth in arrivals numbers being over 40% up over the previous year in 2000.

Despite massive aid flows and the growth of local (including some 'regional') finance sources, overall rates of domestic investment are still low (about 18% in 1999, for example) by Asian standards - one reason being the continuing stagnation or fall in foreign direct investment (FDI). The political instability of 1997 and the bank financing of the budget deficit (leading to a depreciation of the riel by almost 50%) caused major uncertainty among existing and potential investors. No forecasts indicate that Cambodia' tax revenues can rise significantly in the medium-term, and dependence on aid flows for general budget support will continue. A major challenge for Cambodia therefore is now to both increase public investment and improve its efficiency; mobilising revenues for recurrent expenditures will be critical. Increasing FDI flows across a number of industries (i.e., not just textiles) and active participation under AFTA are therefore key international objectives.

Because recent economic growth has not been able to productively absorb new entrants to the labor market (partly because the industrial base has historically been so low), problems of underemployment and falling real wage levels in urban areas are emerging; indeed, a major challenge for Cambodia at the macroeconomic level is to absorb the post-conflict baby boom (26% of the population is aged 10-19 years). Around 230,000 persons enter the labor market annually. Although it has experienced recent major growth (a sevenfold increase to $750 million-worth of exports in 2000 compared to 1996, for example), there must also be doubts about the medium- and longer-term viability of much of the garment industry (traditionally a footloose industry), as it presently depends on preferential access to US and European markets, where such access is not indefinitely assured (world trade in textiles is dues to be liberalised in 2005); early accession to WTO would improve Cambodia's prospects in this regard but the country will still be competing with countries such as China. There is a need to identify and develop labor–intensive and SME type possibilities. However, despite these conditions affecting the formal sector, it remains true that per capita incomes are 3-4 times larger in Phnom Penh than in rural areas; poverty is largely a rural phenomenon (90% of the poor live in rural areas).

Laos

In 2000, GDP per capita in Laos was estimated at $330 (in constant 1990 prices, and about $1400 at purchasing power parity). The economy of Laos remains largely resource-based and depends heavily on a sustainable environment to generate future growth. As well as its aid-dependence, Laos is characterised by a heavy economic dependence upon Thailand (and hence was especially adversely affected by the devaluation of the Thai baht after 1997) and increasing dollarisation of its economy (not to the same extent as Cambodia, but increasingly individuals tend to hold foreign currency rather than kip, given their recent experiences with periods of high inflation and currency depreciation). As the trade regime broadens the basket of non-baht currencies has grown. In late-2002 it seems that inflationary pressure may be re-emerging, and the kip has recently depreciated against the US dollar by about 5% over 3 months.

The current 'Fifth Five Year Socio-economic Development Plan (2001-2005)' and its sectoral constituents generally reflect these types of policy needs, with poverty reduction through increased economic growth being the overarching objective. Targets to be achieved by 2020 (under the Lao 'Strategy for Socioeconomic Development, 2002-2020) include the ending of Laos' 'least developed country' status, and the hope is that poverty can be reduced by 50% by 2005; as these targets are predicated upon GDP growth of about 7% and investment of 25% of GDP they perhaps look rather optimistic.

Major policy issues for Laos to deal with in order to attain any sort of growth path - from the Mekong lands or elsewhere - are widely regarded to be reform of the financial sector, improvements in the system of revenue-raising and government expenditure (particularly so that decentralisation can work), and the reform of State-owned enterprises (the largest borrowers from the banking system and source of most NPLs). Much donor concern now centres on the need for public sector/SOE reform and transparency as a way of making more efficient – in development terms - both official inflows and potential earnings from hydropower (e.g., Ngam Thum II).

Typical of an economy at a low level of economic development, agriculture accounts for over half (some 53%) of GDP and employs about 85% of the workforce. Industry and services account for roughly a quarter of GDP each. Like Cambodia, future economic growth will have to build upon improving productivity in agriculture and releasing resources (especially labor) to more productive sectors of the economy. However, most observers of the Lao economy highlight its more obvious current features such as: an inadequate public sector institutional structure (which is technically weak, and typically focused on targets rather than incentives; a poor climate for private investment (including tariff- and non-tariff-based restrictions on flows of products, in particular inadequate finance at all scales of operation); extremely poor rural physical infrastructure; and, a small and scattered population that is difficult to reach by government services (and that also represents a very modest level of purchasing power for final products).

Despite these disadvantages, real GDP growth in Laos has been higher and more stable than that of Cambodia in recent years, at over 7% in 1999 and nearly 6% in 2000. Population growth of around 2% a year tends to reduce the impact of this growth to many individual households. Poverty remains relatively high, at around 39%, and increasing real national incomes have been associated with increasing inequality in recent years. Growth is also somewhat more evenly balanced among the major economic sectors than is the case in Cambodia; agriculture tended to lead the recovery from the regional financial crisis in 1999 and industry and energy production (mainly for export) were major growth contributors in 2000. The country's textile exports are not as large as Cambodia's, but were still significant at

nearly $80 million in 2000. Energy production and services (particularly tourism) are increasingly important to the national economy.

Figures detailing savings and investment rates in Laos are partial, but it is likely that the savings rate is low (at about 13% of GDP) and much of what constitutes real capital formation lies outside the scope of the formal financial system (where high levels of inflation and administratively-set interest rates discourage depositors). The current reforms in favour of decentralisation are having major impacts on public finances, with the results that sectoral allocations are unclear and likely levels of recurrent expenditures will not be sufficient to meet projected service demands. Again similar to Cambodia, a characteristic of the macroeconomic environment is large inflows of concessionary finance (80% of the PIP is accounted for by ODA).

One other characteristic feature of the Lao economy is that much of the country's identifiable economic activity is confined to the Mekong Corridor (and to a much lesser extent the border with Viet Nam) and that the value of imports and exports (both formal and informal) probably equals about the same amount as annual GDP. Again, some observers argue that Lao PDR is beginning to emerge from its relatively static historical state, and that the Mekong flatlands are entering a phase of agricultural transformation. While overall national cereal production figures are essentially stagnant, some crop areas with ready cash markets (e.g., peanuts, coffee, maize, cotton, and several types of vegetables) have seen production increases in recent years, and the overall growth rate of agriculture has gone up to about 5 percent a year from a more traditional 2–3 percent a year. This is probably the result of market signals being allowed to operate, the greater availability of inputs and access to markets, and freer access for local and foreign entrepreneurs (when previously there was effectively no access at all).

Thailand

Thailand's economy is qualitatively and quantitatively different from those of Cambodia and Laos. With per capita GDP of around $2000 (at 2001 current prices, and at about $6000 in purchasing power parity terms) and agriculture's share of GDP being only 10% (the remainder being roughly equally split between industry and services), plus annual population growth being only 0.8% and the proportion of the population in poverty being some 15% (in 1999, although this is up from around 11% three years previously following the 1997 crisis) it can be seen that the country as a whole is in a different development league.

The last few years have seen the country try to recover from the 1997 currency and financial crisis; after falls in GDP in 1997 and 1998 the economy grew at some 4.2% and 4.4% in 1999 and 2000 respectively (current NESDB estimates for growth - October, 2002, as reported in the 'Bangkok Post', are 4.5% for 2002), largely driven by increases in export earnings. Nevertheless, incomes are today (2001 figures) on average 8% less than pre-crisis levels, and agricultural prices (both worldwide - for exports - and domestically) remain particularly depressed. Credit expansion for new economic activity remains limited because the financial sector is still plagued by NPLs. Thailand's '9th Socioeconomic Development Plan' incorporates a number of objectives aimed at bringing the country more balanced and sustainable development than in the past, with emphases on good governance and strong social foundations, natural resource and environmental management improvements, attempts to address poverty in the Northeast by supporting grassroots movements and linking urban and rural activities, and upgrading national competitiveness, technology and the science base of the country.

Thailand is one of the world's major primary products and agro-industrial producers (sometimes referred to as a NAC - 'newly agroindustrialised country', and compared with, for example, Chile). Its first wave of sustained economic growth in the 1980s was largely due to its success in agricultural and agro-industrial production and trade. Between the mid-1960s and the mid-1980s, the average annual real growth rate of agriculture was 4–5%; this was based on the expansion of cultivated areas, increasing mechanization and capital-for-labor substitution, and increasing input use. The country produces a wide range of agro-industrial products and is, for example, the world's largest canned pineapple exporter and the centre of the world rice trade. Thailand exported 586 billion baht-worth (approximately $15 billion) of agricultural exports in 1998, representing just over a quarter of all national exports by value. In recent years, resource over-exploitation (including water - often thought to be a free good as it is effectively unpriced), over-use of chemicals, and over-pricing of unskilled labor have come to be seen as emerging problems for Thai agriculture and agroindustry.

The Thai part of the LMB comprises the whole of the Northeast Region and some of the Northern Region (Chiang Mai, Chiang Rai, Nan, Phayao etc). Much of the northeast of Thailand (i.e., the Khorat Plateau) is flat, and some areas are prone to both drought and flood. Traditionally, this is Thailand's poorest and least irrigated region: average rice yields here are about 40 percent of those on the central plains. Such areas have been relatively neglected in development planning terms and more effort is now being focused on them in the context of both reducing poverty and promoting more balanced national geographic development. Poverty reduction is important here: the National Economic and Social Development Board (NESDB) estimates that average per capita incomes at around 27,000 baht a year (1999) are one third of those in Bangkok; regional growth has historically been significantly lower than the national average. In addition, recent NESDB surveys have confirmed that poverty (in national terms) is now largely a rural phenomenon and has been exacerbated by remigration and declining real rural wage levels since the financial crisis of 1997. Regional planning for the Northeast (a new plan under the 9th plan is now in preparation) is now strongly oriented around poverty reduction, and most new initiatives involve returning to (and-re-examining) opportunities in agriculture and agroindustry.

To see how the Thai areas of the LMB differ from the country as a whole, it need only be noted that in addition to the poverty and income figures just quoted) agriculture's share in regional GDP is still well over 20%. Industrial activity is dominated by manufacturing (including agroindustry, but also some textiles, light assembly, rubber processing etc). However, despite its relatively poor status in national terms, the Thai northeast and northern areas remain by far the most developed areas of LMB in agricultural and agro-industrial terms. Medium and large local and national companies have made major investments in all types of food processing, chillies, animal feed production, wood products manufacture, fertilizer and other agrochemical production, and various sorts of agricultural equipment manufacture. Many farmers are engaged in aquaculture in farm ponds. Dairying is widespread and milk production is increasing, poultry and shrimp farms are found throughout the region. Households generate many food products (sauces, noodles, honey, sweets, dried fruit) and handicrafts (paper, silk, umbrellas, toys) for sale. The acquisition of raw materials for medium- and large-scale agroprocessing is typically done through householder contract outgrowing (rather than on company-owned plantations, and leaving the sector dominated by smallholders) who are often supplied with inputs, such as seeds and agrochemicals. The very good physical infrastructure, such as all-weather roads, bridges, and storage facilities, facilitates both movement of produce to market and the supplies of inputs to farms, households, and commercial enterprises by truck.

Viet Nam

With per capita GDP at $370 (1999 current prices, and at about $1900 in purchasing power parity terms, and estimated at $400 in the 'General Strategy on Growth and Poverty Reduction, 2002) Viet Nam is not as poor as Laos and Cambodia but is clearly not in Thailand's class (and lags behind even the Northeast of Thailand). The country experienced very fast aggregate growth (averaging 9% a year) across all sectors throughout most of the 1990s, but this had slowed to around 4.5% a year by the end of the decade – although has now picked back up closer to 6-7% (current CIEM estimate – multilateral estimates would be about 1% lower). The major net effect of such growth was to cause the share of GDP accounted for by agriculture to fall to some 25.7% in 1998 - down from 40% exactly 10 years earlier - and to 24.3% by 2000. In policy terms, the 'Social and Economic Development Strategy – 2001-2010' adopted by the 9th Party Congress in 2001 (and the '2001 Strategic Plan for Agriculture') pursues the aim of industrialisation and (consequently) structural transformation (targets include for agriculture's share in GDP to fall to 17% and for poverty to be reduced to below 10% by 2005 and to be 14-15% of the population in 2002). Although there may be some evidence of improvement in total factor productivity (TFP) in Viet Nam, the country remains broadly uncompetitive in international terms – its low costs of labor being more than offset by high business and overhead costs (a recent JICA study, for example, confirmed these findings). A national 'Commission on Economic Integration' has recently been set up to investigate the consequences of increasing openness.

Consistent with a large-scale move of population out of relatively low productivity agricultural activities and towards higher value-adding industrial and service activities is the fact that national estimates of poverty declined from 58% of the population in 1992/93 to 37.4% by 1998 (like in the other countries, this effect has been achieved through overall increased growth rather than more equitable distribution of incomes), and is now about 17% according to Government of Viet Nam's poverty line (and about 32% using, for example, World Bank measures).

Industrial sector expansion prior to 1998 had largely been driven by manufacturing growth, but sluggish domestic demand after that date caused the main drivers of non-agricultural growth to be heavier industry (including mining, oil production for export, and construction). Volume increases of oil, agricultural and garment exports have kept the external balance position strong (despite major reductions in flows of FDI since 1998), but the internal economic environment remains dominated by the slow pace of economic reforms (i.e., dealing with SOEs and the financial system) and the need to improve the business environment. The rate of SOEs economic growth has in some years been negative, which is particularly troubling given that they dominate in the capital-intensive industries (including oil and gas), and the declining private share in the economy is not a welcome development.

Services sector (i.e., anything form street trading, wholesale and retail trades, real estate, employment in hotels etc) growth in Viet Nam was dramatic prior to 1998 and was responsible for massive job creation and overall economic structural change, but has slowed since the regional crisis, contributing (along with SOE layoffs) to rising unemployment.

Despite its falling share in GDP composition, agriculture still employed 70% of the population (i.e., some 50 million people) and accounted for 40% of export values in 1999. Agriculture production remains dominated by rice (which accounts for half the value of the sector's output), a crop which has seen major area and yield increases in recent years. Simultaneously, there have been significant moves towards diversification into perennial crops (rubber, coffee, tea) and annual crops (e.g., sugarcane). Very limited physical infrastructure (especially road and rail links), major floods, and poor post-harvest and storage

practices mean relatively large losses to rice and other crops on-farm and between farm and market. Unless there are technical and policy improvements, the recent lessons from coffee oversupply and poor product quality may also have to be learnt in aquaculture, dairying, mulberry and fruits cultivation etc.

With a large population (of over 70 million) and generally hilly topography, farm sizes are very small: only 22 percent of the land area is used for agriculture, and farm sizes average just 0.3 ha in the Red River Delta and 1.1 ha in the Mekong Delta, for example. Vietnamese farmers (especially in the Delta areas) maximise returns to land (unlike in Thailand, where returns to labor are maximised) and rice yields are among the highest in the region; it is also here that major moves into fruit trees (as is the case in the central region of the country) and aquaculture are occurring.

Most major policy reforms in agriculture have been facilitated by World Bank and ADB interventions and are expected to continue in the future, although they will probably address rather more specific issues than in the past. The signing in 2000 of the Viet Nam-US trade agreement is expected to give substantial impetus to Viet Nam's exports, including many agro-industrial products. For example, the agreement lowers duties on food products, nuts, fruits and vegetables by three quarters. However, adoption of the AFTA tariff provisions will mean that current protection for some internationally-uncompetitive activities (e.g., sugarcane) will have to disappear.

Much of the central highlands area of Viet Nam (including that in LMB) has highly seasonal rainfall, short river basin systems, denuded catchments areas, and relatively poor soils. Agriculture is disproportionately important in this poor region where it accounts for nearly half of GDP, although rice yields are well below the national average. Manufacturing in the central region of the country is generally very underdeveloped: with about 30 percent of the country's population, the region accounts for less than 10 percent of national industrial output. In the Mekong Delta provinces, industrial output is about 9% of the country's total (from 24% of its population). The government's intention for the Mekong River delta (as evidenced in the '99 Decree', for example) is to promote its role as country's largest rice and agro product producer, to increase commodity production and raise quality of cash food, vegetables, fruit (e.g., mango, mangosteen, dragon fruit, papaya, rambutan etc), animal husbandry and aquaculture (turning some 250,000 of rice paddy into aquaculture by 2010), to raise the proportions of labor employed in industry and services, to complete the river transport network, and also to 'plan and construct populated areas and infrastructures adaptable to annual flood control and counter-salinization abilities'. As regards agricultural intensification and diversification, it may be the case that agronomically it is possible to produce a wide range of fruits, but it also apparent that marketing and processing services for large volumes of produce are still absent, and that recent attempts at planning embankments have been poor.

Water quality remains a major source of concern for all natural resource- based activities within the Vietnamese part of the LMB, and new World Bank and Australian aid (AusAid) initiatives are exploring ways of improving resource management structures in the delta. In both the Central Highland and the Mekong Delta (as well as in the small area of LMB in the northwest of the country) exposure to the circumstances of poverty remains strongly linked to vulnerability to shocks (both physical – e.g., floods, and economic –e.g., falling commodity prices).

Summary

The summaries just provided on a country-by-country basis thus help to identify major economic trends and future development aspirations within individual economies, which obviously need to be taken into account when preparing the BDP. The following table highlights some key features of the four summaries, in order to help comprehend both the similarities and differences across countries. From the table and from the earlier summaries, common economic themes and trends can be identified which will have impacts on resource use and planning. Where countries are most similar in this regard is (very broadly, and with some caveats applied perhaps to Thailand) in terms of their general output mix, their need to further diversify economically and to raise factor productivity, their need to attract investment from outside the region, and the need to pursue a form of economic growth which has poverty-reducing impacts; these commonalities of economic activity can be expected to be accommodated within a BDP.

However, it is also apparent that economic activity and future developments within the whole LMB are likely to be more than the simple sum of those within each national area, because of the proximity and integration of all the economies within a subregional and LMB context. What is arguably equally clear from the national-level economic pen-portraits is that the single shared geographic space of the LMB is really comprised of a nexus of four economies which, although they undoubtedly share some characteristics, are also notable for their differences as well as their similarities.

The general levels of economic development (as measured by real per capita GDP and the extents of structural transformation away from an economy in which agriculture predominates, for example), the proportions of populations in poverty, the differing abilities to mobilise domestic resources for public spending and for investment, etc inevitably mean that these economies will view the shared resources of the LMB differently from an economic, as well as technical, perspective.

The fact that the LMB contains such economically-differing areas means that factor costs and product/output mixes will be different across national areas within the LMB. This, in turn, encourages trade and production specialisation to develop, although the extent to which this may happen and/or is formally encouraged by governments depends upon the nature of prevailing trade and investment regimes, and also the extent to which informal flows of goods, finance, services and people may occur (either by being encouraged or by failing to be stopped). The net effect of these circumstances in economic terms is that the interaction between resources within the LMB across national borders may well be as important as what is planned within any one country's geographic space (especially for the smaller countries), and that individual formal national economic policies and plans will only partly determine eventual development outcomes.

Table 6.1: Countries in the LMB: Summaries of major economic features

	Cambodia	Laos	Thailand	Viet Nam
Incomes, growth and poverty	GDP at PP about $1200, recent growth of around 5%, but concentrated in urban areas. Poverty about 35%	GDP at PPP about $1400, positive recent growth at about 6-7%. Poverty at 39% - and persistent	GDP per capita at PPP about $6000, in Northeast about $2500? Slow recovery from 1997 (recent growth 4%), with increasing incidence of poverty in North and Northeast (16%?)	GDP per capita at PPP is about $1900. Rapid growth in early 1990s, slowed to about 4% by end of decade, now about 6.5% Poverty about 17-32% ('hunger' and 'income' measures)
Macro-economic stability and the investment climate	Civil society increasingly stable; low inflation now; major (50%) riel depreciation in 1997. Lack of transparency and rule of law impedes FDI	Historically baht-zone dependent, kip depreciation. Periods of high inflation. FDI falls	Baht depreciated 60% against US$ since 1997. Concessional / official funds limited, domestic finance still constrained by debt overhang/NPLs. Good investment climate with real incentives for LMB areas. Inflation less than 1%	Currency stable against US$, appreciated against regional currencies post 1997. Dominance of some areas by SOEs, poor business environment. FDI declining.
Agriculture in the economy	30% of GDP, 77% of workforce. Sectoral activity composition severely impacted by flooding. Little diversification	53% of GDP, 85% of the workforce, extensive regimes, subsistence-oriented with emerging trends towards commercialisation on Mekong flatlands (large informal trade with Thailand)	10% of GDP (20% in North/Northeast); massive and diversified national agroindustry ('NAC') contributes to export earnings and economic recovery. High labor costs.	24% of GDP, 40% of exports, 70% of labor force. Recent diversification (including fruits and aquaculture), land-intensive farming (esp. Mekong Delta), increased export earnings and contribution to economic recovery
Industry in the economy	25% of GDP, 8% of employment; overwhelmingly textiles (threatened?)	22% of GDP, mainly handicrafts and some agriprocessing / assembly	40% of GDP; focused around BMA. North/Northeast largely light manufacturing and agroindustry. Weak national education base, relatively expensive labor	35% of national GDP, but less in LMB areas. Early 1990s manufacturing growth has slowed. Major oil and gas earnings

The following section of this report therefore attempts to highlight some key features of the LMB economy as a whole, and considers their implications for future economic development trends.

6.4 The economy of the LMB

The previous section suggested that, while from the purposes of more typical planning exercises (e.g., those conducted for one region in a country or for one country as a whole) it may only be necessary to understand economic structures and activities in that region or country, where the planning exercise covers a geographic space containing several economies within a well-defined sub-regional context it also becomes necessary for other dynamics to be taken into account. Accordingly, this section provides an overview of factors which can be expected to influence development trends in the LMB and which are beyond the scope and scale of any one country's planning or control.

6.4.1 Overview

Firstly it may be useful to consider some basic economic characteristics of the LMB as a whole. These might be summarised as:

- the economy of the LMB is overwhelmingly natural resource-based, and perhaps three-quarters of the basin population still depend directly upon agriculture, fisheries and forestry for their livelihoods
- the product base of agriculture is remarkably similar across the LMB; although there are differences in the endowment of natural resource-based factors of production (such as climate, soil types, topography and altitude, and water), each of the four national areas is capable of producing a mixture of grains (rice, maize) and other food crops (cassava, sugar, sorghum), oil crops (groundnuts, soybeans, sesame), tree crops (coconut, oil palm, rubber) and fruits and vegetables (pineapple, durian, mangoes, onions/shallots, garlic, beans, tomatoes, cabbages), livestock (poultry, cattle, pigs), and aquatic products (fish, prawns, squid) in larger or smaller volumes. Wet season rice cultivation still predominates in LMB, and all countries are now in a surplus of production over domestic consumption (this involves very large volumes for Thailand and Viet Nam, much smaller amounts for Cambodia and Laos)
- apart from the North and Northeast of Thailand, industrial development in LMB is very limited in scale, and restricted in scope to some natural resource processing/agroindustrial activities and relatively small amounts of manufacturing
- despite the dependence of population on the sector, agriculture only accounts for about 25-30% of LMB GDP, implying much lower average returns than in industry and services, for example
- the corollary of this situation is that many rural people are poor, and that around a third of the total LMB population could be defined as poor. As a result of this poverty and generally low income levels, savings rates in all areas (except the Thai parts of the LMB) are low by regional standards, and
- all countries see economic growth as the principal way to reduce poverty, and this will involve continuing moves towards greater economic openness (trade as proportions of GDP is growing in all LMB countries), higher factor productivity across all sectors (implying increased investment and skills upgrading) and economic diversification. All countries subscribe to a view that increased subregional economic integration contributes to this process.

However, despite this superficial homogeneity across the LMB, the economic characteristics of the LMB also incorporate the following features, which make for a somewhat less consistent and 'plannable' economic context

- the LMB economic space actually comprises economies of two quite different scales and scopes; on the one hand are Cambodia and Laos, who are both late-comers to development and industrialization with small internal markets and high transaction and transport-to-market costs, and on the other hand are Thailand and Viet Nam - both economies with large internal markets, diversified agricultural and industrial bases (in their national contexts) and relatively lower costs to market (both to their own domestic markets and to foreign markets)
- the economies of Laos and Cambodia are characterized by heavy official development assistance (ODA) reliance, Viet Nam less so and Thailand not at all; this affects to a large extent how government priorties and policies are formed
- macroeconomic-level policies (affecting exchange rates, trade and investment, money supply and credit, taxes and subsidies to producers/consumers etc – with effects in the respective national areas LMB) will be set by Thailand and Viet Nam for purposes other than those connected with that part of their geographic space in LMB alone, and these will have a higher economic and policy priority than simple LMB considerations alone
- the internal transactions of the LMB economy are characterized by significant formal/official barriers to factor and product movements (set at national level), but large and growing formal and informal trade volumes and values and increasing factor movements (notably) across national borders. Evidence suggests that these informal flows respond directly and quickly to aggregate and nationally-differential rates of growth (and changes in these rates), and can significantly constrain (and even undermine) national and sectoral development efforts for small economies
- partly because savings rates are low, each national area of the LMB (apart from Thailand) competes for FDI as a source of capital for new ventures; nationally-defined investment regimes across the LMB vary considerably. However, despite this need for finance, the investment climate in three of the four countries (again, excepting Thailand) is characterized by a lack of consistency, high transaction costs and (in Cambodia's case) a very poor legal framework. As a result, LMB is not generally viewed particularly favourably by FDI sources outside the region.

The economic characteristics of the LMB economic space just described will continue to influence its growth and development for some time to come. In order to understand how these developments may occur it will be appropriate to summarise the patterns of trade and investment in LMB, and also to look at the consequences of the LMB generally having fairly porous borders, such that significant informal trade and factor movements can take place.

6.4.2 Trade and investment patterns

One major feature of economic growth in the whole of the Greater Mekong Subregion is that formally-recorded trade between countries is growing significantly; as an example, the combined value of exports and imports between Laos and Thailand has grown by an average of 33% a year during the last decade (to 2000). The structure of this trade as recorded in the official statistics, reflects individual countries' comparative advantage, for example;

- Thai exports to Laos are mainly vehicles, machinery, fuels, fertilizer, salt, pharmaceuticals, glassware etc

- Thailand can export relatively high value fruits (e.g., mango, longan) and processed products (e.g., juices, concentrates, processed fish and livestock items) to Viet Nam
- Lao exports to Thailand are wood and wood products, gum, oilseeds, live animals
- Lao exports to Viet Nam are gypsum, wood, animals
- Viet Nam's exports to Lao are cement, construction steel, sawn timber.

(There is no formal data for Cambodia's exports by category/destination, but rubber is known to go to Viet Nam, fish to Thailand and in return the country imports a range of manufactured and processed items from both these countries).

In general, based on calculations of revealed comparative advantage (RCA) from trade data, it would seem that both Thailand and Laos have comparative advantage in natural resource-intensive vegetable and animal products, Viet Nam has advantage in some unskilled labor-intensive products (e.g., footwear, clothing) Laos has comparative advantage in mineral products and Thailand in a full range of prepared foodstuffs and skill-intensive products (e.g., electrical and non-electrical machinery). Cambodia's comparative advantage will almost certainly be in natural resource-intensive unprocessed products, such as rubber, fish and some other niche crops (e.g., organic rice).

In addition to growth in aggregate trade volumes and values, it is also apparent from published trade data that LMB countries are increasingly exchanging similar types of goods. This inter-industry, or two-way, trade (IIT) indicates an increasing degree of interdependence of trading partners, and is typically associated with both economies of scale in production and of the production of differentiated goods. IIT calculations suggest possibilities for Thailand and Laos to collaborate across a whole range of goods, from animals and plywood to fabrics and tractors, and for Thailand and Viet Nam to collaborate across a whole range of natural resource-intensive products (e.g., wood, skins, vegetable materials), unskilled labor-intensive products (e.g., footwear, furnishings) to technology-intensive products (such as valves, transistors, optical fibres etc).

While the full range of products quoted as examples above are not made within the LMB (many coming from countries' more industrialized areas), the general point to make from this discussion s simply that formal trade within and among the LMB countries is increasing, that it is based on national/regional comparative advantages and that it can be expected to both increase and (probably) become more specialized; this is as likely to apply within LMB as anywhere else.

As regards investment patterns within LMB, it has already been suggested that three of the four countries' overall investment stances are not especially positive; the LMB in general must be seen against the background of its own low aggregate savings rates and the general decline in FDI since 1997, most of which was previously coming from crisis-affected countries (such as Japan, and also Thailand itself). The scale of the contraction can be seen by the fact that by 1999 FDI approvals into Laos and Viet Nam had fallen to about 10% of their 1996 levels. Cambodia's boom years of FDI enthusiasm (largely for textiles) are over, and FDI has fallen for the last few years. Political risks, high costs of doing business, competition from China (with its cheap labor, world's largest internal market, strong growth etc), and the slow economic recovery worldwide and in Asia, all suggest that this trend will not be reversed in the short term. The exception to this trend may be as regards China as a source of investment funds – some areas of LMB (e.g., northern Laos) are presently seeing notable amounts of Chinese investment in garments, some agroprocessing, hotels and tourism etc, although not yet into any major manufacturing enterprises.

Another consideration is that investment policies and other regimes (including tariff and non tariff barriers) across LMB are not harmonized, meaning that each country (and thus national area of LMB) is effectively competing for FDI with its neighbours; this limits scope for large-scale and cross-border investment. General trade and investment conditions within LMB have also been massively affected by exchange rate changes in recent years; the real (i.e., price inflation-adjusted) cross rates between LMB currencies changed by up to 50% after 1997 (when the baht fell, kip followed suit, riel fell later in the year in response to political problems and government monetising the budget deficit, but the dong remained strong as foreign trade was still dollar-invoiced).

While there are various ASEAN schemes (e.g., ASEAN Investment Area, ASEAN Investment Cooperation) schemes to promote inter-regional trade and investment, and moves to implement the AFTA-CEPT arrangements and (in Cambodia', Laos' and Viet Nam's cases) moves to enter WTO, the impacts of measures these to date are modest, and the overall formal trade and investment environment for the subregion as a whole, including LMB, is not conducive to major change. Opportunities for parts of individual countries to combine to overcome such obstacles (at least at the local level) through participation in 'growth triangles' and economic corridors provide part of the rationale for the kinds of economic cooperation described later.

6.4.3 Porous national borders; consequences of factor and product flows within LMB

Another major feature of the LMB economic space is that national borders within the LMB are relatively porous; the result is that finished goods, semi-processed items, unprocessed raw materials and people can all move across borders to other parts of LMB, and thus beyond to other regions of LMB countries.

The incentives for movement of products are based on the fact that

- markets for goods may not exist in places where commodities are produced; e.g., national physical infrastructure discontinuities may be so large that it is easier for primary goods to be marketed in neighbouring countries than within other regions of the producing country – good examples are provided by agricultural production (including khao niao, garlic, ginger, vegetables, fruits, live cattle) from the 'Mekong Flatlands' of Laos; and fish, maize, soybean, rice, rubber etc (from the border areas of eastern Cambodia) which travels informally across the Thai border, and
- the markets of the two smaller countries (i.e., Laos and Cambodia) are very small (6 and 12 million consumers respectively) relative to the internal markets of Thailand and Viet Nam, and their historical industrial bases are much smaller; this means that potential producers of processed or manufactured goods in Laos and Cambodia are always competing against larger producers in the neighbouring countries who benefit from both economies of scale in producing for their large (i.e., 60 million in Thailand, 70 million in Viet Nam) consumer base and also from generally lower infrastructure and service costs. The tendency is thus for goods from Thailand and Viet Nam (lower quality but lower cost) to cross both formally/legally and informally/illegally into the smaller countries, undermining domestic attempts to diversify and add value by internal processing and manufacture.

(It should also be mentioned that all countries of LMB compete against China, many of whose goods are now increasingly appearing in the region – undercutting Thai and Vietnamese products - especially so as a result of the recent trade and navigation agreements made along the upper Mekong between Thailand, China, Laos and Myanmar).

The consequence of this economic structure within the whole of the four economies has thus largely been to keep the LMB as an area of primary production, with much of the produce destined for processing either within the Thai northeast part of LMB, the Vietnamese Mekong Delta part of the LMB (to a much lesser extent) or other areas of Thailand (notably the east and around Bangkok – especially for fisheries from Cambodia, for example).

The scale of the informal trade in products among LMB countries is of course difficult to measure, but is widely regarded to be large and growing. Recent studies by ADB in the GMS context (e.g., the Pre-investment Study for the East-West Economic Corridor) and other sources suggest the combined trade within LMB is probably worth at least hundreds of millions of dollars a year, and it is now (for example) an implicit part of the Laos national agricultural strategy to allow for production from the flatter areas of the country (provinces like Thakek, Savannakhet and Champasack, which neighbour Thailand) to be destined for places where product markets exist.

It is of course also the case that the porous borders allow for movement of factors of production as well as products. Labor can move relatively easily from the LMB to areas of Thailand and Viet Nam where employment opportunities exist, on both temporary and semi-permanent bases. Many studies of labor migration in the region highlight the importance of Lao and Cambodian labor to Thai industry; while this movement often has exploitative and risky dimensions, it is also true that for many rural households having one or more members earning cash incomes can be a major part of a diversification strategy in an overall livelihood context where domestic/national opportunities are very limited. While no figures are to hand, it seems likely that LMB as a whole would be an area of net labor out-migration rather than in-migration, although within LMB itself there will also be movements from rural areas to the larger towns and cities (e.g., Phnom Penh, Vientiane, and places like Siem Reap, Sihanoukville, Pakse, Savannakhet etc). The consequences for restricted national development as a result of (often localised) labour shortages due to migration need also to be noted.

As long as national borders remain as porous as they are at present they will continue to exert a major influence on the nature of economic growth and development within LMB. Inter alia, the de facto openness of the LMB borders suggests that much of the LMB will remain as a source of primary materials for processing elsewhere (although including the Thai North and Northeast) and that the national industrialisation/diversification/value adding efforts of the smaller countries to produce for their domestic markets will always be undermined to some extent by the proximity of larger and lower cost producers. While this situation may seem, a priori, somewhat pessimistic for the national development efforts of Laos and Cambodia, its positive side (when combined with the trade and investment circumstances across LMB described earlier) is that it provides strong rationale for economic co-operation among the countries of the LMB, which in turn can offer opportunities for significant long-term economic growth.

6.4.4 Incentives for integration, and scope of ongoing initiatives

Given what has just been said about economic conditions within the LMB (and the GMS generally) it is not surprising that various forms of economic co-operation have been advocated by multilateral agencies (notably ADB) as a way to accelerate the subregion's development; the impetus for this integration is also given further strength by the continuing slowness of economic recovery in the USA and Europe (such that simple export-led growth alone might be relied upon to help the subregion) and the shortage of FDI (in particular from Asia).

In order to see how the relevance of greater integration within the existing economic framework of LMB can potentially work to all countries' advantage, it is useful to summarise what drives economic cooperation and what the nature of the benefits are. In sum, the realization of benefits from economic cooperation is partly about helping promote subregional production on the basis of underlying comparative advantage, but is even more about promoting cooperative subregional competitive advantage, i.e., by assisting each of the national areas to identify and develop commercially-viable projects across a range of sectors, allowing the combination of different factors of production across national boundaries, pursuing suitable policies toward the "software" of appropriate trade and investment regimes and human resources development, and adopting programs of public investment in the "hardware" of physical infrastructure (such as roads and ports, industrial estates and processing zones, etc). In the present context, therefore, the notion of comparative advantage is fundamentally based on economic prices, and that of competitive advantage is based on financial prices, and thus subject to influence through various government policies (e.g., on taxes, subsidies etc).

The sources of benefits from subregional economic cooperation can be summarised (with some examples from LMB) as follows:

- differences in factor endowments (such that businesses/projects can combine across national borders – new land for cultivation may be available in one country only, one country may be in a surplus of energy and another in deficit),
- differences in factor prices (labor may be plentiful/cheap in one area, scarce/expensive in another – e.g., west of Cambodia and eastern Thailand),
- differences in access to capital (Northeastern Thai investors may have cash to invest in Laos or Cambodia; Laos, Cambodia and Viet Nam have declining FDI flows)
- differences in levels of technical and managerial skills (skills in agroindustry in Northeast Thailand - and/or Mekong Delta?),
- differences in proximity to markets (i.e., to bring about cost reductions – to help Laos and Cambodia export)
- realization of economies of scale in production, and joint product marketing (to reduce overall costs)
- inward investment attraction (promoting 'Mekong', 'Indochina' etc), and
- realization of other externalities (environmental benefits in managing shared resources – e.g., the Mekong).

The LMB is already being influenced by various efforts at economic integration. Overarching these is the ASEAN structure, and in particular the recent 'Initiative for ASEAN Integration' (IAI), which attempts to get the four 'new' ASEAN economies of Myanmar, Laos, Cambodia and Viet Nam closer to those of the other original six members. ASEAN also contains numerous other specific initiatives (e.g., AICO and AIA) designed to promote cross-border economic integration.

Efforts at economic integration are also being promoted by all the LMB countries (plus Yunnan province in PR China, and Myanmar) through the ADB GMS program and cover a range of sectors, some are more local-level and focused initiatives; some are simply planning exercises to date, others have had significant investments in physical infrastructure already made. Various of them exploit major investments in roads, airports, river transport, communications, environmental management, and tourism which are being made or are planned within the GMS context or by individual countries. Some examples of these

initiatives which involve – or impact on - the LMB economic space (and need to be reflected in BDP work over the longer term) include

- the East-West Economic Corridor (involving Northeast Thailand and central Laos as well as central Viet Nam - among other areas -, and based on current upgrades of Route 9 in Laos, a new bridge across the Mekong etc), which involves agriculture and agroindustry, industrial estates and processing zones, improved logistics and communications (There is another – Japanese-sponsored – variant on this corridor, called the West-East Corridor, although it is likely this will subsumed within the former concept)
- the proposed 'southern economic corridor' which links Bangkok, Phnom Pennh and Ho Chi Minh City (there are two alternate routes – one coastal mainly and one primarily inland). The recent rehabilitation of the Phnom Penh-HCMC section through a joint ADB loan to the two countries underpins part if this corridor
- the Thai-Cambodian 'Master Plan for the Border Area' (2002-2012), involving some 7 Thai and 7 Cambodian provinces with multiple border crossing points and including trade promotion, border industrial estates, joint tourism, and agricultural cultivation (e.g., soybeans, maize, oilseeds for processing in Thailand), and
- the 'Emerald Triangle' involving small border areas of Thailand, Laos and Cambodia and promoted by the Tourist Authority of Thailand (little development has happened so far), and another 'growth triangle' is being discussed between Cambodia, Laos and Viet Nam,
- the recent agreement about navigation on the upper Mekong between Thailand, Laos, Yunnan and Myanmar, and also agreements about blasting 11 sets of rapids in this region to facilitate larger barge movements, and
- numerous other studies of potential for cross-border economic cooperation have also been undertaken (e.g., JICA studies of possible Thai-Lao border joint border area development, joint Mekong tourism planning) or are envisaged (e.g., North-South Economic Corridor from Yunnan to Bangkok, which would include road and river transport in LMB areas). ADB is also considering work in northern Laos to identify ways to exploit economic complementarities between Laos, Thailand and China in a way that will not despoil the environment (this is in anticipation of joint rehabilitation by China, Thailand and Laos of Route number 3). The recent (1999) study conducted by NESDB of the possibilities for the development of Thai border towns also has major cross-border implications.

This kind of model of cross-border economic integration can also be applied on a national basis, i.e., within one country, if the right combination of factors is felt to be present. Viet Nam (for example) has a policy of promoting two 'growth triangles' centred on Hanoi in the north and Ho Chi Minh City in the south, where the idea is to combine large domestic demand with different sorts of agricultural and industrial resources to produce economic growth *('agrobelts around major cities'* according to the 2000-2010 economic strategy).

6.4.5 Summary

This section has summarised the major features of the economy of the LMB and has examined the single geographic space in terms of its four constituent economies and the implications of their coexistence, given both the porous nature of national borders and the general trade and investment regimes which prevail across the countries. The incentives for, and nature of, moves towards increased economic integration as a driver of future economic growth have been explained. While it may be impossible to predict how far these formal

cross-border initiatives towards economic integration will actually drive economic growth, the underlying nature of the economic conditions within LMB from which they derive their rationale is hard to dispute.

Given these circumstances of the LMB as a whole, and the national macroeconomic and development planning aspirations described previously, the next section of this paper tries to identify some of the major features of its likely future economic growth.

6.5 Emerging economic development trends within LMB

6.5.1 Introduction

There are perhaps three major sets of determinants of economic growth affecting the LMB, each of which acts at different level:

- firstly, are the economic development policies and plans (including State spending, tax, exchange rate and monetary policies) of the four individual LMB States themselves
- secondly, are the circumstances of the LMB economic and geographic space as a whole, and the consequences of various sorts of interactions (both formal and informal) between the constituent economies, and
- thirdly, are the trade and investment conditions within the GMS, Asia and the world economy which determine levels of export demand, FDI inflows etc. Notable among these will be the consequences for the LMB economies of accession to AFTA and its CEPT provisions (differentially across the countries, ranging up to 2015 for agriculture in Laos and Cambodia, for example), inclusion lists etc, which will increase competitive pressure for all of them.

Economic growth outcomes in LMB will be a result of the combination and interaction of these conditions. While these are impossible to actually predict, at the most general level what can probably be said with some confidence about the factors determining likely economic growth over the medium term and beyond (and which need to be reflected within BDP) is the following:

- on the basis of their available macroeconomic and sectoral development planning documents (e.g., 9th 'National and Economic Social Development Plan' in Thailand, 2nd 'Socioeconomic Development Plan in Cambodia', 1999 'Strategy and Vision for the Agriculture Sector ' in Laos), budget and finance statements etc, all LMB countries are committed to relatively open economic regimes with growth as an objective to reduce poverty; exports of primary and processed materials, increased agricultural diversification / intensification and value adding, expansion in tourism etc
- the major factors which affect how the LMB economies interact with one another are not going to change significantly (e.g., labor and land distribution patterns and prices, and the centres of industry and demand for products are not going to change dramatically in the next few years, national borders will remain relatively porous etc), but formally-encouraged moves (and economic imperatives) towards increasing formal economic integration are likely to continue and intensify; the impacts of these may be restricted to certain physical areas and/or economic sectors (depending on

specific items of physical infrastructure and/or sector- or industry-level interventions), but will be felt across all of LMB to some extent, and

- the era of large FDI inflows is probably over for the LMB countries; Viet Nam, Laos and Cambodia have – to differing extents – all had some kind of 'honeymoon' with FDI, but various sorts of problems connected with individual investment climates (usually centring on the high costs of doing business) have contributed to recent major declines across LMB. Also, the historically-successful, export-led growth of the region in recent years is subject to more competition (e.g., from China), and the continuing slowness of recovery in the US and Europe means that demand is limited right now anyhow.

The broad implications of these conditions are probably that

- to some extent, all LMB countries will become more open and will increasingly compete with one another as regards national agricultural and industrial development objectives (and in simple terms of investment attraction, export promotion etc)
- the present economic and technical roles of each of the LMB economies within the basin will probably remain largely as they are, with the structure of markets, centres of primary and secondary production, factor movements etc tending to be difficult to dislodge and (to some extent) undermining some national development intentions of the smaller economies
- the incentives to cross-border integration will intensify as the realisation of some of these factors bites home, and the attractions of joint investment promotion become more apparent; at both informal and formal levels *de facto* economic integration will increase. Apart from any other considerations, this obviously increases rather than diminishes the logic of exercises like the BDP and collective thinking about the management of shared natural resources), and
- the LMB will probably have to rely more on its own internal consumer market and that of neighbouring areas for sources of product demand and economic growth than hitherto. Developing and encouraging this demand will not always be easy (especially given the region's – particularly Thailand's – historical export orientation and Viet Nam's growing export orientation), but as levels of incomes rise the more that consumption can be domestically-oriented through appropriate policy encouragement the greater will be national benefits.

6.5.2 Opportunities for economic growth

While some of these kinds of conclusions just arrived at may imply considerable doubt about economic growth and its capacity to lift a large number of people within LMB out of poverty in the medium-term, there are also major reasons to be more optimistic about the LMB future. Overall, economic activity in the LMB is notably undeveloped at present, and there is major capacity for general economic growth in levels of output, trade, employment, and income generation in the medium-term. This view is predicated on two main points:

- the existence of significant unemployed and underemployed resources, particularly labor, but also land in some areas and installed capacity in others. Even those resources committed to various activities at present frequently exhibit inefficiencies in application, resulting in poor product quality and unnecessarily high costs of production; and
- the likely expansion of product markets (national, subregional, and international) for food and other natural resource-processed products, especially as local and regional

incomes rise and household consumption patterns change in favour of processed and purchased items at the expense of subsistence production.

The challenge for policy-makers and investors within LMB (as well as maintaining overall internal and external balances) is thus to pursue economic growth through specific policies, plans and projects which

- promote activities in which LMB and its constituent parts have underlying comparative advantages and/or can develop dynamic competitive advantages (and combine resources across national borders where necessary to achieve this), and
- spread the benefits of growth as widely as possible within LMB such that locally-generated incomes are spent on locally-produced products (thus reducing poverty and establishing a virtuous circle of income-demand-incomes etc).

6.5.3 Economic growth rates and patterns

Overall, the LMB is probably experiencing growth in real GDP at about 4-5% a year at present. It may not be unreasonable to assume that this kind of level can be maintained over the medium term, given the relative difficulty of current conditions in terms of the slowness of the world economy, the ending of the FDI boom etc, which have already been discussed. It would be at the optimistic end of the scale to think that the rates of 7-9% plus real GDP growth of the early and mid-1990s (e.g., as in Viet Nam) can easily re-occur.

At 4% real GDP growth, average per capita incomes (apart from the effects of population increase) would more than double in 20 years; at 6% sustained real GDP growth over the same period they would almost exactly treble. Given the aggregate, but highly differential, population increases across LMB, it may be reasonable to expect - on average – the LMB population to be 50-70% better off in real terms in 2020 than now. Based on past patterns in LMB countries and elsewhere, economic growth of this kind would not be spread equally across all sectors but would actually make income distribution more unequal while simultaneously lifting large numbers of the population out of poverty. (Expecting such a growth rate for the LMB is probably not unreasonable based on current trends, but it is important to note that both aggregate growth and per capita GDP increments can be affected by trends in population growth. The influence of events in Viet Nam (with its large population and high proportion under the age of 15 is particularly influential in this respect of course).

Given the likely sources of growth which were detailed above, the associated consequences of such growth would be apparent not just in aggregate real national incomes on a per capita basis, but also in a number of major economic and socio-economic trends, as patterns of investment and economic structure, consumption and mobility changed. These need to be identified and described for the purposes of planning (e.g., for BDP), as they will have major and long-term implications for resource use (e.g., water – scale, seasonality and location of demand) and cross-border cooperation.

It is arguable that the following four major trends in economic activity will be apparent

- Increasing agricultural commercialization and specialisation
- Increasing non resource-based industrial developments
- Increasing urbanization and consumer spending, and
- Increasing subregional integration.

These trends are broadly-defined and aggregated phenomena, subsuming within them (to varying degrees across the four countries) many more minor and specific tendencies (e.g., towards rural industrialisation in Viet Nam, towards flatland areas development in Laos etc). They have been defined at this level of conceptualisation to be useful to BDP planning in the most general sense only, rather than to guide the design of any specific plans or project interventions. Some implications of each of these major trends are briefly discussed in turn:

1 - Increasing agricultural commercialization and specialisation

All countries are intending to pursue policies aimed at intensification of their agriculture, although at somewhat different levels of sophistication and on the basis of differing levels of development. In Cambodia and Laos the issues are mainly about improving input (e.g., finance, fertilisers) and technology supply plus the development of marketing links (plus food security in the context of poverty reduction), in Viet Nam the issues are mainly about quality improvements (through policies such as rural industrialisation and technological intensification; by introducing large-scale commodity agriculture, raising productivity, developing industry and services in the countryside etc), while in Thailand the issues are about increasing the technology and science base of agriculture, promoting the sustainability and natural resource management etc. As well as the policies they intend to pursue, the previous tariff and other mechanisms which used to afford some protection (e.g., to agriculture sectors) will be diminished under AFTA.

In all LMB countries the effect will probably be to increase agricultural intensification (involving higher yields, more marketed volumes etc) per se, and also (on the basis of the kind of basin-wide analysis discussed earlier) to encourage increasing specialisation between counties (with, for example, Thailand and Viet Nam tending to produce less rice than now and more higher-value products, while Cambodia and Laos will probably maintain or increase current production levels of staples).

2 - Increasing non resource-based industrial developments

Similarly, all LMB countries are intending to develop their non resource-based industries more fully – again at different levels and in different ways across the LMB. For Cambodia (and also Laos, to a lesser extent), the main issue is about both broadening and deepening the industrial base (e.g., ending the garment dependence) in aggregate terms, with a view to creating employment in urban areas. For Viet Nam, the main issues are about developing small and medium-sized industrial establishments (SMEs) with diverse trades and crafts, applying potentially labor-intensive technologies, forming specialized farming areas linking to processing industries, attracting more labor from the Mekong River delta etc. For Thailand the objectives are about moving further up the ladder technologically and in terms of labor skills, adding further to export values, and also increasing rural-urban linkages (and also – of direct relevance to BDP and LMB - diversifying industry geographically out of the BMA/Central Plains areas).

Again, a natural non resource-based industrial specialisation based upon existing comparative advantage and emerging competitive advantages will probably be detectable across the LMB, and it may also be expected that a proliferation of industrial parks, export processing zones, hi-tech zones, industrial clusters, open economic zones will emerge within the LMB, both at various border locations (e.g., Mukdahan/Savannkhet) and elsewhere.

3 - Increasing urbanization and consumer spending

Concomitant with a growth in both agroindustrial and non resource-based activity, as well as overall population growth and growing levels of literacy and lifestyle expectations, can be expected a continuing drift towards urban areas from rural areas. This process (i.e., rural-urban migration) is as an inevitable part of economic development as the structural change in economies as they develop (i.e., as the share of agriculture in GDP declines). It is likely to happen more or less slowly within LMB to the extent that physical infrastructure is put in place (allowing easier temporary and season migration, for example) and borders remain porous. It will also of course happen within individual economies as they grow and their activity composition changes – in the LMB this means moves towards the capital cities of Vientiane and Phnom Penh, while in all countries 'secondary towns' such as Ubon, Can Tho, Pakse and Siem Reap can also expect to grow.

Along with increasing urbanisation will go changes in lifestyles and working patterns, and thus changes in consumption behaviour; for example, urban consumers spend higher proportions of their income on processed foods and other goods than do rural consumers, and for which the income elasticity of demand is greater than one.

4 - Increasing subregional integration

The last major trend to be observable will almost certainly be increasing de facto subregional integration. This will continue to be promoted by the formal ASEAN, GMS and other initiatives - but will almost certainly also grow on the basis of the economic analysis of the four riparian countries which was presented earlier. The factor locations and prices, border and trade and investment circumstances discussed previously, plus expected differential tasks and growth across LMB, will inevitably tend to encourage further integration between the economies within the single geographic space of the LMB.

While increasing subregional integration may tend to increase, rather than diminish, the relative economic hegemony of the two larger economies within LMB, there is still likely to be an overall welfare benefit for all constituent LMB economies.

The separate description of these four tends does not imply they are not inter-related; for example, increased non resource-based industrialisation will be closely associated with particular spatial locations and increasing migration towards the sources of employment; similarly, increased urban incomes will be associated with increased demand for agroindustrial/processed products (some of which will be processed locally, some of which will be imported from or through neighbouring countries). Some of the major ways in which the four trends are inter-related are summarised in the following table:

Table 6.2: Some relationships between emerging economic trends in LMB

Emerging economic trend:	Increasing agricultural commercialization and specialisation	Increasing non resource-based industrial developments	Increasing urbanization and consumer spending	Increasing subregional integration
Increasing agricultural commercialization and specialisation		Strengthened forward and backward linkages between primary and secondary sectors	Increased urban demand for agroindustrial (especially food) products	Emerging agricultural and agroindustrial specialization across LMB countries (low value/high value or technology split)
Increasing non resource-based industrial developments	Strengthened forward and backward linkages between primary and secondary sectors		Industrial jobs provide urban demand	Emerging industrial specialization across LMB countries; joint border developments
Increasing urbanization and consumer spending	Increased urban demand for agroindustrial (especially food) products	Industrial jobs provide urban demand		Demand for imports; demand for labor from neighbouring countries
Increasing subregional integration	Emerging agricultural and agroindustrial specialization across LMB countries (low value/high value or technology split)	Emerging industrial specialization across LMB countries; joint border developments	Demand for imports; demand for labor from neighbouring countries	

6.5.4 Evolving national roles

If economic development within LMB does occur at the level expected and contains the kinds of features captured in the trends just described, this will have implications for the roles each of the constituent LMB national areas may play. The table below tries to summarise, on the basis of the existing situation, what might be regarded as underlying natural advantages and emerging potentials of different sorts, what the role of each of the national LMB areas might be in the medium-term.

What does seem to be clear is that the likely future roles of each of the areas in the LMB are perhaps going to be not too dissimilar from what they are at present; Cambodia and Laos are primarily sources of raw materials (and some factors of production), while Thailand and Viet Nam's development is largely driven by forces outside the LMB. In effect, these larger countries can afford to treat the LMB space as extra provinces (either as sources of raw materials or as additional product markets). It is hard to see how, in the medium-term at least, the present fundamentals of economic roles can be changed, although it is equally obvious that certain economic tasks can be re-assigned; as competition among the LMB countries evolves (and as more pressure is felt from China) and more specialisation develops there will be re-assignment of some existing tasks on a cost-structure/productivity-determined basis.

(A corollary of this kind of analysis is probably that the smaller economies of Cambodia and Laos have more to gain from the whole MRC-BDP process, and that their national expectations in this regard are accordingly greater).

Table 6.3: Possible evolution of economic roles

	Cambodia	Laos	Thailand	Viet Nam
Present economic structure and role	Source of primary raw materials (crops, fish) – generally poor quality – small and fragmented internal market.	Source of primary raw materials (crops, wood) – generally poor quality – small internal market. Poor FDI history.	Major agricultural and agroindustrial player. Significant industrial depth on national basis. Source of capital, technical expertise and primary product demand (both in LMB/rest of country)	Emerging regional agroindustrial and light manufacturing power in LMB. Poor quality products and generally low technological base at present. Some demand for LMB produce (wood, crops) for processing
Areas of underlying comparative advantage	Some crops (corn, soybean) and fruits, rubber (?). Major freshwater fisheries potential. Possible/temporary garments industry? Major labor surplus (low skill, low cost)	Some crops (rice, soybean) and wood products; extensive agriculture. Large livestock. Hydropower and minerals. Some surplus labor (low cost)	Early-developer in regional terms has captured regional product markets	Intensive rice and other crops' cultivation, fisheries (including saltwater), production of consumer and semi-industrial products. Point of export to other regions (e.g., East Asia) from LMB
Emerging competitive advantages / possible sources of growth	Major tourism potential (including water-based tours), fisheries, some niche primary products (e.g., organic rice), some bulk commodities based on agriculture in border areas (especially for Thailand). Inter-country LMB and GMS economic conduit	'Mekong flatlands'-based agriculture (some for export), agroindustry. Tourism (?) Inter-country LMB and GMS economic conduit. Developments may depend upon extent of Thai investments	Higher-technology quality products; sales of expertise and equipment to other areas of LMB. Processor of primary products from Cambodia, Laos	Low-to-medium technology quality products; some sales of expertise and equipment to other areas of LMB, and some processing of primary products from Cambodia, Laos. Large labor force, low cost and medium skills; SMEs may predominate, doubts re. SOE reform
Socio-economic implications of the LMB development role	Net supplier of labor and primary products to other parts of LMB. Border provinces may experience more growth than central ones, unless internal market conditions improve significantly. Limited domestic value-adding, and poverty reduction will be uneven	Net supplier of labor and primary products to other parts of LMB. 'Mekong flatlands' likely to grow fastest; possible growth in north as Chinese interest increases; many hilly and border provinces (e.g., with Viet Nam) likely to remain remote and relatively poor	Economic growth in LMB likely to be determined largely by national trends; N and NE remain relatively poor areas of labor surplus (increasing competition with Cambodia/Lao labor keeps wages down in LMB?) but still richest area of LMB	Economic growth in LMB likely to be determined largely by national trends; Mekong Delta may be affected by VN's 'southern growth triangle' success?

6.5.6 Summary

This section of the paper has suggested that positive economic growth is likely for LMB, and that the extent and nature of this growth will be determined by the interplay of factors at national, regional and international levels. Government policies and plans will only partially determine growth and distribution outcomes. Four major (inter-linked) economic trends are probably identifiable at present. Increasing specialisation of agriculture and industry within

the LMB space is likely as subregional economic integration intensifies, but overall national economic roles in the LMB may not change substantially in the medium term.

6.6 Monitoring economic development trends

In order for economic trends within LMB to be understood and measured, a set of indicators can be defined which would provide information about these trends across countries over time. The following table summarises some key indicators for the four major identified trends.

The set of indicators are designed to be (collectively) a reasonably manageable number of items (38) about which data could be compiled on a cross-country comparable basis each year if desired as an input into the BDP process. Necessary data can be taken from existing national publications, without recourse to specific enquiry from national organisations. (Detailed issues with cross-country data for macroeconomic monitoring are dealt with in the Appendix). Most of the indicators would also be identifiable and applicable for subarea analysis, to the extent that Provinces (and groups of Provinces upon which base data sets can be compiled) correspond with geographically-defined subareas.

Table 6.4: Key indicators for major development trends

Trend	Indicators
1 – Increasing agricultural commercialization and specialisation	Agriculture share in GDP (%)
	Total value-added in agriculture sector ($)
	Number of formal jobs in agriculture sector ('000)
	Number of formal enterprises (by size) in agriculture
	Agroindustry share in GDP (%)
	Total value-added in agroindustry ($)
	Number of formal jobs in agroindustry ('000)
	Number of formal enterprises (by size) in agriculture
	Number of crops comprising more than 5% of total planted area
	Gross value / provincial value or volume of marketed produce
	Number of crops being exported
	Number of crops comprising more than 5% of total export values
	Total value of agriculture and agroindustry exports ($)
	Number of approvals for FDI into agriculture and agroindustry ('000)
2 - Increasing non resource-based industrial developments	Non resource-based industry share in GDP (%)
	Total value-added in non resource-based industry subsector ($)
	Number of formal jobs in non resource-based industry subsector ('000)
	Number of formal enterprises (by size) in non resource-based industry
	Range / number of identifiable (5% or more of market value share) non resource-based industrial products
	Range / number of identifiable (5% or more of export values) non resource-based industrial exports
	Number of approvals for FDI into non resource-based industry ('000)

Trend	Indicators
3 - Increasing urbanization and consumer spending	Aggregate national population in urban areas ('000)
	Proportion of total national population in urban areas (%)
	Estimated annual rate of in-migration to urban areas (%)
	Average real incomes in urban areas ($)
	Growth in annual real incomes in urban areas (%)
	Spending by urban population by category (food, clothing, travel etc - %)
	National savings rate (%)
4 - Increasing Subregional Integration	Number of subregional/multi-country loan/grant projects (e.g., WB, ADB) across LMB
	Number of cross-border industrial estates/EPZs within LMB (private sector)
	Number of joint LMB/GMS joint investment promotions in a year
	Total value of exports to LMB countries from LMB countries ($)
	Total value of imports from LMB countries into LMB countries ($)
	Number of FDI approvals from LMB countries within all LMB countries
	Number of AICO and AIA scheme approvals
	Estimates of informal product flows (value - $)
	Estimates of informal factor/labor flows (volume)
	Remittances by labor from LMB sources ($)

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7 Economic development and water resource demands in the Lower Mekong Basin

by Petrina Rowcroft and Keith Ward, June 2005

7.1 Macroeconomic setting

7.1.1 Introduction

The purpose of this paper is to present an overview of current and emerging major economic conditions in the Lower Mekong Basin (LMB), and broadly to describe the associated demands on water resources that may result from such circumstances, such that the overall model design context and rationale is made clear1. It provides the context in which to analyse the results from a Resource Allocation Model (RAM) developed by the Planning Division of the Mekong River Commission (MRC)2.

The RAM is a hydrological-economic model that has been developed to assist in the rational management of LMB water resources that are shared between the four riparian countries (Cambodia, Lao PDR, Thailand and Vietnam) – from an economics perspective. The model shows the activity-based composition and the geographical distribution of economic benefits from any particular pattern of water use in the LMB, and the economic consequences of changes to that water resource use. It thus allows users to consider various development opportunities and to understand the structure of their costs and benefits vis-à-vis changes from that original situation. Essentially, it is an analytical tool for the rapid assessment of various development options. Its overall technical and representational design is explicitly predicated on the existing economic and natural resource conditions, observed economic trends and potential developments outlined in the remainder of this paper.

Section 7.1 describes current economic conditions in the four countries of the LMB, Section 7.2 outlines likely future development trends for the LMB as a whole, and Section 7.3 describes some major water-resource demands. Section 7.4 describes the changing context of water demands in the LMB, i.e. water's evolution into an economic – as opposed to only a social – good. Collectively, these conditions help determine the approaches to resource valuation for the various water resource uses3.

LMB comprises nearly all (97%) of Lao PDR, about 86% of the Kingdom of Cambodia, some 36% of the Kingdom of Thailand (i.e., the whole of the northeast region and some of the northern region) and about 20% of the Socialist Republic of Viet Nam (i.e., the Mekong Delta and Central Highlands). Thus for the Cambodian and Lao areas of the LMB their national economies and entire geographic circumstances are largely synonymous with their constituent parts of the LMB, while for both Thailand and Viet Nam only (quite distinctive) parts of their economic and geographic space are included in the LMB. While the LMB may therefore be seen as a natural physical and geographic planning unit, its economic logic and analysis may be somewhat more complex. In particular,

- The Thai and Vietnamese parts of the LMB have more in common economically (i.e., in terms of prevailing policy regimes, prices, administrations, regulations etc)

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1 Some of the material in this paper originally appeared in 'A Macroeconomic Overview Of The LMB' BDP 010 (2002) and also in the MRC 'State Of The Basin' report (2003). This material has now been substantially revised, updated and linked more closely to water demands.

2 A more comprehensive report containing the full RAM analysis, macroeconomic context, technical modelling details and economic valuation methodology will become available in mid-2005.

3 Further information on the methodological approach to water resource valuation for the purposes of the RAM can be found in BDP (2005) Valuation of Water Resource Demands: Methodologies and Sources technical report for the Basin Development Plan by Petrina Rowcroft, MRC, Vientiane

with other parts of their respective national economies means that they cannot really be considered in isolation from those circumstances, and

- The LMB economic space can really best be seen as a subset of the regional economic space created by the whole national economies of Lao PDR, Thailand, Cambodia and Viet Nam.

The importance of a wider (essentially subregional) setting for the LMB is also strengthened by the fact that all constituent/riparian countries within the LMB are:

- following export-oriented growth models to some extent, and
- formally committed to increased subregional integration, not only through the Asian Development Bank (ADB)-sponsored Greater Mekong Subregion (GMS) program, but through membership of the ASEAN Free Trade Area (AFTA) (and its Common Effective Preferential Tariff provisions), though participation in various ASEAN fora ('10 Years of the Mekong') and by involvement in various investment promotion schemes such as the ASEAN Investment Area (AIA) and the ASEAN Industrial Cooperation Scheme (AICO).

In sum, the economic space of the LMB will most fully and properly be defined in terms of all of the following factors:

- The constituent individual national parts of the basin, plus
- (in the cases of Thailand and Viet Nam) the relationship these specific national parts of the basin have to their formal economic hinterlands, plus
- The consequences of co-existence and interaction between four economies within one geographic space, plus
- The relationship of the economic space of the LMB to the wider subregional (i.e., GMS) economy and the rest of Asia and the world.

7.2.1 Economic conditions in the riparian countries

This section provides a summary of the major macroeconomic features (such as gross domestic product, economic growth, activity composition, etc) of each of the riparian countries - with an emphasis on those features of most relevance to national activities within the LMB. It also includes a summary of broad regional economic circumstances for Thailand and Viet Nam which have only part of their economies in the LMB.

(a) Cambodia

At about US$310 (2003 current prices) or US$2,060 in purchasing power parity, Cambodia's GDP per capita is low, and even recent average GDP growth at 5.2% for 2003 (World Bank, 2004) combined with a national population growth rate of some 2.5% can only have a modest impact on overall levels of poverty (currently about 35%). Real growth in 2004 is estimated to have slowed to about 4.3% (World Bank, 2004) due to a slowdown in agriculture.

The termination of the Multi-Fiber Arrangement (MFA) in 2005 is expected to lead to negative growth in the garments sector; and, given the importance of garments to the manufacturing sector, this decline is predicted to reduce real GDP growth to around 2.4% in 2005 (World Bank, 2004). Optimists forecast that the growth in tourism and agriculture (with

new irrigation projects coming into operation and as implementation of land ownership gathers pace) may stimulate GDP growth to reach around 5% in 2005 (ADB, 2004).

Around 74% of Cambodians are literate (NIS, 2004) and life expectancy is around 57 years (UNDP HDI, 2002). The country's overarching development goal is to move out of the ranks of least developed countries by 2020 and this will require the growing labour force to be become more productive and earn a living wage.

Recent national planning (eg, the Second Social And Economic Development Plan – SEDPII) incorporates major themes of 'good governance', 'balanced growth', 'poverty reduction', and also a range of strategies for agriculture, forestry, fisheries, rural development, industry etc. Regarding national planning, it is also useful to note that Cambodia's documentation is notable for its reference to the 1995 Mekong Agreement and the recognition of its importance for the country.

National physical infrastructure (particularly the road network) in the country is in a dilapidated or destroyed state, less than 30% of the population has access to sanitation (UNICEF, 2003), irrigation covers only 10% of planted areas, and civil society is still in transition to a settled and democratic context. Typical of an economy at very early stages of development, agriculture currently generates about 37% of GDP and engages some 70% of the employed population, while industry (three quarters of which is manufacturing, including production of textiles) generates some 27% of GDP and accounts for only 8% of the employed population (ADB, 2004).

A major feature of the economy in the past few years has been notably unbalanced growth across different sectors of the economy. Growth in agricultural productivity has generally remained low and the agriculture sector as a whole experienced severe shocks in the form of major floods, eg, 2000 and 2002. Simultaneously, urban-based industries (such as textiles, construction, hotels, services etc) have rapidly expanded in the wake of continuing political stability (industrial value added in 2000 grew at double digit rates).

Within agriculture as a whole, years of severe floods adversely can affect crops and livestock, but at the same time increase fisheries production, thus tending to keep overall sector product levels stable. However, a national inability to mitigate flood damage tends to make investment in anything other than low input-low output, single crop, rainfed, subsistence rice cropping virtually impossible.

Low irrigation coverage also means that areas of the country can be affected by seasonal droughts while others are flooded (it was estimated in September 2002 that only a third of the rainfed rice crop had been planted in some areas, for example). The net effect is that average rice yields at 2 tonnes per hectare (Nesbitt, 2003) are among the lowest in Asia, and only about 25% of domestically-consumed vegetables are produced within Cambodia (some are collected wild, about half are imported). Poor land titling and security of tenure is another major constraint to agricultural development.

Cambodia's freshwater capture fishery - estimated around 400,000 tonnes annually (MRC, 2003) - should be by far the most productive in the region, but past over-exploitation has reduced recent catches.

Despite these problems and the other major civil disruptions, such as the Indochina War, in recent decades, it is perhaps surprising that the areas and production of crops (such as peanut, soybean, sesame, sugarcane and tobacco) have increased at all, let alone to the extent that they have (notably largely at the expense of corn, which has declined in area and output terms). Because of physical and marketing discontinuities within Cambodia, many crops

produced in border provinces are sold to traders from Thailand and Viet Nam – rice, soybean, sugarcane, as well as live animals and fish all cross the country's porous borders for consumption and processing elsewhere in the region. Domestic supplies of such products do not seem to reach Phnom Penh in any significant quantity. SEDPII includes objectives to: improve financing and marketing of agriculture, introduce sustainable technologies, promote community management and develop links to eco-tourism, among others.

In regard to other traditional sources of GDP, with the crackdown on illegal logging, passage of a forestry law and falling world prices, forestry's contribution to GDP is shrinking; on the other hand, tourism is now a major national industry, with growth in arrival numbers in 2002 being over 30% up over the previous year (Cambodia Ministry of Tourism, 2004).

Despite massive aid flows and the growth of local (including some 'regional') finance sources, overall rates of domestic investment are still low - about 18% in 2001 and 17% in 2003, for example (ADB, 2003) - by Asian standards, one reason being the continuing stagnation or fall in foreign direct investment (FDI). The political instability of 1997 and the bank financing of the budget deficit (leading to a depreciation of the Cambodian riel by almost 50%) caused major uncertainty among existing and potential investors. The anti-Thai riots of 2003 did not help this situation either. No forecasts indicate that Cambodia's tax revenues can rise significantly in the medium-term, and dependence on aid flows for general budget support will continue.

A major challenge facing Cambodia now is to both increase public investment and improve its efficiency. Mobilising revenues for recurrent expenditures will be critical. Increasing FDI flows across a number of industries (i.e., not just textiles) and active participation under AFTA are therefore key international objectives.

Because recent economic growth has not been able to productively absorb new entrants to the labour market (partly because the industrial base has historically been so low), problems of underemployment and falling real wage levels in urban areas are emerging. A 2000 Labour Force Survey indicated that 31% of employed respondents were available for extra work (ADB, 2003). Indeed, a major challenge for Cambodia at the macroeconomic level is to absorb the post-conflict baby boom (26% of the population is aged 10-19 years). Around 230,000 people enter the labour market annually.

However, despite these conditions affecting the formal sector, per capita incomes are three to four times higher in Phnom Penh than in rural areas. Poverty is largely a rural phenomenon (90% of the poor live in rural areas), and about 35-39% of the country's population can be defined as poor. A National Poverty Reduction Strategy (NRPS) was finalised in 2002.

(b) Lao PDR

In 2003, GDP per capita in Lao PDR was estimated at $310 (Atlas method, and about $1,730 at purchasing power parity; World Bank, 2004). The economy of Lao PDR remains largely resource-based and depends heavily on a sustainable environment to generate future growth. In addition to its foreign-aid dependence, Lao PDR is characterised by a heavy economic dependence upon Thailand (and hence was especially adversely affected by the devaluation of the Thai baht after 1997) and increasing dollarisation of its economy[1]. As the

[1] This did not happen to the same extent as in Cambodia but increasingly individuals tend to hold foreign currency rather than kip, given their recent experiences with high inflation and currency depreciation.

trade regime broadens – especially with other ASEAN countries and with China – the basket of non-baht currencies has also grown in recent years. Recent inflation estimates are also now lower – at about 10% p/a than previous years

Major policy issues that Lao PDR needs to address in order to attain any sort of growth path – from the Mekong lands or elsewhere – are widely regarded to be:

- Reform of the financial sector
- Improvements in the system of revenue-raising and government expenditure (particularly so that decentralisation can work); and
- The reform of State-owned enterprises (SOEs) which are typically the largest borrowers from the banking system and the source of most non-performing loans (NPLs).

Much donor concern now centres on the need for public sector/SOE reform and transparency as a way of making more efficient (in development terms) official inflows and potential earnings from hydropower (eg the Nam Theun 2 Hydropower project).

The current Fifth Five-Year Socio-economic Development Plan (2001-2005) and its sectoral constituents generally reflect these types of policy needs, with poverty reduction through increased economic growth being the overarching objective. An Interim Poverty Reduction Strategy Paper (I-PRSP) was released by the government in 2002. Targets to be achieved by 2020 (under the Lao Strategy for Socioeconomic Development, 2002-2020) include the ending of Lao PDR's "least developed country" status, and the hope that poverty can be reduced by 50% by 2005. As these targets are predicated upon GDP growth of about 7% and investment of 25% of GDP they perhaps look rather optimistic, although World Bank estimates (East Asia Updates, November 2004) do suggest poverty incidence is continuing to fall.

At present agriculture accounts for about half (some 49%) of GDP and employs about 85% of the workforce. Industry and services account for roughly a quarter of GDP each (ADB, 2004). Like Cambodia, future economic growth in Lao PDR will have to build upon improving productivity in agriculture and releasing resources (especially labour) to more productive sectors of the economy. However, most observers of the Lao economy highlight its more obvious current features such as:

- An inadequate public sector institutional structure (which is technically weak, and typically focused on targets rather than incentives)
- A poor climate for private investment (including tariff- and non-tariff-based restrictions on flows of products and inadequate finance at all scales of operation)
- Extremely poor rural physical infrastructure; and,
- A small and scattered population that is difficult for government services to reach (and also representing a very modest level of purchasing power for final products).

Natural resources are a major national asset; however, forest cover is declining rapidly across the country. Productive forests now cover about 40% of the country's area, down from 47% in 1989 (World Bank, 2003). This represents a major challenge and disadvantage for the poorest sections of rural society who are disproportionately dependent upon common property resources.

Despite these disadvantages, real GDP growth in Lao PDR has been higher and more stable than that of Cambodia in recent years, at over 7% in 1999. Growth has slowed moderately

since then, partly as a result of lower private investment and reductions in tourist arrivals due to the outbreak of SARS in 2003, but was back up at around 6% in 2004 (ADB, 2004). However, an annual population growth of around 2.8% has tended to reduce the benefit of this increased GDP in many individual households. Poverty remains relatively high, at around 39%, and increasing real national incomes have been associated with increasing inequality in recent years. Growth is also somewhat more evenly balanced among the major economic sectors than is the case in Cambodia; agriculture tended to lead the recovery from the regional financial crisis in 1999 and industry and energy production (mainly for export) were major growth contributors in 2001-2. The country's textile exports are not as large as Cambodia's, but were still significant at nearly $100 million in 2001/2 (ADB, 2004), although they have declined since. Energy production and services (particularly tourism) are increasingly important to the national economy, as are gold exports. Mining activity and exports are expected to increase in future years.

Figures detailing savings and investment rates in Lao PDR are incomplete, but it is likely that the savings rate is low (at about 20% of GDP), and much of what constitutes real capital formation lies outside the scope of the formal financial system (where high levels of inflation and administratively-set interest rates discourage depositors). Current reforms in favour of decentralisation are having major impacts on public finances, resulting in unclear sectoral allocations and the likelihood that levels of recurrent expenditures will not be sufficient to meet projected service demands. Again similar to Cambodia, a characteristic of the macroeconomic environment is large inflows of concessionary finance - 80% of the Public Investment Plan (PIP) is accounted for by Official Development Assistance (ODA).

One other characteristic feature of the Lao economy is that much of the country's identifiable economic activity is confined to the Mekong Corridor (and to a much lesser extent the border with Viet Nam) and that the value of imports and exports (both formal and informal) is estimated to be equal to annual GDP.

Again, some observers argue that Lao PDR is beginning to emerge from its relatively static historical state, and that the Mekong flatlands are entering a phase of agricultural transformation. While overall national cereal production figures are essentially stagnant, some crop areas with ready cash markets (eg, peanuts, coffee, maize, cotton, and several types of vegetables) have seen production increases in recent years, and the overall growth rate of agriculture has gone up to about 4-5% a year from a more traditional 2–3% a year. This could be considered to be the result of market signals being allowed to operate, the greater availability of inputs and access to markets, and freer access for local and foreign entrepreneurs where previously there was effectively no access at all.

(c) Thailand

Thailand's economy is qualitatively and quantitatively different from those of Cambodia and Lao PDR. Per capita GDP in 2003 was over $2,100 (at 2002 current prices, and about $7,450 in purchasing power parity terms – World Bank, 2004). Agriculture's share of GDP is only 10% (the remainder being roughly equally split between industry and services), and annual population growth is only 0.8% (ADB, 2004). The poverty ratio is also substantially lower at 12% (2001), although this is up from about 11% in the three years previous years which followed the 1997 crisis). Overall, these figures put Thailand in a different development league than other countries in the LMB.

The past few years have seen the country recover from the 1997 currency and financial crisis. After falls in GDP in 1997 and 1998, the economy grew at 4.4% and 4.8% in 1999 and 2000 respectively, and jumped to 5.4% by 2002 (ADB, 2004). The rebound was largely driven by

increases in export earnings and tourism and manufacturing (which experienced heavy foreign and domestic investment immediately following the 1997 crisis). Some government deficit spending and credit expansion further contributed to the recovery.

Expectations for growth in 2004 are around 6.4%, depending in part on the continuing strength of export demands. (Thailand's terms of trade are expected to increase by about 3.5% in 2004) and by 5.8% in 2005 (World Bank, 2004). Average incomes are now about the same as, or slightly higher than, pre-crisis levels, although inequality has risen over the intervening period. However, financial and corporate restructuring worries cloud Thailand's current positive growth and the over-investment of the pre-crisis period has yet to be fully absorbed in the post-crisis period. Converting the current recovery into sustained high-level economic growth will require improvements in productivity and competitiveness.

Thailand is one of the world's major primary products and agro-industrial producers. It is sometimes referred to as a 'newly agro-industrialised country' (NAC) and is now compared with countries such as Chile. Its first wave of sustained economic growth in the 1980s was largely due to its success in agricultural and agro-industrial production and trade. Between the mid-1960s and the mid-1980s, the average annual real growth rate of agriculture was 4–5%. This was based on the expansion of cultivated areas, increasing mechanisation and capital-for-labour substitution, and increasing input use. Growth in agriculture was 3.3% in 2001, but zero in 2002, due to a fall in fisheries output and erratic weather conditions affecting major crops.

The country produces a wide range of agro-industrial products. For example, it is the world's largest canned pineapple exporter and the centre of the world rice trade. Thailand exported 586 billion *baht*-worth (approximately US$15 billion) of agricultural produce in 1998, representing just over a quarter of all national exports by value. However, in recent years, over-exploitation of resources (including water - often considered a free good, as it is effectively un-priced), over-use of chemicals, and over-pricing of unskilled labour are recognised as emerging problems for Thai agriculture and agro-industry.

The Thai part of the LMB comprises the whole of the Northeast Region and some of the Northern Region (Chiang Mai, Chiang Rai, Phayao and Petchabun). Much of the northeast of Thailand (ie, the Khorat Plateau) is flat and prone to both drought and flood. Traditionally, this is Thailand's poorest and least irrigated region: Average rice yields here are about 40% of those on the central plains and regional growth has historically been significantly lower than the national average.

Poverty reduction is especially important in this region. Two-thirds of the country's poor live in the Northeast, and the National Economic and Social Development Board (NESDB, 2003) estimates that average per capita incomes are around 30,000 baht (US$ 750) a year (2003), or 15% of the average income of someone living in Bangkok. Agriculture's share in the regional GDP is still around 20% (NESDB, 2003), twice the national average. In addition, recent NESDB surveys have confirmed that poverty (in national terms) is now largely a rural phenomenon and has been exacerbated by remigration and declining real rural wage levels since the financial crisis of 1997.

Thailand's Northeast has also been relatively neglected in development planning terms, and more effort is now being focused on the region in order to both reduce poverty and promote more balanced national geographic development. Most new initiatives involve returning to (and re-examining) opportunities in agriculture and agro-industry.

Thailand's '9th Socioeconomic Development Plan' incorporates a number of objectives aimed at bringing the country more balanced and sustainable development than in the past,

with emphasis on good governance and strong social foundations, natural resource and environmental management improvements, attempts to address poverty in the Northeast by supporting grassroots movements and linking urban and rural activities. It also recognises the need to upgrade national competitiveness, technology and the science base of the country.

Despite its relatively poor status in national terms, the Thai northeast and northern areas remain by far the most developed areas of the LMB in agricultural and agro-industrial terms. Industrial activity is dominated by manufacturing (including agro-industry, but also some textiles, light assembly, rubber processing, etc). Medium and large local and national companies have made major investments in all types of food processing, chillies, animal feed, fertiliser and other agrochemical production, wood products manufacture and various sorts of agricultural equipment manufacture. Many farmers are engaged in aquaculture in farm ponds. Dairying is widespread and milk production is increasing. Poultry and shrimp farms are also found throughout the region. Households generate many food products (sauces, noodles, honey, sweets, dried fruit) and handicrafts (paper, silk, umbrellas, toys) for sale.

The acquisition of raw materials for medium- and large-scale agroprocessing is typically done through householders growing produce under contract (rather than on company-owned plantations), leaving the sector dominated by small holders who are often supplied with raw materials, such as seeds and agrochemicals. The very good physical infrastructure, such as all-weather roads, bridges, and storage facilities, facilitates both movement of produce to market and supplies to farms, households, and commercial enterprises by truck.

(d) Viet Nam

With per capita GDP at $480 (2003 current prices; World Bank, 2004) and around $2,490 in purchasing power parity terms, Viet Nam is not as poor as Lao PDR and Cambodia, but still lags behind Thailand (even Thailand's Northeast). The country experienced very fast aggregate growth (averaging 7% annually) across all sectors throughout most of the 1990s, but slowed to around 4.5% annually by the end of the decade. It then picked up again, reaching about 7% in 2002 and 7.5% by late 2004 (ADB, 2004). Similar growth rates are expected to continue for the next few years, challenges in export markets notwithstanding.

The major net structural effect of Viet Nam's growth has been a reduction in agriculture's share of GDP from 40% in the early 1990s to 22% in 2003 (ADB, 2004).

In policy terms, the 'Social and Economic Development Strategy – 2001-2010' adopted by the 9th Party Congress in 2001 and the '2001 Strategic Plan for Agriculture' pursue the aim of industrialisation and (consequently) structural transformation. Targets include further reducing agriculture's share in the GDP to 17% and bringing poverty to below 10% by 2005.

Although there may be some evidence of improvement in total factor productivity (TFP) in Viet Nam, the country remains broadly uncompetitive in international terms. Its low labour costs are heavily offset by high business and overhead costs. However decentralisation, stricter enforcement of legislation and trade reforms are all making the economy more productive and reducing transaction costs; but this is a medium-term process at least.

Consistent with a large-scale move of the population out of relatively low productivity agricultural activities towards higher value-adding industrial and service activities, estimates of national poverty declined from 58% of the population in 1992/93 to 37.4% by 1998 (Viet Nam Living Standards Survey, World Bank, 2001). Similar to the other LMB countries, this effect has been achieved through overall increased growth rather than more equitable

distribution of incomes. In 2002, it was estimated that poverty was down to about 17%, using the Government of Viet Nam's poverty line (and about 32% using UNDP measures[1]).

Industrial sector expansion prior to 1998 was largely driven by manufacturing growth, but sluggish domestic demand then shifted the emphasis to heavy industry (including mining, oil production for export, and construction). Increases in oil, agricultural and garment exports have kept the external economic balance strong (despite major reductions in flows of FDI since 1998), but the domestic economy remains constrained by the slow pace of economic reforms (i.e., dealing with SOEs and the financial system) and the need to improve the business environment. In some years the rate of economic growth of SOEs has been negative, which is particularly troubling given that they dominate the capital-intensive industries (including oil and gas), and that there has been a declining private share in the economy. Overall industry sector growth at the end of 2000 was about 7.7% p.a. (ADB, 2004), although this rose to over 10% by 2004, with manufacturing growth at about 9.3% (World Bank 2004b).

Growth in the services sector (ie, street trading, wholesale and retail trades, real estate, employment in hotels, etc) in Viet Nam was dramatic prior to 1998 and was responsible for massive job creation and overall economic structural changes, but has slowed since the regional crisis, contributing (along with SOE layoffs) to rising unemployment. Services growth was still around 6.6% in 2003 (ADB, 2004), however, and tourism has been a buoyant contributor with some 2.5 million tourists visiting Viet Nam in 2003 (Viet Nam National Administration of Tourism, 2003).

Despite its falling share in GDP composition, agriculture still employed nearly 70% of the population (about 53 million people) and accounted for 40% of export values at the end of the century (ADB, 2000). In recent years these figures have fallen slightly with the dramatic growth of the garment industry. Agriculture production remains dominated by rice, which has seen major area and yield increases in recent years and which accounts for half the value of agricultural output. However, there have been significant moves towards diversification into perennial crops (rubber, coffee, tea) and annual crops (eg, sugarcane). Very limited physical infrastructure (especially road and rail links), major floods, and poor post-harvest and storage practices mean relatively large losses for rice and other crops on-farm and between farm and market. Unless there are technical and policy improvements, the recent lessons from coffee oversupply and poor product quality may also have to be learnt in aquaculture, dairying, mulberry and fruit cultivation. Agriculture sector growth in 2004 is estimated at about 2.3% (World Bank, 2004b).

Viet Nam has a generally hilly topography and only 22% of the land area is used for agriculture. With a population of over 80 million this has resulted in farms tending to be very small, averaging just 0.3 ha in the Red River Delta and 1.1 ha in the Mekong Delta, for example. Vietnamese farmers (especially in the Delta areas) maximise returns to land (unlike in Thailand, where returns to labour are maximised) and rice yields are among the highest in the region; it is also here that major moves into fruit trees (as is the case in the central region of the country) and aquaculture are occurring.

Most major policy reforms in agriculture have been facilitated by World Bank and ADB interventions, which are expected to continue in the future, although they will probably

[1] The international poverty line (UNDP) is defined as $1 a day at 1985 international prices (equivalent to $1.08 at 1993 international prices), adjusted for purchasing power parity. The existing national poverty line (Vietnam) is VND150,000 per month (or US$0.35 per day at current prices) in urban areas and VND100,000 per month (or US$0.22 per day at current prices) in rural areas.

address more specific issues than in the past. The signing in 2000 of the Viet Nam-US trade agreement is expected to give substantial impetus to Viet Nam's exports, including many agro-industrial products. For example, the agreement lowers duties on food products, nuts, fruits and vegetables by three quarters. However, adoption of the AFTA tariff provisions will mean that current protection for some internationally non-competitive activities, such as sugarcane, will have to disappear.

Much of the central highlands area of Viet Nam (including that in the LMB) has highly seasonal rainfall, short river basin systems, denuded catchment areas, and relatively poor soils. Agriculture is disproportionately important in this poor region accounting for nearly half of the GDP, although rice yields are well below the national average. Manufacturing in the central region is generally very underdeveloped. With about 5% of the country's population, the region accounts for less than 1% of national industrial output.

In the Mekong Delta provinces, industrial output is about 9% of the country's total – generated by 21% of the population (GSO, 2001). The Government's objective for the Mekong Delta (from Decree No. 99 on agricultural development in the Mekong Delta, for example) is to:

- Promote its role as the country's largest rice and agro product producer,
- Increase commodity production and raise the quality of cash crops, vegetables, fruit (eg, mango, mangosteen, dragon fruit, papaya, rambutan etc), animal husbandry and aquaculture (turning some 250,000 ha of rice paddy into aquaculture by 2010),
- Raise the proportions of labour employed in industry and services,
- Complete the river transport network; and
- "Plan populated areas and construct infrastructures adaptable to annual flood control and counter-salinisation abilities".

With respect to agricultural intensification and diversification, it may be agronomically possible for Vietnamese farmers to produce a wide range of fruits, but it is also apparent that marketing and processing services for large volumes of produce are still absent and that recent attempts at implementing flood control and salinity measures have not always been successful.

Water quality remains a major source of concern for all natural resource-based activities in Vietnam's share of the LMB. New World Bank and Australian Aid (AusAid) initiatives are exploring ways of improving resource management structures in the delta[1]. In both the Central Highlands and the Mekong Delta (as well as in the small area of LMB in the northwest of the country), the poor are the most vulnerable to physical and economic shocks such as floods or falling commodity prices.

7.13 Summary of national economic circumstances

Table 7.1 highlights some key economic features of the four LMB countries, and is intended to explain both the similarities and differences across borders. From the table and from the earlier summaries, common economic themes and trends can be identified which will have impacts on resource use and planning. All LMB countries share the need to diversify their

[1] For example, North Vam Nao Water Control Project, Viet Nam-Australia Water Resource Management Assistance Project (AusAid) and Mekong Transport and Flood Protection Project, Mekong Delta Water Resources Project (World Bank).

economies, boost productivity and attract wider foreign investment. Economic growth also needs to be better linked to poverty reduction throughout the region.

However, what is equally clear is that while the countries' economies share many characteristics, they are also notable for their differences. The general levels of economic development (as measured by real per capita GDP and the extent of the move from an agriculture-based economy, for example), the proportions of populations in poverty and the differing abilities to mobilise domestic resources for public spending and for investment inevitably mean that these economies will view the shared resources of the LMB differently from an economic, as well as a technical, perspective.

Table 7.1: Major national economic circumstances of LMB countries (2003)

	Cambodia	Lao PDR	Thailand	Viet Nam
Incomes, growth and poverty	GDP per capita at purchasing power parity (PPP) around $2,060 Recent growth of just over 5%, but concentrated in urban areas. Poverty about 35%	GDP per capita at PPP about $1,730 Positive recent growth at about 6%. Poverty at 39% - although falling slightly	GDP per capita at PPP over $7,450; in Northeast about $3,000. Slow recovery from 1997 (recent growth in North and Northeast around 4%, although much higher nationally), with increasing incidence of poverty in North and Northeast (16%)	GDP per capita at PPP is just under $2,500. Rapid growth in early 1990s, slowed to about 4% by end of decade, now about 7% Poverty about 17-32% ('hunger' and 'income' measures)
Macro-economic stability and the investment climate	Civil society increasingly stable; low inflation now; major (50%) riel depreciation in 1997. Lack of transparency and rule of law impedes FDI	Historically baht-zone dependent, kip depreciation. Periods of high inflation. FDI falling	Baht depreciated 60% against US$ since 1997. Concessional / official funds limited, domestic finance still constrained by debt overhang/NPLs. Good investment climate with real incentives for LMB areas. Inflation less than 1%	Currency stable against US$, appreciated against regional currencies post 1997. Dominance of some areas by SOEs, poor business environment. FDI declining
Agriculture in the economy	37% of GDP 70% of workforce. Sectoral activity composition severely impacted by flooding. Little diversification	49% of GDP 85% of the workforce Extensive regimes Subsistence-oriented with emerging trends towards commercialisation on Mekong flatlands (large informal trade with Thailand)	10% of GDP (20% in North / Northeast) 45% of the total workforce Massive and diversified national agroindustry ('NAC') contributes to export earnings and economic recovery. High labour costs	22% of GDP, 40% of exports 70% of labour force. Recent diversification (including fruits and aquaculture) Land-intensive farming (esp. Mekong Delta) Increased export earnings and contribution to economic recovery
Industry in the economy	27% of GDP 8% of employment Overwhelmingly textiles (threatened?)	25% of GDP Mainly handicrafts and some agro-processing / assembly	44% of GDP; focused around BMA. North/Northeast largely light manufacturing and agroindustry. Weak national education base Relatively expensive labour	40% of national GDP, but less in LMB areas. Early 1990s manufacturing growth has slowed. Major oil and gas earnings

Furthermore, the fact that the LMB contains such economically diverse areas means that factor costs and product/output mixes will be different across national areas within the LMB. This, in turn, encourages trade and production specialisation to develop, although the extent to which this may happen and/or is formally encouraged by governments depends upon the nature of prevailing trade and investment regimes. It also depends on the extent to which informal flows of goods, finance, services and people may occur (either by being encouraged or by failing to be stopped).

The net effect of these circumstances, in economic terms, is that the interaction between resources within the LMB across national borders may well be as important as that planned within any one country (especially for the smaller countries), and that individual formal national economic policies and plans will only partly determine development outcomes.

7.2 Economic growth and structural development

This section describes briefly the expected future development trends of the LMB in terms of economic growth; the likely features of future economic development and some specific identifiable trends and activities that drive this development.

7.2.1 Factors affecting economic growth

Having examined each of the national economies in the previous sector, it may now be useful to consider some basic economic characteristics of the LMB as a whole (i.e., as one geographic and economic entity). In summary:

- The LMB's economy is overwhelmingly natural resource-based with around three-quarters of the basin population still directly dependent upon agriculture, fisheries and forestry for their livelihoods
- The product base of agriculture is remarkably similar across the LMB. Although there are differences in factors contributing to production (such as climate, soil types, topography and water), each of the four countries is capable of producing a mixture of grains (rice, maize) and other food crops (cassava, sugar, sorghum), oil crops (groundnuts, soybeans, sesame), tree crops (coconut, oil palm, rubber) and fruits and vegetables (pineapple, durian, mangoes, onions/shallots, garlic, beans, tomatoes, cabbages), livestock (poultry, cattle, pigs), and aquatic products (fish and prawns) in larger or smaller volumes. Wet season rice is still the predominant crop in the LMB, and all countries now have a surplus of production over domestic consumption (this involves very large volumes for Thailand and Viet Nam and much smaller amounts for Cambodia and Lao PDR).
- Apart from the North and Northeast of Thailand, industrial development in the LMB is very limited in scale and restricted in scope to some natural resource processing/agro-industrial activities and relatively small amounts of manufacturing
- Despite the dependence of the population on agriculture this sector only accounts for about 25-30% of LMB GDP, implying much lower average returns than in industry and services, for example
- Reliance on agriculture means many rural people are poor. It is estimated that around one-third of the total LMB population could be defined as poor. As a result

of this poverty and generally low income levels, savings rates in all areas (except the Thai parts of the LMB) are low by regional standards

- All countries see economic growth as the principal means of reducing poverty. This will require continuing moves towards greater economic openness (trade as proportion of GDP is growing in all LMB countries), higher factor productivity across all sectors (implying increased investment and skills upgrading) and economic diversification. All countries share the view that increased sub-regional economic integration contributes to this process.

Despite many similarities across the LMB, the individual economies of the countries are somewhat less consistent:

- The LMB actually comprises economies of two quite different scales and scopes. Cambodia and Lao PDR are latecomers to development and industrialisation with small internal markets and high transaction and transport-to-market costs, while Thailand and Viet Nam have economies with large internal markets, diversified agricultural and industrial bases (nationally) and relatively lower costs to market (both to domestic markets and foreign markets).
- The economies of Lao PDR and Cambodia are characterised by heavy reliance on official development assistance (ODA) , Viet Nam less so and Thailand not at all. This largely affects how government priorities and policies are formed.
- Thailand and Viet Nam set up macroeconomic-level policies (affecting exchange rates, trade and investment, money supply and credit, taxes and subsidies to producers/consumers etc) based on national economic and policy priorities, not those just those which affect the areas within the LMB
- The internal transactions of the LMB economy are characterised by significant formal/official barriers to factor and product movements (set at national level), but large and growing formal and informal trade volumes and values and increasing factor movements (notably) across national borders. Evidence suggests that these informal flows respond directly and quickly to aggregate and nationally-differential rates of growth (and changes in these rates), and can significantly constrain (and even undermine) national and sectoral development efforts for small economies
- Partly because savings rates are low, each national area of the LMB (apart from Thailand) competes for FDI as a source of capital for new ventures, though investment regimes vary considerably by country. However, despite this need for finance, the investment climate in three of the four countries (again, excepting Thailand) is characterised by a lack of consistency, high transaction costs, and in Cambodia's case a weak legal framework. As a result, the LMB is generally not viewed favourably by FDI sources outside the region.

These characteristics of the LMB economy will continue to influence its growth and development. In order to understand how these developments may occur, it is appropriate to summarise the patterns of trade and investment in the LMB, and also to look at the consequences arising from porous borders, such that significant informal trade and labour movements can take place. (Porous borders are those which allow movement of goods, raw materials and people to other parts of the LMB and beyond.)

(a) Trade and Investment Patterns within the Lower Mekong Basin

A major feature of economic growth in the Greater Mekong Subregion is the significant rise in formally recorded trade between countries. For example, the combined value of exports

and imports between Lao PDR and Thailand grew by an average of 33% a year through the 1990s. The structure of this trade reflects each individual countries' unique assets:

- Thai exports to Lao PDR are mainly vehicles, machinery, fuels, fertiliser, salt, pharmaceuticals and glassware.
- Thailand can export relatively high value fruits (eg, mango, longan) and processed products (eg, juices, concentrates, processed fish and livestock items) to Viet Nam
- Lao exports to Thailand are wood and wood products, gum, oilseeds, live animals and hydropower
- Lao exports to Viet Nam are gypsum, wood, animals and some hydropower
- Viet Nam's exports to Lao are cement, construction steel, sawn timber.

There is no formal data for Cambodia's exports by category/destination, but rubber is known to go to Viet Nam, fish to Thailand and in return the country imports a range of manufactured and processed items from both these countries.

In addition to growth in aggregate trade volumes and values, it is also apparent from published trade data that LMB countries are increasingly exchanging similar types of goods. This inter-industry, or two-way, trade (IIT) indicates an increasing degree of interdependence of trading partners, and is typically associated with both economies of scale in production and of the production of differentiated goods. IIT calculations suggest possibilities for Thailand and Lao PDR to collaborate across a range of goods, from animals and plywood to fabrics and tractors, and for Thailand and Viet Nam to collaborate across a range of natural resource-intensive products (eg, wood, skins, vegetable materials), unskilled labour-intensive products (eg, footwear, furnishings) and technology-intensive products (transistors, optical fibres etc).

While the full range of products quoted as examples above are not all made within the LMB (many coming from countries' more industrialised areas), it is clear that formal trade within and among the LMB countries is increasing, based on national/regional comparative advantages and will likely increase and become more specialised.

Regarding investment patterns in the LMB, it has already been suggested that three of the four countries' overall investment stances are not especially positive. The LMB in general must be seen against the background of its own low aggregate savings rates and the general decline in FDI since 1997, most of which was previously coming from crisis-affected countries (such as Japan, and also Thailand itself).

The scale of the contraction can be seen by the fact that by 1999 FDI approvals into Lao PDR and Viet Nam had fallen to about 10% of their 1996 levels. Cambodia's boom years of FDI enthusiasm (largely for textiles) are over, and FDI has fallen in the past few years. Political risks, high costs of doing business, competition from China (with its cheap labour, world's largest internal market and strong growth), and the slow economic recovery worldwide and in Asia, all suggest that this trend will continue in the short term. The exception may be China's current role as a source of investment funds: some areas of the LMB (eg, northern Lao PDR) are seeing notable amounts of Chinese investment in garments, some agro-processing and hotels and tourism. However, the region is yet to see major manufacturing enterprises.

Another consideration is that investment policies and other regimes (including tariff and non-tariff barriers) across the LMB are not harmonised, meaning that each country (and thus its area of the LMB) is effectively competing for FDI with its neighbours. This limits scope

for large-scale and cross-border investment. General trade and investment conditions within the LMB have also been massively affected by exchange rate changes in recent years. The real (i.e., price inflation-adjusted) cross rates between the LMB currencies changed by up to 50% after 1997 when the Thai baht fell, the Laotian kip followed suit and the Cambodian riel fell later in the year in response to political problems and government financing of the budget deficit. The Vietnamese dong remained strong, however, as foreign trade was still dollar-invoiced.

While there are various ASEAN schemes (eg, ASEAN Investment Area, ASEAN Investment Cooperation) to promote inter-regional trade and investment, and moves to implement the AFTA-CEPT arrangements and (in the case of Cambodia, Lao PDR and Viet Nam) moves to enter WTO1, the impacts of these measures to date are modest, and the overall formal trade and investment environment for the subregion as a whole, including the LMB, is not conducive to major change. Opportunities for areas of individual countries to form strategies to overcome such obstacles (at least at the local level) through participation in 'growth triangles' and economic corridors provide part of the rationale for the kinds of economic cooperation described later.

(b) Porous national borders: Consequences of informal factor and product flows

Another major feature of the LMB economic space is that national borders within the LMB are relatively porous; meaning finished goods, semi-processed items, unprocessed raw materials and people can all move across borders to other parts of the LMB and beyond.

Product movements are based on the following incentives:

- Markets for goods may not exist in places where commodities are produced; eg, national physical infrastructure discontinuities may be so large that it is easier for primary goods to be marketed in neighbouring countries than within other regions of the producing country. Good examples are provided by agricultural production (including glutinous rice, garlic, ginger, vegetables, fruits, live cattle) from the 'Mekong Flatlands' of Lao PDR; and fish, maize, soybean, rice, rubber etc from the border areas of eastern Cambodia, which travels informally across the Thai border.
- The markets of Lao PDR and Cambodia are very small (five and 13 million consumers respectively) relative to the internal markets of Thailand and Viet Nam, and their historical industrial bases are also much smaller. This means that potential producers of processed or manufactured goods in Lao PDR and Cambodia are always competing against larger producers in the neighbouring countries who benefit from the economies of scale generated by a large consumer base (i.e., 60 million in Thailand, 70 million in Viet Nam) and also from generally lower infrastructure and service costs. The tendency is thus for cheaper but lower quality goods from Thailand and Viet Nam cross both formally/legally and informally/illegally into the smaller countries, undermining domestic attempts to diversify and add value by internal processing and manufacture.

It should also be mentioned that all countries of the LMB compete against China, and the influx of goods appearing in the region as a result of the recent trade and navigation agreements made along the upper Mekong between Thailand, China, Lao PDR and Myanmar.

[1] At the time of writing, Cambodia's accession to WTO had already been ratified.

The consequence of this economic structure within the whole of the four economies has largely been to keep the LMB as an area of primary production, with much of the produce destined for processing either within north eastern Thailand or to a much lesser extent the Vietnamese Mekong Delta (both areas within the LMB) or other areas of Thailand, notably the east and around Bangkok – especially for fisheries from Cambodia, for example.

The scale of the informal trade in products among LMB countries is, of course, difficult to measure, but is widely regarded to be large and growing. Recent studies by ADB in the GMS context (eg, the Pre-investment Study for the East-West Economic Corridor) and other sources suggest the combined trade within LMB is worth hundreds of millions of dollars a year, and it is now (for example) an implicit part of the Lao PDR national agricultural strategy to allow production from the flatter areas of the country (provinces like Thakek, Savannakhet and Champassak, which neighbour Thailand) to be designated as places where product markets exist.

It is of course also the case that the porous borders allow for movement of labour as well as products.

Labour can move relatively easily from the LMB to areas of Thailand and Viet Nam where employment opportunities exist, on both temporary and semi-permanent bases. Many studies of labour migration in the region highlight the importance of Lao and Cambodian labour to Thai industry. While this movement often has exploitative and risky dimensions, having many rural households with one or more members earning cash incomes can be a major part of a diversification strategy where domestic or national opportunities are very limited. It seems likely that the LMB as a whole would be an area of labour emigration rather than immigration, although within the MB itself there are movements from rural areas to the larger towns and cities such as Phnom Penh and Siem Reap in Cambodia and Vientiane, Pakse and Savannakhet in Lao PDR). The consequences for restricted national development as a result of (often localised) labour shortages due to migration need also to be noted.

As long as national borders remain as porous as they are at present they will continue to exert a major influence on economic growth and development within the LMB. Openness of the LMB borders suggests that much of the LMB will remain a source of primary materials for processing elsewhere (including the Thai North and Northeast) and that the national industrialisation/diversification/value adding efforts of the smaller countries to produce for their domestic markets will always be undermined to some extent by the proximity of larger and lower cost producers.

While this situation may seem pessimistic for the national development efforts of Lao PDR and Cambodia, its positive side (when combined with the trade and investment circumstances across the LMB described earlier) is that it provides a strong rationale for economic co-operation among the countries of the LMB, which in turn can offer opportunities for significant long-term economic growth.

(c) Incentives for integration and scope of ongoing initiatives

Various forms of economic co-operation have been advocated by multilateral agencies (notably ADB) as a way to accelerate the subregion's development. The impetus for this integration has also been strengthened by the continuing slow economic recovery in the USA and Europe (such that simple export-led growth alone might be relied upon to help the subregion) and the shortage of FDI (in particular from Asia).

In summary, the realisation of benefits from economic cooperation is partly about helping promote subregional production on the basis of underlying *comparative* advantage, and is even more about promoting cooperative subregional *competitive* advantage. This can be done by assisting each of the national areas to identify and develop commercially-viable projects across a range of sectors, allowing the combination of different factors of production across national boundaries, pursuing suitable policies toward the 'software' of appropriate trade and investment regimes and human resources development, and adopting programs of public investment in the 'hardware' of physical infrastructure (such as roads and ports, industrial estates and processing zones, etc).

Currently, the notion of comparative advantage is based on economic prices, while competitive advantage is based on financial prices, which are then subject to influence through various government policies (eg taxes, subsidies etc)

The sources of benefits from subregional economic cooperation can be summarised (with some examples from the LMB) as follows:

- Differences in factor endowments (such that businesses/projects can combine across national borders, eg new land for cultivation may be available in one country only or one country may have a surplus of energy and another a deficit)
- Differences in factor prices, eg labour may be plentiful/cheap in one area and scarce/expensive in another – eg, west of Cambodia and eastern Thailand
- Differences in access to capital, eg Northeastern Thai investors may have cash to invest in Lao PDR or Cambodia; while Lao PDR, Cambodia and Viet Nam have declining FDI flows
- Differences in levels of technical and managerial skills, eg skills in agroindustry in Northeast Thailand and the Mekong Delta
- Differences in proximity to markets (i.e., to bring about cost reductions and thus to help Lao PDR and Cambodia export)
- Realisation of economies of scale in production, and joint product marketing (to reduce overall costs)
- Inward investment attraction (promoting 'Mekong', 'Indochina' etc)
- Realisation of other externalities, eg environmental benefits in managing shared resources such as the Mekong.

The LMB is already being influenced by various efforts at economic integration. Overarching these is the ASEAN structure, and in particular the recent 'Initiative for ASEAN Integration' (IAI), which attempts to bring the four 'new' ASEAN economies of Myanmar, Lao PDR, Cambodia and Viet Nam closer to those of the other original six members. ASEAN also contains numerous other specific initiatives (eg, AN Industrial Co-operation Scheme and ASEAN Investment Area) designed to promote cross-border economic integration.

Efforts at economic integration are also being promoted by all the LMB countries (plus Yunnan province in China, and Myanmar) through the ADB GMS program and cover a range of sectors. Some are more local-level and focused initiatives; some are simply planning exercises to date, while others have seen significant investments in physical infrastructure already made. Many of them exploit major investments in roads, airports, river transport, communications, environmental management, and tourism, which are being made or are planned within the GMS context or by individual countries.

Some examples of these initiatives which involve, or impact upon, the LMB economic space include:

- The East-West Economic Corridor (involving Northeast Thailand and central Lao PDR as well as central Viet Nam, among other areas, and based on current upgrades of Route 9 in Lao PDR and a new bridge across the Mekong), which involves agriculture and agro-industry, industrial estates and processing zones, and improved logistics and communications. (There is another Japanese-sponsored variant on this corridor, called the West-East Corridor, although it is likely this will be subsumed within the former concept).
- The proposed 'southern economic corridor' which links Bangkok, Phnom Penh and Ho Chi Minh City (there are two alternate routes – one coastal and one primarily inland). The recent rehabilitation of the Phnom Penh-HCMC section through a joint ADB loan to the two countries underpins part of this corridor.
- The Thai-Cambodian 'Master Plan for the Border Area' (2002-2012), involving some seven Thai and seven Cambodian provinces with multiple border crossing points and including trade promotion, border industrial estates, joint tourism, and agricultural cultivation (eg, soybeans, maize, oilseeds for processing in Thailand)
- The 'Emerald Triangle' involving small border areas of Thailand, Lao PDR and Cambodia and promoted by the Tourist Authority of Thailand (little development has happened so far), and another 'growth triangle' being discussed between Cambodia, Lao PDR and Viet Nam.
- The 2000 agreement on navigation on the upper Mekong between Thailand, Lao PDR, Yunnan and Myanmar, and also agreements about blasting 11 sets of rapids in this region to facilitate larger barge movements.
- Numerous other studies of potential for cross-border economic cooperation have also been undertaken (eg, JICA studies of possible Thai-Lao border joint border area development, joint Mekong tourism planning) or are envisaged (eg, North-South Economic Corridor from Yunnan to Bangkok, which would include road and river transport in LMB areas). ADB is also considering work in northern Lao PDR to identify ways to exploit economic complementarities between Lao PDR, Thailand and China in a way that will not despoil the environment (this is in anticipation of completion of the rehabilitation by China, Thailand and Lao PDR of Route 3 – currently under way). A 1999 study conducted by NESDB of the possibilities for the development of Thai border towns also has major cross-border implications.

This kind of model of cross-border economic integration can also be applied on a national basis, i.e., within one country, if the right combination of factors is present. Viet Nam, for example, has a policy of promoting two 'growth triangles' centred on Hanoi in the north and Ho Chi Minh City in the south. The idea is to combine large domestic demand with different agricultural and industrial resources to create economic growth *('agrobelts around major cities'* according to the 2000-2010 economic strategy).

7.2.2 Likely features of economic development

Having summarised the major characteristics of the economy of the LMB and examined the region in terms of its four constituent economies and the implications of their coexistence, the next section of this paper attempts to identify some of the likely major features of future economic growth in the LMB.

There are three major sets of factors affecting economic growth in the LMB, each of which acts at a different level:

- The economic development policies and plans (including state spending, tax, exchange rate and monetary policies) of the four individual LMB countries. Evidence of good governance is also becoming an increasingly important consideration for foreign investors including multilateral lending agencies;
- The circumstances of the LMB economic and geographic space as a whole, and the consequences of various sorts of interactions (both formal and informal) between the constituent economies; and
- The trade and investment conditions within the GMS, Asia and the world economy, which determine levels of export demand and FDI inflows. Notable among these will be the consequences for the LMB economies of accession to AFTA and its CEPT provisions (different across the countries, ranging up to 2015 for agriculture in Lao PDR and Cambodia, for example) and inclusion lists which will increase competitive pressure for all of them.

Economic growth outcomes in the LMB will be a result of the combination and interaction of these conditions. While impossible to predict accurately, the following economic scenarios are likely in the medium-term:

- On the basis of their available macroeconomic and sectoral development planning documents (eg, 9th 'National and Economic Social Development Plan' in Thailand, 2nd 'Socioeconomic Development Plan in Cambodia', 1999 'Strategy and Vision for the Agriculture Sector ' in Lao PDR) and budget and finance statements, all LMB countries are committed to relatively open economic regimes with growth as an objective to reduce poverty. Exports of primary and processed materials will grow; agricultural diversification / intensification will increase; and tourism will expand
- The major factors which affect how the LMB economies interact with one another will not change significantly. For example, labour and land distribution patterns and prices, and the centres of industry and demand for products are likely to remain stable in the next few years, and national borders will remain relatively porous, but formally-encouraged moves (and economic imperatives) towards increasing formal economic integration are likely to continue and intensify. The impacts of these may be restricted to certain physical areas and/or economic sectors (depending on specific items of physical infrastructure and/or sector- or industry-level interventions), but will be felt across all of the LMB to some extent, and
- The era of large inflows of FDI is probably over for the LMB countries: Viet Nam, Lao PDR and Cambodia have – to differing extents – all had some kind of 'honeymoon' with FDI, but various sorts of problems connected with individual investment climates (usually due to the high costs of doing business) have contributed to recent major declines across the LMB. Also, the historically-successful, export-led growth of the region in recent years has is becoming subject to more competition (eg, from China), and the continuing slowness of recovery in the USA and Europe. FDI inflows may to some extent be offset by investments from China, as it moves down the supply chain towards not just trading for goods (i.e., imports) but also becoming more involved with their production (especially of tropical agricultural commodities and produce).

The broad implications of these conditions are that:

- To some extent, all LMB countries will become more open and will increasingly compete with one another on agricultural and industrial development objectives (and in simple terms of investment attraction, export promotion etc)
- The present economic and technical roles of each of the LMB economies within the basin will probably remain largely as they are, with the structure of markets, centres of primary and secondary production and factor movements tending to be difficult to dislodge, possibly undermining some national development intentions of the smaller economies
- The incentives for cross-border integration will intensify with the realisation of some of these factors and, as the attractions of joint investment promotion become more apparent, economic integration will increase.
- The LMB will probably have to rely more on its own internal consumer market and that of neighbouring areas to buy its products and stimulate its economic growth. Developing and encouraging this demand will not always be easy (especially given the region's – particularly Thailand's – historical export orientation and Viet Nam's growing export orientation), but as income levels rise, domestic consumption will rise if there is appropriate policy encouragement.

While some of these conclusions may imply considerable doubt about economic growth and its capacity to lift a large number of people within LMB out of poverty in the medium-term, there are also important reasons to be optimistic about the LMB's future. Overall, economic activity in the LMB is notably undeveloped at present, and there is major capacity for general economic growth in levels of output, trade, employment, and income generation in the medium-term. This view is based on two main points:

- The existence of significant unemployed and underemployed resources (particularly labour, but also land in some areas) and the underused capacity of other resources. These inefficiencies in application, result in poor product quality and unnecessarily high costs of production; and
- The likely expansion of product markets (national, subregional, and international – *especially China*) for food and other natural resource-processed products, particularly as local and regional incomes rise and household consumption patterns change in favour of processed and purchased items, leading to a reduction in subsistence production.

The challenge for policy-makers and investors within the LMB (in addition to maintaining overall internal and external balances) is thus to pursue economic growth through specific policies, plans and projects which

- promote activities in which LMB and its constituent parts have underlying comparative advantages and/or can develop dynamic competitive advantages (and combine resources across national borders where necessary to achieve this), and
- spread the benefits of growth as widely as possible within LMB such that locally-generated incomes are spent on locally-produced products (thus reducing poverty and establishing a virtuous circle of income-demand-incomes, etc).

Overall, the LMB is probably experiencing growth in real GDP at about 5% a year at present, and this is expected to continue in the absence of any major extra-subregional shocks.

This level may be maintained over the medium term, given the current slow pace of the world economy, the ending of the FDI boom, etc, already discussed. Optimistically, the rates of 7-9% plus real GDP growth of the early and mid-1990s (eg, as in Viet Nam) could reoccur.

At 4% real GDP growth, average per capita incomes (apart from the effects of population increase) would more than double in 20 years; at 6% sustained real GDP growth over the same period they would almost exactly triple. Given the aggregate, but highly differential, population increases across LMB, it may be reasonable to expect, on average, the LMB population to be 50-70% better off in real terms in 2020.

Based on past and present patterns in LMB countries and elsewhere, economic growth of this kind would not be spread equally across all sectors, but would actually make income distribution more unequal while simultaneously lifting large numbers of the population out of poverty. Expecting such a growth rate for the LMB is probably not unreasonable based on current trends, but it is important to note that both aggregate growth and per capita GDP increments can be affected by trends in population growth. The influence of events in Viet Nam, with its large population and high proportion under the age of 15, is particularly noteworthy in this respect.

7.2.3 Some specific trends in structural economic development

Sectors and activities

Given the likely sources of growth detailed above, the associated consequences of such growth would be apparent not just in aggregate real national incomes on a per capita basis, but also in a number of major economic and socio-economic trends, as patterns of investment and economic structure, consumption and mobility change. These need to be identified and described for the purposes of planning, as they will have major and long-term implications for resource use (eg, scale, seasonality and location of water demand) and cross-border cooperation.

The following economic trends can be expected:

- Increasing agricultural commercialisation and specialisation
- Increasing non resource-based industrial developments
- Increasing urbanisation and consumer spending, and
- Increasing subregional integration.

These trends are broadly-defined and aggregated phenomena, subsuming within them (to varying degrees across the four countries) many more minor and specific tendencies (eg, towards rural industrialisation in Viet Nam and towards the development of flatland areas in Lao PDR). Some implications of each of these major trends are briefly discussed below.

(a) Increasing agricultural commercialisation and specialisation

Each LMB country intends to pursue policies aimed at intensification of agriculture, although at somewhat different levels of sophistication and on the basis of differing levels of development:

- In Cambodia and Lao PDR, the issues are mainly about improving input (eg, finance, fertilisers) and technology supply and the development of marketing links (and food security in the context of poverty reduction).
- In Viet Nam, issues primarily include quality improvements (through policies such as rural industrialisation and technological intensification; by introducing large-scale commodity agriculture, raising productivity, developing industry and services in the countryside etc).
- In Thailand, the issues are about increasing the technology and science base of agriculture and promoting sustainability and natural resource management. Previous tariff and other mechanisms, which provided some protection, especially to agriculture sectors, will be diminished under AFTA.

In all LMB countries the effect of these policies and agreements will most likely be to increase agricultural intensification (involving higher yields, more marketed volumes etc) *per se*, and also (on the basis of the kind of basin-wide analysis discussed earlier) to encourage increasing specialisation between countries such that Thailand and Viet Nam may produce less rice and more higher-value products than now, while Cambodia and Lao PDR will probably maintain or increase current production levels of staples. Increased trade in primary products with ASEAN countries and even more so with China will also tend to support such trends.

(b) Increasing non resource-based industrial developments

Similarly, all LMB countries intend to develop their non resource-based industries more fully – again at different levels and through different means. For Cambodia (and also Lao PDR, to a lesser extent), the main issue is about both broadening and deepening the industrial base (eg, ending dependence on the garment industry) in aggregate terms, with a view to creating employment in urban areas.

For Viet Nam, the main issues are about developing small and medium-sized industrial establishments (SMEs) with diverse trades and crafts, applying potentially labour-intensive technologies, forming specialised farming areas linked to processing industries and attracting more labour from the Mekong Delta.

For Thailand the objectives involve growing technologically and in terms of labour skills, adding further to export values, increasing rural-urban linkages and also diversifying industry geographically out of the Bangkok Metropolitan Area (BMA)/Central Plains areas.

Again, a natural non resource-based industrial specialisation based upon existing comparative advantage and emerging competitive advantages will probably be detectable across the LMB, and it may also be expected that a proliferation of industrial parks, export processing zones, hi-tech zones, industrial clusters, open economic zones will emerge within the LMB, both at various border locations (eg, Mukdahan/Savannkhet) and elsewhere.

(c) Increasing urbanisation and consumer spending

With growth in both agro-industrial and non resource-based activity, as well as overall population growth and higher levels of literacy and lifestyle expectations, rural-urban migration is expected to continue. This process is an inevitable a part of economic development. The pace at which this occurs within the LMB is likely to be influenced by the extent to which physical infrastructure is put in place (allowing easier temporary and seasonal migration, for example) and if borders remain porous. It will also of course happen within

individual economies as they grow and their sectoral composition changes. In the LMB this means moves towards the capital cities of Vientiane and Phnom Penh, while in all countries 'secondary towns' such as Ubon Ratchathani, Can Tho, Pakse and Siem Reap can also expect to grow.

Along with increasing urbanisation, one can expect changes in lifestyles and working patterns, and thus changes in consumption behaviour; for example, urban consumers spend higher proportions of their income on processed foods and other goods for which the income elasticity of demand1 is greater than one, than do rural consumers.

(d) Increasing subregional integration

The last major observable trend will almost certainly be increasing subregional integration. This will continue to be promoted by the formal ASEAN, GMS and other initiatives - but will most likely also grow on the basis of the economic analysis of the four riparian countries presented earlier. The factor locations and prices, border and trade and investment circumstances discussed previously, plus expected differential tasks and growth across LMB, will inevitably encourage further integration between the economies.

This integration is not likely to diminish the relative economic hegemony of the two larger economies within the LMB, and there is still likely to be an overall net benefit for all constituent LMB economies.

These four trends are inter-related; for example, increased non resource-based industrialisation will be closely associated with particular locations and growing migration towards the sources of employment. Similarly, higher urban incomes will be associated with increased demand for agroindustrial/processed products (some of which will be processed locally, some of which will be imported from or through neighbouring countries). Some of the major ways in which the four trends are inter-related are summarised in the following table:

Table 7.2: Some inter-relationships between emerging economic trends in the LMB

Emerging economic trend:	Increasing agricultural commercialisation and specialisation	Increasing non resource-based industrial developments	Increasing urbanization and consumer spending	Increasing subregional integration
Increasing agricultural commercialisation and specialisation		Strengthened forward and backward linkages between primary and secondary sectors	Increased urban demand for agroindustrial (especially food) products	Emerging agricultural and agroindustrial specialisation across LMB countries (low value/high value or technology split)
Increasing non resource-based industrial developments			Industrial jobs provide urban demand	Emerging industrial specialisation across LMB countries; joint border developments
Increasing urbanisation and consumer spending				Demand for imports; demand for labour from neighbouring countries

[1] See glossary for an explanation of income elasticity of demand.

If economic development within the LMB does occur at the level expected and contains the kinds of features captured in the trends just described, this will have implications for the roles each of the constituent LMB national areas may play.

Table 7.3 below tries to summarise the underlying natural advantages and emerging potentials and what the role of each of the national LMB areas might be in the medium-term.

Each area's future role in the LMB is not likely to change dramatically; Cambodia and Lao PDR are primarily sources of raw materials (and some factors of production), while Thailand and Viet Nam's development is largely driven by forces outside the LMB. In effect, these larger countries can use their neighbours as sources of raw materials or as additional product markets. It is hard to see how, in the medium-term at least, the present fundamentals of economic roles can be changed, although it is equally obvious that certain economic tasks can be re-assigned. As competition among the LMB countries evolves (and as more pressure is felt from China) and more specialisation develops there will most likely be some re-assignment of some existing tasks on a cost-structure/productivity-determined basis.

Table 7.3: Possible evolution of economic roles within the LMB

	Cambodia	Lao PDR	Thailand	Viet Nam
Present economic structure and role	Source of primary raw materials (crops, fish) – generally poor quality Small and fragmented internal market	Source of primary raw materials (crops, wood), generally of poor quality Small internal market Poor FDI history	Major agricultural and agroindustrial player Significant industrial depth on national basis. Source of capital, technical expertise and primary product demand (both in LMB/rest of country)	Emerging regional agroindustrial and light manufacturing power in LMB. Poor quality products and generally low technological base at present. Some demand for LMB produce (wood, crops) for processing
Areas of underlying comparative advantage	Some crops (corn, soybean) and fruits, rubber (?) Major freshwater fisheries potential Possible/temporary garments industry? Major labour surplus (low skill, low cost)	Some crops (rice, soybean) and wood products Extensive agriculture Large livestock Hydropower and minerals Some surplus labour (low cost)	Early-developer in regional terms has captured regional product markets	Intensive cultivation of rice and other crops Fisheries (including saltwater) Production of consumer and semi-industrial products. Point of export to other regions (eg, East Asia) from LMB
Emerging competitive advantages / possible sources of growth	Major tourism potential (including water-based tours) Fisheries Some niche primary products (eg, organic rice) Some bulk commodities based on agriculture in border areas (especially for Thailand) Inter-country LMB and GMS economic conduit	Hydropower Tourism Agroindustry 'Mekong flatlands'-based agriculture (some for export) Inter-country LMB and GMS economic conduit. Developments may depend upon extent of Thai investments	Higher-technology quality products Sales of expertise and equipment to other areas of LMB Processor of primary products from Cambodia, Lao PDR	Low-to-medium technology quality products Some sales of expertise and equipment to other areas of LMB, and some processing of primary products from Cambodia, Lao PDR Large labour force, low cost and medium skills SMEs may predominate Doubts re. state owned enterprise reform
Socio-economic implications of the LMB development role	Net supplier of labour and primary products to other parts of LMB Border provinces may experience more growth than central ones, unless internal market conditions improve significantly Limited domestic value-adding, and poverty reduction will be uneven	Net supplier of labour and primary products to other parts of LMB 'Mekong flatlands' likely to grow fastest Possible growth in north as Chinese interest increases Many hilly and border provinces (eg, with Viet Nam) likely to remain remote and relatively poor	Economic growth in LMB likely to be determined largely by national trends N and NE remain relatively poor; areas of labour surplus (increasing competition with Cambodia/Lao labour keeps wages down in LMB) but still richest area of LMB	Economic growth in LMB likely to be determined largely by national trends Mekong Delta may be affected by VN's 'southern growth triangle' success

7.3 Overview of economic activities demanding water

7.3.1 Introduction

This Part of the paper outlines some of the most important water-related social and economic activities in the LMB. It provides the context for Part 4, which describes how changes in the economy may impact upon LMB water demands.

The major water-based economic activities in the LMB are irrigated agriculture, fisheries, hydropower, municipal and industrial use, water-based tourism and navigation.

7.3.2 The composition of demand for water resources

The sections below detail the importance of various water-related activities to the economies in the LMB. Indicators used to measure the significance of each activity include contribution to national GDP/GNP, employment (share of labour force employed by activity), value-added activities and contribution to export earnings. However, these indicators do not give a complete picture of the relative economic importance of each of these activities. For example, they rarely account for informal economic activities (such as subsistence agriculture and non-motorised water transport); roles in poverty reduction; indirect links that arise as a result of the primary activity (eg servicing of trucks used to transport produce to market), and the social and environmental impacts of the activities.

(a) Irrigated agriculture

The agricultural sector is critically important to the LMB economy. Over 40% of the basin's land area is devoted to agriculture and agricultural activities provide the livelihoods of the majority of the basin's population, which is growing rapidly. Overall, 75% of the region's population is estimated to be directly dependent upon agricultural crops, fisheries, livestock or forestry. Agriculture is responsible for 80-90% of all water abstractions from the Mekong River, most of which is for crop cultivation (Nesbitt, 2003). It is estimated (FAO, 1999, cited in Ringler, 2003) that water withdrawals for irrigated agriculture account for 94% of the water use in Cambodia, 82% in Lao PDR, 91% in Thailand and 86% in Viet Nam. Agricultural water demand is therefore arguably the most significant, and one of the highest value users (despite the relatively low economic returns per unit of water applied) and is therefore likely to play a major role in determining levels of availability for other users.

Yields from crop production in the LMB are considered low by international standards, and there is scope for increasing the scale, intensity and efficiency of production. Access to water is, however, a major constraint to increasing crop yields in the LMB, and irrigation schemes continue to be installed or improved in each of the four countries (Nesbitt, 2003). Such changes, along with effective measures to improve water use efficiency, could significantly enhance rural incomes and national macroeconomic performance. Increasing commercialisation of production, expansion and intensification of irrigation and the diversification of rice-based production systems into alternative crops with greater financial returns are all important trends in this direction.

Agriculture accounted for around 37% of GDP in Cambodia in 2003 (ADB, 2004). However, structural problems continue to hamper expansion in agriculture. Farmers have

limited access to productive land, irrigation, improved seeds, inputs, and finances, deficiencies which hinder the ability to raise productivity and diversify to higher value-added products. In 2002, a combination of drought and floods also hurt the sector, resulting in a 2.7% negative growth rate (ADB, 2004).

Similar to Cambodia, Lao PDR's economy is at a low level of development, with agricultural production accounting for around half of GDP (ADB 2004). An estimated 85% of the workforce is employed in agriculture (ESCAP, 2002) with 74% of economically active people in rural areas engaged in subsistence agriculture. Agriculture led the economy's recovery from the regional financial crisis of 1997/98.

Growth in the agricultural sector has been variable over the past decade, declining from almost 5% in 2000 to 2.2% in 2003 (ADB, 2004).

Less than 10% of Thailand's GDP is generated by agricultural production. Nationally, agriculture employs around 56% of the labour force (ADB, 2003), though it reaches nearly 70% in the Northeast region.

In 2002, agriculture comprised 23% of the Vietnamese economy (ADB, 2004), and nearly 70% of the population was engaged in agriculture. Rice accounts for half of total national agricultural production. Production methods have been intensified and rice yields are now among the highest in the region. Vietnamese farmers have also begun to diversify into other agricultural products. Perennial cash crops such as rubber, coffee, tea and fruit are grown in significant quantities. In the Mekong Delta, agricultural production accounts for about 55% of the regional GDP. Coffee and rubber export prices increased by 50 and 46% respectively during 2003, providing a boost to the value of commodity exports (World Bank, 2004b).

The development of agriculture beyond subsistence farming to include a diversified range of cash crops, as well as expansion of non-farm economic activities in rural areas, will likely contribute to higher household incomes. A tabular summary of the importance of agriculture to each of the national economies is provided below.

Table 7.4: Importance of agriculture to LMB economies (2002)

Country	Share of agriculture in GDPa	Growth in agricultural productionb	Growth in agricultural value addedd	Share of labour force in agriculturee	Net agricultural exportsf
	% (2003)	*% per year (2003)*	*% per year (2002)*	*% (2001)*	*US$ millions*
Cambodia	37.2	9.8 (1.9)c	1.8	70	-282.1
Lao PDR	48.6	2.2	4.3	76	-41.1
Thailand	9.8	6.8	4.4	56	4,499.70
Viet Nam	21.8	3.3	3.0	67	966.7

Sources: a,b/ ADB (2004); c/ National Institute of Statistics, Cambodia; d/ ADB, 2003; e/ FAO; f/ FAO

(negative numbers indicate imports)

(b) Fisheries

The Mekong River has one of the largest, most diverse and abundant fisheries in the world. The annual fish catch in Cambodia alone is roughly estimated to be around 300,000 – 400,000 tonnes, making it the fourth largest fishery in the world after China, India and Bangladesh (Van Zalinge et al, 2001).

The Mekong's fishery is of enormous importance to the basin's population. Around two-thirds of the rural population (40 million people) is involved in the Mekong's fishery at least part-time or seasonally. Not only do they derive their livelihood from the fishery, but they also depend on fish and other aquatic animals for nutrition and food security. It is estimated that on average, people consume about 36kg of aquatic products per person per year1. The two million tonnes of fish and aquatic products caught and cultured in the basin are worth over US$1.4 billion at farm gate prices (i.e. not including the multiplier effects of fish trade) (MRC, 2003 State of the Basin Report). Most fish is consumed within the LMB.

The value of the capture fishery in the LMB is estimated at US$1.042 billion. The aquaculture sector is worth US$273 million (of which around US$28 million can be attributed to marine prawn aquaculture in the Mekong Delta), and the reservoir fishery is valued at US$163 million annually (MRC, 2003). The capture fisheries currently constitute a significant proportion of the total output and value of LMB fisheries, however their productivity can be affected the construction of physical barriers and water extraction (which have an influence on habitats and migration patterns), fishing pressure and destructive fishing practices and pollution. The table below summarises the value of fisheries in the LMB:

Table 7.5: Value of fisheries in the LMB

Fish and aquatic product source	Quantity (tonnes)	Price (US$ per kg)	Value ($ millions)
Capture fisheries	1,533,000	0.68a	1,042
Aquaculture	260,000	1.05b	273
Reservoirs	240,000	0.68*	163
TOTAL	2,033,000		1,478

Notes: a/ Aeron-Thomas (2003); b/ Phillips (2002); */ The reservoir fishery consists of both capture and aquaculture sectors, but the respective proportions of each are unknown. The value of the reservoir fishery was estimated conservatively using the lower price estimate of $0.68.

Note that the yields and values presented in the sections above and below are 'best estimates'. The value of the fishery in the LMB is difficult to estimate due to a number of factors:

- the relative proportions of fish, processed fish products and other aquatic animals are not well described
- the average prices of products in many regions are not known
- the fishery yield cannot be easily estimated using traditional fisheries collection methodologies

1 This varies from 30kg per capita in the upland areas of Lao PDR (around Luang Prabang) to around 70kg per capita around Tonle Sap Great Lake (Sverdrup-Jensen, 2002).

- the fisheries are widely dispersed, effectively operating along the lengths of all the main rivers and most tributaries
- there are no centralised landing ports where data can be easily collected
- there are numerous species, the catch of which varies seasonally and with many different types of gear, and
- the fisheries operate at commercial, semi-commercial and subsistence levels.

Poor information has led to significant undervaluation of fishery yields as well as their economic and nutritional importance. Estimates have however been made of the value of the fishery by applying fish prices (using average landing site prices for cultured fish and average first-hand sales prices for capture fish) to the total yield of fish, fish products and other aquatic animals.

The fisheries sector in Cambodia can be characterised as follows:

- It was valued at around US$407 million per annum in 2001 (IMF, 2001) and contributed between 7-12% of total GDP in 2001 (IMF, 2001; Kang and Chan, 2003). Other estimates by the Department of Fisheries suggest fisheries accounted for as much as 16% of GDP in 2002.
- Growth in the fisheries sector averaged around 4.31% per annum between 1993 and 2002, with a surge in growth of 6.8% during 2000/1 and a sudden drop to 1.3% during 2001/2 (NIS, 2003). Several factors may have contributed to this decline including the large floods in late 2000, which affected fisheries production and damaged fishing vessels and gear, and general over-fishing, resulting in lower stocks and fewer larger species. In the longer term, increased use of flood control (including road construction along embankments, which effectively act as dykes) and loss of the fish-spawning habitat, particularly in the flooded forest area of Tonle Sap could significantly reduce fish productivity.
- Capture fisheries alone are estimated to yield between 300,000 and 400,000 tonnes, valued at US$220-250 million at landing site prices (van Zalinge *et al*, 2000) during the late 1990s and over US$300 million at retail prices. Estimates of the annual mean fish yield for Tonle Sap are 230kg per hectare for the Lake and floodplain (MRCS, 2003). Another estimate put the value of freshwater fish production, including subsistence fishing, at around US$300 million (Jensen, 2000 in Degen *et al*, 2002). In comparison, the total monetary value of paddy rice in Cambodia is roughly US$350-400 million (McKenney and Tola, 2002).
- With large surpluses of fish caught during peak fishing periods, fish trade and export (including within the LMB) is critical to income growth in the sector. Presently, fresh and processed fish are traded widely within Cambodia, exported in significant quantities to neighbouring countries, and in some instances exported to more distant markets. The fisheries sector has been targeted as an important sector for export promotion because the high level of fish production provides a comparative advantage over neighbouring countries (Chea and McKenney, 2003). This promotion is taking place within the context of broader regional and international trade agreements such as the ASEAN Free Trade Agreement and the World Trade Organisation accession. Official statistics on fish exports from Cambodia are considered unreliable due to inadequate data, but it is estimated that total freshwater fish exports to Thailand alone may be in the region of 50,000 tonnes (van Zalinge *et al*, 2000) or between 30,000 to 100,000 tonnes if marine fish are included (Ministry of Commerce, 2001; cited in Chea and McKenney, 2003).

- Recorded *value added* for fisheries in Cambodia has been increasing rapidly over the past years, growing by 45% since 1995 and by as much as 16% in 1999 alone (ADB, 2000). The IMF presents more conservative estimates of around 4.16% growth per year between 1994 and 2000, with a peak of 6.8% during 2000 (IMF, 2001). Value added in the fisheries sector was approximately 40% of total production value added in 2001 (IMF, 2001), slightly more than the contribution made by agriculture.
- Individual fish catch rates have reportedly been falling, but overall catches have been growing because of increases in the number of people fishing. A rapid increase in medium- and small-scale fishing and mismanagement of fishing lots in recent years has lead to overexploitation of some fish species, though others are still plentiful.
- The recorded fisheries sector in Cambodia provided employment for over 261,000 people in 2001, or 4.2% of the total recorded labour force (IMF, 2001). More than 1.2 million people (between 64% and 93% of households) living in fishing communes around the Tonle Sap area depend almost entirely on fishing as their principal livelihood (van Zalinge *et al*, 2001). In Cambodia, subsistence fisheries produce higher catches than the large-scale commercial fisheries (Ahmed *et al*, 1998). Livelihood studies around Tonle Sap Great Lake found that villagers there spent less time on fishing activities but generated 3.5 times more value than for their farming activities (Yin *et al*, 2000).

Few statistics are available on the fisheries of Lao PDR, as a result of limited financial and technical resources to undertake surveys (Souvannaphanh *et al*, 2002). In 2000, total fisheries production was estimated to be about 71,316 tonnes per year (Souvannapanh *et al*, 2002). The most recent IMF Country Report (2001) estimates that together, livestock and fisheries were worth US$23 million in 2001 (1990 constant prices), and fisheries accounted for about 8% of the national GDP in 2002 (Souvannapanh *et al*, 2002). Up to 71% of rural households in Lao PDR are reliant on fishing to varying degrees for subsistence and additional cash income (Sverdrup-Jensen, 2002). The wild fishery is particularly important for the poorest and landless rural households, making significant contributions to their nutrition, food security and income.

In 1997, the fisheries sector in Thailand as a whole was worth an estimated US$3.18 billion (1997 constant prices) and contributed approximately 2% to GDP. Fisheries in the north and northeast were worth US$147 million (Alpha Research Company Ltd, 2000). In 1999, total freshwater catches in Thailand were more than 3.16 million tonnes (Alpha Research Company Ltd, 2000).

The fisheries sector contributed between US$1.1 million and US$2.8 million (2001 prices) or 3.44% to total GDP in Viet Nam in 2001 (GSO, 2002). Official estimates of total fish production in 2001 were around 2.4 million tonnes for the country as a whole, over half of which (1.27 million tonnes) was produced in the Mekong Delta (GSO, 2002). Inland fisheries in the Delta provide about 62% of national culture fisheries production. The sector has experienced strong growth in the past four years for which data was available, particularly in shrimp culture, which rose sharply from 5.12% growth between 1998 and 1999 to almost 7% between 1999 and 2000 in the Mekong Delta (GSO, 2002). The reasons for this sudden expansion could be the result of growing demand from regional and national markets and a general shift from rice mono-cropping to more profitable rice-shrimp agriculture in the Delta. The Delta contributes over 75% of national shrimp production (GSO, 2002).

The table below shows (where sufficient data is available), the relative importance of fisheries to each of the national economies.

Table 7.6: Contribution of inland fisheries to the LMB economy

	Gross output (tonnes)	Contribution to GDP (%)	% of labour force
Cambodia	300,000 - 500,000a	12	4.2
Lao PDR	71,316 – 133,000b	8	No data
Thailand		1	No data
NE Thailand	795,000c	1.75	No data
Viet Namd	2,434,600	3.44	1.96
Mekong River Delta	597,000 - 1,273,707e	No data	No data

Notes: a/ Souvannapanh et al (2002); MRCS (2003a); b/ Fisheries and Livestock are lumped together. No disaggregated statistics were readily available; c/ MRCS, 2003a; d/ Government Statistics Office, Viet Nam (2002). Employment statistics are for the fisheries sector as a whole (inland and marine);e/ The lower estimate is taken from MRCS (2003a) based on consumption data analysed by Sjorslev. The higher estimate is based on GOS (2002) figures.

Total freshwater *aquaculture* production in the LMB rose from 60,000 tonnes in 1990 to around 260,000 tonnes per annum in 2001, worth an estimated US$ 244.6 million. The Mekong Delta of Viet Nam and Northeast Thailand are the most important producers of cultured fish in the LMB. There are a number of important factors that influence the development of aquaculture potential, including infrastructure, access to supplies, access to markets, access to extension and other support services, and availability of fish seed.

Aquaculture in Northeast Thailand has grown significantly over the past decade and contributes over 33,500 tonnes per year. The Korat Plateau is the second largest area for aquaculture in the Basin after the Delta. Aquaculture production has expanded significantly over the past 10 years. Fish culture in ponds, rice fields, ditches and cages contributes over 33,500 tonnes per year, according to the Department of Fisheries. These statistics underestimate total production since small-scale producers are not included. With production from small-scale operations estimated to be in excess of 30,000 tonnes per year, a conservative estimate for the total annual aquaculture production is 65,000 tonnes (Sverdrup-Jensen, 2002).

Viet Nam has the largest aquaculture area in the basin, covering 330,000 hectares. In 1999, freshwater aquaculture production in the Mekong Delta was 171,570 tonnes, with an average annual pond production of 4.8 tonnes per ha. The Viet Nam government has also recently begun promoting giant freshwater prawn culture in the Mekong Delta. Current production is about 5,000 tonnes per year, but the government has set a target of 60,000 tonnes per year by 2010. Small-scale aquaculture contributes to food supply in areas where wild fish are not available and in seasons when wild fish are in short supply. It provides opportunities for flexible supplementary income and helps families diversify from fishing and rice farming activities.

Table 7.7: Freshwater aquaculture production in the LMB

	Number of households engaged in aquaculture	Estimated annual production (tonnes)	Estimated value ($)a
Thailand	> 156,000	33,521b + 30,000c	20,400,000d
Lao PDR	55,400e	5,378f	7,000,000
Cambodia	No data	14,100g	17,200,000
Viet Nam	1,606,000 – 1,873,000h	171,570i	200,000,000
Total		255,569	244,600,000

Notes: a/ This value is the theoretical cash value of production and does not reflect the actual income or expenditure on aquatic resources; b/ DoF 1997 official production statistics for NE Thailand; c/ Estimated unreported small-scale aquaculture production; d/ Estimated from 1997 DoF data on the average freshwater fish price of Baht 27/kg and 1997 annual production figures and an exchange rate of US$1 = Baht45; e/ Lao Agricultural Census, 1998/99. Steering Committee for the Agricultural Census. Agricultural Census Office, Vientiane, Feb 2000; f/ Pond production estimated as: estimated pond area x average productivity 800kg/ha, rice fish culture area x 120kg/ha; g/ Official DoF figures for 1998; h/ Le Than Luu 2001; i/ The figure excludes shrimp production – in 2000 there were 82,656 tonnes, 191,516 ha and 79.1% of the total productivity 0.432 t/ha/year in the Mekong Delta region; Source: Phillips 2002 in the MRC State of the Basin Report (2003), based on 1997-2001 statistics.

(c) Hydropower

Energy is a fundamental driver of socio-economic development. Modest increases in per capita energy consumption for the poorest countries can potentially lead to significant improvements to the quality of life of people living in these countries (UNDP, 2002). In the LMB, the combination of rapid economic development and improvement of people's living standards has greatly increased the demand for electric power.

The energy needs of the LMB are driven by projected economic growth rates, bottlenecks due to inadequate financing in the past, rapid urbanisation and globalisation of trade (which requires adequate and efficient power, roads and telecommunications infrastructure). Additionally, there is growing demand for better quality energy and service to increase international competitiveness (World Bank, 1998). Over the next decade, MRC member countries will need to develop about 20,000 MW of new generating capacity to meet growing demands (ADB, 2001). After this period, generating capacity will have to be developed at an even higher pace. Most of the power generation developments currently planned for Thailand and Viet Nam are thermal and gas turbine projects (fuelled primarily by natural gas and coal). There are also plans for the development of hydropower, but mainly in Lao PDR (on tributaries of the Mekong) and in Viet Nam (mostly outside the Mekong Basin).

Overall, it is estimated that over the next 20 years, demand for electric power in the Mekong Region will increase by an average of about 7% per year. Thus in 20 years the total generating capacity in the region will need to quadruple.

In recent years there has been a shift away from the use of fossil fuels for energy production because of limited supplies, volatile prices and environmental concerns. In order to reduce dependency on non-renewable resources and mitigate adverse environmental impacts, efforts are being made to develop other sources of generating electricity such as fuel cells, solar and wind power. Many of these alternative forms are, however, currently too expensive or capacity is too limited to meet more than a small fraction of the demand for power.

Of energy sources other than fossil or nuclear fuels, only hydropower has the potential to satisfy growing national and regional energy needs. For some countries in the region, it is

one of the main exploitable natural resources. As such, hydropower represents at present, and potentially even more so in the future, a major source of export earnings. It has the potential to contribute to economic development in a sustainable way when planned and implemented properly.

Demand for hydropower has escalated quickly with the rapid economic development in some of the riparian countries and elsewhere in Southeast Asia. Demand has increased fastest in Thailand and is expected to reach 62 GW by 2020, a more than six-fold increase from 1993 levels. Demand is also set to increase rapidly in Viet Nam, but is expected to remain below 1 GW in Cambodia and Lao PDR (Ringler, 2001).

Table 7.8: Energy in the LMB

Country	Energy Demand 2000 (GWh)1	Electrification rate (%) in 20012	Projected energy demand 2020 (GWh per year)3	Current installed capacity from all sources (MW)4	Hydropower Potential (GWh/year) 5	Currently installed hydropower capacity (MW)6
Cambodia	381	4-80	5,700	143	36,300	11
Lao PDR	865	5-100	4,400	643.1	102,300	625.6
Thailand	96,781	802-100	328,000	22,888	26,100	2,936
Viet Nam	26,722	28-100	169,000	8,227	10,000	4,154
TOTAL	124,749	-	507,100	31,901.1	174,700	7,726.6

Notes: 1/ ADB, 2001; 2/ MRC, 1997; BDP, 2002; Meritec, 2004; MRC (2003b); 3/ ADB, 2001; 4/ MRC, 2001; 5/ MRC, 1997; 6/ MRC, 2001

The MRC estimates put the hydropower potential of the Basin at 30,000 MW. Of this, 13,000 MW are on the mainstream, 13,000 MW in Lao tributaries, 2,200 MW in Cambodian tributaries, and 2,000 MW in Viet Nam tributaries. To date, 11 schemes have been completed in the LMB. All are tributary projects totalling some 1,600 MW, or 5% of the potential.

The lowest-cost hydropower potential is located in Lao PDR, while the main markets are Thailand, increasingly Viet Nam, and the more distant markets of Malaysia and Singapore. This means there is substantial potential for power trade between all countries (including Myanmar and southwest China) (Crousillat, 1998).

Thailand has developed only 25% of its hydropower potential but is unlikely to develop much more because of social and environmental resistance against further development. Current policy has placed a hold on hydropower development in Thailand's part of the Mekong Basin, except for pumped storage projects for daily peaking. Future possible sources of energy for Thailand include hydropower imports from Lao PDR, Myanmar and China; thermal power based on imported coal; and combined cycle gas plants.

Lao PDR is endowed with substantial hydropower resources, but has one of the lowest electrification rates in the region. The Government recognises that hydropower is one of the major resources to be developed, and has made great efforts to promote export-oriented power projects to earn foreign exchange revenue to support its economic and social development, and improve access to electricity for its large rural population. However, the 1997 Asian financial and economic crises adversely affected the Government's efforts due to the severe depreciation of the local currency and the slowing demand in the export power market.

Reliance on a single buyer is not a desirable situation for developers of hydropower in Lao PDR, whether public or private. The emerging market in Viet Nam for electricity import from Lao PDR, combined with power sector reforms in Thailand, may introduce competition between buyers in the not too distant future, thus reducing some of the risks associated with a one buyer scenario and benefiting both the producers and the Lao Government.

The less-developed power system in Cambodia, consisting of a large number of isolated grids supplied mainly from small diesel plants, makes small hydropower in the central areas of the country an option. However, until an overall transmission and distribution system is established, connecting the country to the larger Thai and Viet Nam grids (or to larger domestic mainstream projects developed for export) small-scale hydropower in the southern and western parts of Cambodia will not be economically viable. Development will therefore depend on the time frame for interconnections with its neighbouring countries[1].

The power sector in Cambodia is highly inequitable, with an electrification ratio of 80% in Phnom Penh and less than 4% in some rural areas, which have a considerably higher poverty incidence. Consumption patterns are also skewed, with per capita consumption rates ranging from 328 kilowatt-hours (kWh) per month in Phnom Penh to 9 kWh per month in provincial areas. These inequities have strong implications for the distribution of economic growth and poverty reduction. Electricity demand is growing at approximately 12% annually, with most growth occurring in the Phnom Penh area. The challenge for *Electricité de Cambodge* (EDC) is to continue to develop new sources of power generation, improve operations of the existing systems, and reduce the average purchase cost of generation. The challenge for the Government, given its limited financial resources, is to improve electricity supply throughout the country.

(d) Domestic and industrial water supplies

Water supplies in urban areas of the LMB originate mostly (about 85%) from the Mekong River and its tributaries. Not all of the urban population of the LMB has access to safe supplies. In 1995, ESCAP estimated that only one-third of Vientiane's population was served by a public water supply, for example, and only about 60% of the population of Phnom Penh was connected to the public water supply system in 2000 (Ringler, 2001). Service coverage has however been increasing since the reform of public sector utilities, with access up to around 84% in Phnom Penh and 63% in Vientiane (ADB, 2001). Industrial uses represent a small share of total withdrawals in the LMB (eg, Thailand: 4% and Viet Nam 10%).

It is estimated that up to one-third of the water abstracted cannot be accounted for (i.e. does not reach the end user). Water withdrawals for domestic and industrial water supply are estimated at 55,000m3/day or 140 litres per capita per day in Vientiane – this represents only about 0.04% of the annual discharge of the Mekong. Despite the fact that this is only a tiny volume of flow, its economic value is very high.

The application of water in this use is projected to grow (See Table 7.9). Clearly the kind of economic trends identified earlier (increasing urbanisation, increased industrialisation/ processing etc) are only likely to fuel this growth.

[1] Small-scale here refers schemes that produce sufficient energy to supply sub-national grids, as opposed to either national (large-scale) or micro-hydropower schemes.

Table 7.9: Basin population and domestic water withdrawals (2000 and 2020 projected)

Country	Basin population 2000	Water demand (Mm3) in 2000	Basin population 2020	Water demand (Mm3) in 2020
Cambodia	10,570,188	127	16,238,388	195
Lao PDR	4,956,981	99	7,481,013	150
Thailand	22,846,875	548	26,967,375	647
Viet Nam	17,033,866	715	21,817,222	916

Sources: MRCS (2003); MRC-WUP (2002)

(e) Tourism

Tourism in the LMB countries has been developing rapidly since the early 1990s. It already plays an important role in Thailand's national economic development and it is one of the key sectors the six GMS countries have pledged to promote as part of their regional economic cooperation programme.

Tourism potential is increasingly recognised in the economic development policies of all LMB countries, which are targeting both domestic and international demand. For example, an explicit objective of the Viet Nam National Administration of Tourism is "to develop the tourism industry into a spearhead economic sector" such that tourism will contribute at least 5% of GDP by 2005 and 6-8% by 2010 with revenues for 2005 and 2010 of US$2-2.5 billion and US$4-4.5 billion respectively.

Tourism is a major source of foreign exchange earnings and foreign direct investment for each of the four LMB countries and is emerging as a significant component of the national GDPs of each of the countries in the region. Table 10 summarises most recent available data for the contribution of tourism to GDP. The estimates provided by the World Travel and Tourism Council account for multiplier effects and therefore include direct, indirect and induced tourism benefits.

Table 7.10: Contributions of tourism to national and regional GDP

Country	GDP Contribution (%)			Tourism revenues US$ millions (2003)
	2001	*2002 est.*	*2012 projected*	
Cambodia	9.18	9.27	11.51	350a
Lao PDR	9.73	9.35	12.69	113.4b
Thailand	12.95	11.95	12.04	7,522c
Viet Nam	6.71	6.49	7.38	1,266d
Southeast Asia	8.51	8.15	8.93	-

Source: World Travel and Tourism Council (2002)

Notes: a/ Ministry of Tourism of Cambodia, 2004; b/ Lao National Mekong Committee – Sub-Area Reports for Lao PDR; c/ Tourism Authority of Thailand, 2004; d/ Viet Nam National Administration of Tourism, 2004

Based on figures provided by the World Tourism Organisation, the ADB projects that 61.3 million tourist arrivals in 2020 could generate an additional US$ 7.56 billion in tourism

expenditures, 290,000 more hotel rooms and about 194,000 new jobs directly in the hotel sector alone within the sub-region. Combined with related services and facilities this expansion would require investment of around US$ 14.5 billion,

Tourism will almost certainly represent a large and growing constituent in the LMB in the future, and the patterns of this consumption will not directly follow existing urban settlements (as tourists probably go disproportionately to smaller locations). Tourism should be treated as a separate water-use category.

(f) Navigation

The Lower Mekong and its tributaries have an important function as a basic means of mobility for poor communities. The river and its tributaries also continue to provide a transport conduit for trade throughout much of the LMB (especially between landlocked Lao PDR and the rest of the world), even though this role may be gradually eroded by bridge construction and on-going road improvement programmes. For many small communities located along the Mekong River and its tributaries, small boats often provide the only practical means of travelling to district or provincial towns and market centres, especially during the wet season when many roads become impassable and it is estimated that around 33% of the riverside populations of Cambodia and Mekong tributaries in Lao PDR live further than 10-11 km from a road that can be used year-round.

Today, the river is becoming increasingly important to international trade. The greater operating efficiency and lower costs of inland waterway transport (IWT) compared to other forms of transport are widely recognised. Yet the advantages offered by IWT are not readily reflected in volumes of cargo or passengers, nor in the evolution of government plans, policies and spending priorities.

Four main factors influence the extent to which the Mekong River and its tributaries are used for transportation:

- General economic and trade growth.
- Non-physical (or institutional) barriers to international navigation.
- The strength of competition from other transport choices (most notably road transport).
- Physical restrictions such as limitations on vessel draft imposed by the maximum available water depth during the dry season or, in the case of the estuarine region, at low tide.

Table 7.11: Value of inland waterway trade (2001)

Country	Trade value (million US$)
Thailand –China	88 million
Thailand – Lao PDR	350 million
Cambodia	235 million
Mekong Delta (excluding trade with Cambodia)	4 billion

Source: estimated on the basis of CIF value data supplied by Customs Departments (Cambodia, Lao PDR, Thailand) and national statistical publications (Viet Nam)

In 2002, trade on the Lower Mekong River and its associated waterways was valued at US$4.7 billion. The trade value within and between countries can be broken down as shown in Table 7.11.

MRC member countries share an interest in increasing levels of international trade and regional integration, and shipping is clearly one way to achieve this. Navigation contributes to economic diversification, provides employment opportunities and can supply a positive balance of payments. Waterborne transport has advantages over other transport modes in its cost, cargo capacity, reduction of road maintenance requirements and costs and congestion, and its attractiveness to tourists. MRC signatories opted for a separate article in the 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin. Article 9 - Freedom of Navigation provides the mandate for the MRC to promote and co-ordinate water transportation and to encourage freedom of navigation in the LMB. However, the extent to which water transportation for trade can be encouraged, is largely dependent on the availability of suitable shipping channels.

Volumes of cargo and passenger traffic are projected to grow substantially. Forecasts for trade and passenger flows using the Mekong River have been made as follows (Hodgkinson, 2002):

Table 7.12: Cargo traffic in LMB countries (million tonnes)

	2001	2007	2012	2017	2022
Cambodia	0.5	0.6	0.6	0.7	0.7
Lao PDR (domestic)	0.7	0.9	1.0	1.1	1.3
Thailand – China – Thailand	0.4	0.8	1.1	1.6	2.2
Thailand – Lao PDR – Thailand	1.5	2.0	2.2	2.4	2.7
Viet Nam (Mekong Delta)	21.8	32.0	42.9	57.4	76.8
Total LMB	24.9	36.3	47.8	63.2	83.7

Table 7.13: Passenger traffic in LMB countries (million passengers)

	2001	2007	2012	2017	2022
Cambodia	0.3	0.4	0.5	0.6	0.7
Lao PDR (domestic)	1.8	2.4	2.8	3.2	3.8
Thailand – Lao PDR – Thailand	0.2	0.3	0.3	0.3	0.4
Viet Nam (Mekong Delta)	86.0	86.0	90.3	113.2	141.4
Total LMB	88.3	89.1	93.8	117.4	146.3

Source: Mekong River Commission (2002) Assessment of trends in the transport sector of the Lower Mekong Basin, with special emphasis on waterborne transport report prepared for the Navigation Programme. MRC: Phnom Penh.

Landlocked Lao PDR realises substantial benefits from using the Mekong River for international trade. In 2001, the value of exports, imports and transit through river checkpoints opposite Thailand was estimated at US$350 million, or 44% of total trade. This figure also accounts only for recorded legal trade. River checkpoints account for an even higher share of the value of Lao PDR's exports (around 64%) since exports tend to be dominated by logs, timber products and other agricultural commodities, all of which are well

suited to river transport. Thailand has also been a beneficiary of the trade passing over the shared border of the Mekong River.

In addition, in recent years Thailand has been benefiting from the use of the river to transport a growing proportion of its bilateral trade with Yunnan Province of China, mostly through the ports of Chiang Saen and Chiang Khong. In a single year, the value of this trade more than doubled, from US$43 million in 2000 to US$87 million in 2001 (Thai Customs Dept, 2001), most likely boosted by the signing of the Agreement on Commercial Navigation on Lancang-Mekong River between China, Lao PDR, Myanmar and Thailand in April 2000.

In Viet Nam, around 90% of rice exports and 60% of fruit and vegetables originate in the Mekong Delta and are transported at least as far as Ho Chi Minh City by inland waterways. Rice exports in 1999 were estimated at approximately 4.06 million tonnes and worth US$1.8 billion. Fruit and vegetable exports in the same year were about 63,000 tonnes worth US$63 million. The combined value of agricultural exports moved by inland waterway vessels in the Mekong Delta is estimated at nearly US$2 billion annually. If this figure were augmented by the value of other exports and by the value of import volumes, the total value of trade moved annually on the waterways of the Mekong Delta would amount to US$4 billion, or nearly 20% of the country's overall foreign trade.

Annually, about 73 % of the region's cargo tonnage and about 27 % of its passengers travel by water (GOS, 2000). In addition, the relatively short average distances for passenger trips on inland waterways in the delta suggest that waterways are satisfying a crucial need for intra-district transportation.

7.3.3 Summary overview

The growth and economic sustainability of each of these economic activities discussed here is largely dependent upon adequate supplies of good quality water. These activities are currently the main drivers of economic growth in the region although it is likely that agricultural production will remain a mainstay of the LMB economy for years to come. Even as crop and irrigation efficiencies improve, and agro-processing becomes a more important part of the value chain (i.e. becomes more widespread), the sector will continue to demand significant volumes of water.

Water is an important – indeed crucial – contributor to macro-level GDP but is also fundamental to more local poverty reduction and livelihood support initiatives, especially among rural communities. For many of these communities, the Mekong and its tributaries not only provide the water required to satisfy basic human needs, but also support the aquatic resources upon which many of them depend for consumption and sale. Inland water transport is another basin asset allowing Mekong countries to move heavy bulk goods around the region relatively cheaply.

Many activities not detailed here (eg industry) rely on affordable and reliable sources of energy, which the hydropower potential of the LMB may be able to support.

7.4 The changing context of water demands

7.4.1 Introduction

The LMB countries' economies are growing in simple economic/GDP terms, and structural changes associated with this growth will have implications for the composition of output and value-adding generally and for the uses of water for production and consumption purposes in particular.

7.4.2 Summary: The 'Drivers Of Demand' for water

Table 7.14 summarises the major likely 'drivers' of water use in the LMB and their individual implications for water demand in the LMB. There is really nothing new about identifying these trends, although when they are presented collectively and considered in relation to the background of the economic (macro, sector and activity-level) circumstances described earlier, their context and implications become much clearer.

Table 7.14: Summary of 'drivers' of water demands in the LMB

Factor level	Factor	Implications for water demands
Macro/basin-wide trends	Population growth (70 million by 2020 from about 53 million in 2004)	Simple aggregate demand for all uses of water will increase proportionately or more. This will be manifest in numerous ways, eg,
	Changing lifestyles	• Overall, it is estimated that over the next 20 years, demand for electric power in the whole Mekong Region will increase by an average of about 7% per year. Thus in 20 years the total generating capacity in the region will need to be about four times greater than at present; the construction of dams for hydropower may have downstream implications for wetlands, fisheries and agriculture. • Increasing demand for higher value food products • Increasing demand for M&I supplies • The Mekong River has one of the largest, most diverse and abundant fisheries in the world. The annual fish catch in Cambodia alone is between 300,000 and 400,000 tonnes, making it the fourth largest fishery in the world; this will need to be both maintained in scale and expanded in productivity
	GDP / purchasing power per capita	Increased demands for water for agriculture production Increasing energy demands
	Increasing sub-regional integration (trade growth, etc)	Increasing need for adequate navigation flows for imports and exports and passenger trade volumes growing (cargo volumes are predicted to more than triple by 2020)
Major sector/activity trends	Increasing tourism	Increased water quantity and quality demand at LMB tourist sites
	Increasing agricultural commercialisation and specialisation	Increased demand for water for processing at specific locations, and increased demands for water for agriculture production (especially dry season irrigation)
	Increasing urbanisation and consumer spending	Urban domestic demands for piped water and sanitation services will increase
	Increasing non resource-based industrial developments	Urban-based industrial demands for water and reliable sources of energy will increase

7.4.3 The economic demand for water: An emerging paradigm

These trends are likely to have major implications for water-resource planning in the LMB, and will help to encourage the emergence of a new planning paradigm; this is essentially because water can be both a social and an economic good.

Access to clean water is fundamental to survival and is critical for reducing the prevalence of many water-related diseases. In the Mekong River Basin, water has historically been – and largely still is – first and foremost treated as 'common property' (i.e., a social good). Water is essential for sustaining life is a commodity to which people and the aquatic environment have right of access. It has been traditionally recognised less as an economic good, despite the fact that its use has a major impact on the creation of wealth and the wellbeing of the people.

However, failure over the past century to meet basic needs for water for all people, and also to stem the trend of water quality deterioration in many places, has led to rethinking of international, regional, national and local water priorities and policies. Countries and regions now differ to the degree to which they treat water as either a social or economic good. Generally, countries with strong free-market tendencies that emphasise private ownership tend to highlight its economic value, while others emphasise its social characteristics.

Overall, consideration has come more and more to be given to the potential value of applying economic tools and principles in water resource management. The International Conference on Water and the Environment (Dublin, 1992), concluded, among other things, that water has an economic value in all its competing uses and should be recognised as an economic good.

Increasingly, the need to assess the economic value of water in its alternative uses is being more widely recognised, and almost without exception there is an increasing interest worldwide in using pricing policies

- to increase allocative efficiency (i.e., by letting those who can use water most productively demonstrate this by paying for it),
- to effect desired behavioural change among water users (eg, to avoid waste), and
- to use water as a catalyst for the generation of wealth and prosperity.

This applies within the LMB as much as anywhere, and clear moves in this direction are already apparent in Thailand. Each of the trends described in the preceding text will add to the pressure for the treatment of water as an economic good, and therefore for its value to be made much more explicit to both policy-makers and consumers.

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Glossary

Association of South East Asian Nations (ASEAN) is an international body founded in 1967 to promote regional stability, economic development and cultural exchange in Southeast Asia. Its members include Cambodia (1999), Myanmar and Lao PDR (1997), Viet Nam

(1995), Brunei Darussalam (1984) and Thailand, Singapore, Malaysia, Philippines and Indonesia (1967). http://www.aseansec.org

ASEAN Investment Area (AIA): The Framework Agreement on the ASEAN Investment Area (AIA) was signed by the ASEAN Economic Ministers in Manila, in October 1998. The AIA is aimed at:

- Establishing the ASEAN region as a competitive investment area by 1 January 2010, with a liberal and transparent investment environment; and
- Contributing towards achieving free flow of investments in the region by 2020.

The AIA covers all direct investments, excluding portfolio investment and matters relating investment covered by other ASEAN agreements such as the ASEAN Framework Agreement on Services (AFAS). http://www.aseansec.org

ASEAN Industrial Co-operation Scheme (AICO): The AICO Scheme is the latest industrial cooperation program of ASEAN to promote joint manufacturing industrial activities between ASEAN-based companies.

The AICO is intended to be an important feature of ASEAN economic cooperation. It is designed to encourage technology-based investments in ASEAN, and is open to any ASEAN-based company meeting the following requirements:

1) incorporated in and operating in an ASEAN country
2) a minimum of 30 % ASEAN equity;
3) the company engages in some form of resource sharing (such as sharing of technology, market sharing, or consolidated purchases of raw materials).

A minimum of two companies in two ASEAN countries must participate. Output of approved AICO projects will enjoy 0-5% tariffs immediately, as will raw materials and intermediate products. Such products will also enjoy local content accreditation and non-tariff incentives. This involves not only the physical movement of products between the participating companies and countries but also resource sharing/pooling and/or industrial complementation. http://www.aseansec.org/6402.htm

ASEAN Free Trade Area (AFTA): The main objective of AFTA is to increase ASEAN's competitive edge as a production base geared for the whole market. A critical step in this direction is the liberalisation of trade in the region through the elimination of intra-regional tariffs and the elimination of non-tariff barriers. This will have the effect of making ASEAN's manufacturing sector more efficient and competitive in the global market. At the same time, consumers will source goods from the more efficient producers in ASEAN, thus expanding intra-ASEAN trade.

As the cost competitiveness of manufacturing industries in ASEAN is enhanced and with the larger size of the market, investors can enjoy economies of scale in production. In this manner, ASEAN hopes to attract more foreign direct investments into the region. This will in turn stimulate the growth of supporting industries in the region for many direct foreign investments. http://www.aseansec.org/12025.htm

The Common Effective Preferential Tariff (CEPT) Scheme is a cooperative arrangement among ASEAN Member States that would reduce intra-regional tariffs and remove non-tariff barriers over a 10-year period commencing 1 January 1993. The goal of the Scheme is to reduce tariffs on all manufactured goods to 0-5% by the year 2002 for the original six member states, Malaysia, Singapore, Brunei, Thailand, Philippines and Indonesia. The new members of ASEAN, namely Viet Nam, Lao PDR, Myanmar and Cambodia have been given the same 10 year flexibility to reduce tariffs from the time of their membership of ASEAN. In the case of Viet Nam, it will reduce tariffs to 0-5% by 2006, Lao PDR and Myanmar (2008) and Cambodia (2010). This means that ASEAN Member States shall have common effective tariffs among themselves in AFTA, but the level of tariff a with non-ASEAN countries shall continue to be determined individually. http://www.aseansec.org/1164.htm

Economic prices – reflect actual resource use (including opportunity costs of time, labour the money) in undertaking an activity. Economic values:

- Exclude transfers (eg taxes and subsidies) which are simply a reallocation of resources among groups in society, rather than a resource use
- Include externalities (unintended environmental and social impacts of a particular activity)
- Use real (present day) values to account for past/future cost-benefit streams

Financial prices – are direct accounting measures (direct cash flows), usually expressed in nominal (ie non-inflation adjusted) terms.

Foreign Direct Investment (FDI) is a cross-border investment made by an investor with a view to establishing a lasting financial interest in an enterprise and exerting a degree of influence on that enterprise's operations and where the foreign investor holds an interest of at least 10% in equity capital.

FDI is often mentioned as a lead driver for economic growth and thought to bring certain benefits to national economies. It can contribute to Gross Domestic Product (GDP), Gross Fixed Capital Formation (total investment in a host economy) and balance of payments.

Gross Domestic Product (GDP) refers to the total value of all goods and services produced within that territory during a specified period (most commonly, per year).

The ADB Greater Mekong Sub-Region (GMS) comprises Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Viet Nam, and Yunnan Province in the People's Republic of China. In 1992, with the assistance of ADB, the six countries entered into a program of subregional economic cooperation, designed to enhance economic relations among the countries. The program has contributed to the development of infrastructure to enable the development and sharing of the resource base, and promote the freer flow of goods and people in the subregion. It has also led to the international recognition of the subregion as a growth area. Since its establishment, ADB has been financing subregional projects in the GMS, both in the form of loans and technical assistance in grants. http://www.adb.org/GMS/default.asp

The United Nations Human Development Index (HDI) measures the average achievements in a country in three basic dimensions of human development:

- A long and healthy life, as measured by life expectancy at birth.
- Knowledge, as measured by the adult literacy rate (with two-thirds weight) and the combined primary, secondary and tertiary gross enrollment ratio (with one-third weight).
- A decent standard of living, as measured by GDP per capita (PPP USD).

Each year, countries are ranked according to these measures. http://hdr.undp.org/

Income elasticity of demand refers to the proportionate change in the quantity of a commodity demanded after a unit proportionate change in the income of consumers, with prices held constant.

Initiative for ASEAN Integration (IAI): At the Fourth ASEAN Informal Summit held in Singapore from 22-25 November 2000, the Singapore government announced a framework to assist the integration of the newer member countries (Cambodia, Lao PDR, Myanmar and Viet Nam) into ASEAN. Titled "Initiative for ASEAN Integration" or IAI, the framework encompasses a variety of programmes aimed at developing the human resources of these countries. http://202.154.12.3/14013.htm

Inter-Industry Trade (IIT): Trade in which a country's exports and imports are in different industries

Poverty Reduction Strategy Papers (PRSP) are prepared by the member countries through a participatory process involving domestic stakeholders as well as external development partners, including the World Bank and International Monetary Fund. Updated every

three years with annual progress reports, PRSPs describe the country's macroeconomic, structural and social policies and programs over a three year or longer horizon to promote broad-based growth and reduce poverty, as well as associated external financing needs and major sources of financing. Interim PRSPs (I-PRSPs) summarize the current knowledge and analysis of a country's poverty situation, describe the existing poverty reduction strategy, and lay out the process for producing a fully developed PRSP in a participatory fashion. http://www.imf.org/external/np/prsp/prsp.asp

The Multi-Fiber Arrangement (MFA), has since 1974 governed world trade in the textile and apparel industry. The MFA provided the basis on which industrialised countries (US, Europe) restricted imports from developing countries. Quotas have been negotiated each year on a country-by-country basis, assigning the quantities of specified items which can be exported from developing countries to the developed countries. The Agreement is being phased out by 2005 with implications for where apparel supplier factories will choose to locate.

Newly Agroindustrialised Country (NAIC): Countries wherein agriculture has played a key role in the industrialisation process. It is usually the parallel development of traditional (eg rice and rubber) and high-value, export-orientated agriculture that stimulates the growth of agro-industry.

Non-Performing Loan (NPL): Loans that are, or are close to being, in default such that the debtor has failed to repay the interest or capital payments due.

Official Development Assistance (ODA) is defined as those flows to developing countries and multilateral institutions provided by official agencies or by their executive agencies, which meet the following tests: a) it is administered with the promotion of the economic development and welfare of developing countries as its main objective;and b) it is concessional in character and conveys a grant element of at least 25 %.

The MRC-BDP Resource Allocation Model (RAM) is a hydrological-economic model that allows users to assess the nature and significance of the trade-offs between water-related economic activities and between sub-catchments and LMB countries that arise as a result of different water allocation choices.

Revealed Comparative Advantage (RCA) is a measure of relative export performance by country and industry, defined as a country's share of world exports of a particular good divided by its share of total world exports.

State-Owned Enterprises (SOE) operate as commercial businesses but are owned by the State.

Total Factor Productivity (TFP) is a measurement of how well an organisation utilises all of its resources, such as capital, labour, materials, land, water and energy to produce its outputs.

The World Trade Organisation (WTO) is an international organisation that sets global rules of trade between nations. The core of the WTO system, referred to as the multilateral trading system, are the WTO agreements which lay down the legal ground rules for international trade as well as the market-opening commitments taken up by its Members. These agreements are negotiated and signed by all Members of the WTO, and ratified in their parliaments. The goal is to help producers of goods and services, exporters, and importers conduct their business. http://www.wto.org/

8 Issues and priorities

Agriculture

Rice cultivation dominates agriculture in the LMB for a number of physical, biological, social and economic reasons. The crop, however, does consume a large amount of water, and the area under cultivation may need to be reduced if irrigation water shortages become more serious. Average consumption across the LMB is close to 2.7 m3/kg of grain whereas soybeans use 56% of this amount. Constraints to overcome before suitable areas can be cultivated with non-rice crops include the low prices earned for other crops, poor storage facilities and quality control, poor marketing, pests, water quality and water stresses, a lack of labour and capital, poor plant nutrition and a lack of technical knowledge by farmers. Farmers are also reasonably risk averse when replacing their guaranteed family food source with a cash crop.

In the foreseeable future agriculture in NE Thailand is projected to consist mainly of low-input, low-risk, wet season, rain-fed and irrigated rice production in the lowlands. Sugar cane, maize and fruit production and tree crops will occupy higher, less flood-prone areas along with extensive cattle production. Water use is not projected to increase greatly until soil improvement techniques are extended or food commodity prices rise.

Lao agriculture is less developed than in Thailand and there is room for expansion in rain-fed and irrigated agriculture in the large areas of flat and gently sloping hills. Thirty five percent of the total Mekong river flow originates from Lao PDR and there are over 850,000 ha of potentially good soils on flatter land that may be irrigated. The remaining 1.37 million ha of less fertile acrisols may also be developed for less intensive agricultural activities.

Cambodia possesses 10 million ha of gently sloping and flat land that is currently unutilised for agriculture. Abstractions from the Mekong River will increase when this land is developed further, especially if the country continues to construct roads and provide other infrastructure to isolated areas. Although 59% of the Class 5 land in Cambodia is composed of infertile acrisols, there is still considerable potential for production increases on these and other soil types.

The aquifer system in the central highlands of Viet Nam appears to be overextended and new sources of water may be required to support an expanding coffee industry. The area of potentially irrigable flat land is quite small and composed of mainly infertile soil types. Room for expansion in the level of water abstractions from the Mekong River therefore appears to be quite small.

The Mekong Delta already faces water constraints during the dry season. Farming system proposals for different eco-regions of the delta will result in a reduction in the area of rice grown, but there is potential for increasing abstractions during the dry season if farmers significantly expand the area under upland crops, perennials and fish ponds.

Farmers in the LMB remain poor due to the low prices received for the major agricultural commodities. Rationalisation of the industry to achieve greater economies of scale is unlikely to occur in the foreseeable future because of the basic subsistence nature of a majority of farms. Already, farmers receive cash supplements from off farm activities to support their incomes. Farmers are therefore unlikely to pay for irrigation water. On-farm overuse or miss use of water may however, be reduced through the promotion of water saving techniques and the introduction of crops with higher water use efficiencies. This needs to be

accompanied by a reduction in the risk farmers face in the adoption of new crops and practices.

River water pollution currently appears to be a minor problem in all watersheds excepting the Mekong Delta close to aquaculture enterprises. Management of all additives entering the river needs to be monitored, especially in the Mekong Delta.

Poverty and livelihoods

The following issues have been identified:

The predominance of subsistence based agricultural practices, particularly in rice production: The vast majority of farmers in the LMB, outside of the delta and Korat plateau regions, have limited access to irrigation, credit and farming inputs. They so rely upon producing rice primarily for household consumption. Opportunities for diversification into higher value crops are limited, as are the economic returns from rice. Small scale agricultural producers therefore have few alternatives, and are locked into subsistence based poverty

A regional inland fisheries sector under increasing pressure from multiple sources: Wild, capture fisheries are critical for food security, nutritional well being and seasonal income generation for a vast number of people throughout the LMB. However, wild fisheries in the LMB are increasingly under stress as a cumulative result of changes to river based ecosystems resulting from hydropower development on major Mekong tributaries, and fish habitats are being destroyed through infrastructure and other river based developments (such as blasting of rapids) In addition, more people are fishing in more intensive ways; smaller fish and less diverse fish species are being caught, though the catch requires an increasingly greater effort. Fishing concessions, river enclosure and the development of aquaculture effectively exclude the poor from traditional fishing spaces. The long term impact of wild fisheries decline will affect the poorest first and most intensely, as they have few livelihood alternatives.

The eradication of upland farming systems upon which minority peoples depend: Traditional forms of shifting cultivation are " mono-causally" blamed for upland degradation, which in turn affects watershed health. Resettlement and other policy measures have often intensified poverty for minority peoples, and have adversely affected cultural identities. These are intimately linked to the management of the land. Recent research suggests there is nothing inherently degrading about traditional forms of agriculture, in fact quite the reverse, and that the causes of watershed degradation may lie more with the large scale logging (both legal and illegal) currently taking place throughout the basin.

The eradication of upland farming systems upon which minority peoples depend: Traditional forms of shifting cultivation are singled out for blame for upland degradation, which in turn affects watershed health. Resettlement and other 'environmental' policy measures have often created or intensified poverty for minority peoples, and have adversely affected cultural identities, which are intimately linked to the management of the land. Recent research suggests there is nothing inherently degrading about traditional forms of agriculture, and in fact the causes of watershed degradation may be more complex and multi-dimensional i.e land closure policies with these traditional shifting cultivation practices. Large scale logging is currently taking place throughout the basin, and is a primary cause of upland watershed degradation.

Processes for hydropower and infrastructure development which adversely impact those with the least stake, or voice, in the national development 'project': Hydropower generation

offers significant opportunities and benefits for the region as a whole, particularly for Laos, which has a mountainous and relatively sparsely populated hinterland. However, those who are most severely affected by this development (through resettlement and the subsequent loss of river based livelihoods) are those who benefit least from the electricity generated. Though often consulted, they seldom participate actively in the development of these hydropower schemes. Dam projects, road projects, and other infrastructure developments which change the natural environments in which people live, often result in the complete dislocation of traditional communities which are ill-equipped to adapt rapidly to the change/ new realities. They suffer greatly as a result, both materially, and through cultural loss.

Economics

There are perhaps three major sets of determinants of economic growth affecting the LMB, each of which acts at different level:

- firstly, are the economic development policies and plans (including State spending, tax, exchange rate and monetary policies) of the four individual LMB States themselves
- secondly, are the circumstances of the LMB economic and geographic space as a whole, and the consequences of various sorts of interactions (both formal and informal) between the constituent economies, and
- thirdly, are the trade and investment conditions within the GMS, Asia and the world economy which determine levels of export demand, FDI inflows etc. Notable among these will be the consequences for the LMB economies of accession to AFTA and its CEPT provisions (differentially across the countries, ranging up to 2015 for agriculture in Laos and Cambodia, for example), inclusion lists etc, which will increase competitive pressure for all of them.

Economic growth outcomes in LMB will be a result of the combination and interaction of these conditions. While these are impossible to actually predict, at the most general level what can probably be said with some confidence about the factors determining likely economic growth over the medium term and beyond (and which need to be reflected within BDP) is the following:

- on the basis of their available macroeconomic and sectoral development planning documents (e.g., 9th 'National and Economic Social Development Plan' in Thailand, 2nd 'Socioeconomic Development Plan in Cambodia', 1999 'Strategy and Vision for the Agriculture Sector ' in Laos), budget and finance statements etc, all LMB countries are committed to relatively open economic regimes with growth as an objective to reduce poverty; exports of primary and processed materials, increased agricultural diversification / intensification and value adding, expansion in tourism etc
- the major factors which affect how the LMB economies interact with one another are not going to change significantly (e.g., labor and land distribution patterns and prices, and the centres of industry and demand for products are not going to change dramatically in the next few years, national borders will remain relatively porous etc), but formally-encouraged moves (and economic imperatives) towards increasing formal economic integration are likely to continue and intensify; the impacts of these may be restricted to certain physical areas and/or economic sectors (depending on specific items of physical infrastructure and/or sector- or industry-level interventions), but will be felt across all of LMB to some extent, and

- the era of large FDI inflows is probably over for the LMB countries; Viet Nam, Laos and Cambodia have – to differing extents – all had some kind of 'honeymoon' with FDI, but various sorts of problems connected with individual investment climates (usually centring on the high costs of doing business) have contributed to recent major declines across LMB. Also, the historically-successful, export-led growth of the region in recent years is subject to more competition (e.g., from China), and the continuing slowness of recovery in the US and Europe means that demand is limited right now anyhow.

The broad implications of these conditions are probably that

- to some extent, all LMB countries will become more open and will increasingly compete with one another as regards national agricultural and industrial development objectives (and in simple terms of investment attraction, export promotion etc)
- the present economic and technical roles of each of the LMB economies within the basin will probably remain largely as they are, with the structure of markets, centres of primary and secondary production, factor movements etc tending to be difficult to dislodge and (to some extent) undermining some national development intentions of the smaller economies
- the incentives to cross-border integration will intensify as the realisation of some of these factors bites home, and the attractions of joint investment promotion become more apparent; at both informal and formal levels de facto economic integration will increase. Apart from any other considerations, this obviously increases rather than diminishes the logic of exercises like the BDP and collective thinking about the management of shared natural resources), and
- the LMB will probably have to rely more on its own internal consumer market and that of neighbouring areas for sources of product demand and economic growth than hitherto. Developing and encouraging this demand will not always be easy (especially given the region's – particularly Thailand's – historical export orientation and Viet Nam's growing export orientation), but as levels of incomes rise the more that consumption can be domestically-oriented through appropriate policy encouragement the greater will be national benefits.

9 Solutions

Agriculture

Crop production in watersheds of the Mekong river is limited by flooding, poor soils, poor access to markets, high input costs, pests and diseases and insufficient labour. However, by far the greatest constraint to production overall is a lack of soil water. Drought is a serious problem for crops in Lao PDR, NE Thailand, Cambodia and parts of Viet Nam. If water were not a limiting factor in the rice paddies and upland areas of these countries, yields would initially increase by at least 50% without extra inputs and possibly double with applications of inorganic fertiliser. There is more than enough water in the Mekong River to provide the current watersheds' requirements year round. Excepting for the Mekong Delta in Viet Nam, water distribution systems are limited, but abstractions are increasing as riparian governments promote agricultural production by subsidising the installation of irrigation infrastructure. Planning for efficient utilisation of available water is therefore essential to equitably spread the benefits of this resource for the majority of the watersheds' inhabitants.

Projecting the consumption of water by agricultural activities is a difficult task considering the poor database on which the calculations are to be based. Short, medium and long-term approaches are therefore needed to overcome these planning constraints.

Short-term studies are required to improve the accuracy of calculating current water consumption rates. Recommended studies include carefully reviewing the government stated areas and yields of all crops cultivated in the LMB. The amount of water consumed by representative farming systems should then be physically measured.

Further expansion in the use of Mekong River water for agricultural purposes is constrained by a range of physical, economic and social factors. Sites must be identified and closely researched before installation of infrastructure. Economic viability from a farmer's perspective will rely on low cost access to water on fertile soils that have the potential for providing high crop yields. As illustrated in NE Thailand, farmers will not invest capital into cultivating crops when the rates of return are low. Inputs and markets must also be accessible and labour must be available.

Water use efficiencies are different for a range of crops and for varieties within species. It may be possible to decrease the use of irrigation water by growing particular crops and selecting the correct varieties possessing high efficiencies. Research to select crop and variety type with high efficiencies is a long term measure but worthwhile in locations where water shortages are severe.

Poverty and livelihoods

Pro-poor water use scenarios for the next 15-20 years would look to mainstream the critical aspects of a social development approach within an overall sustainable development approach; of a balance between economic, environmental and social concerns. This balance is critical for the well being of the regions poor, who are a significant transboundary group, and who share a close relationship with, or reliance upon, natural resources, and for whom water availability and access is crucial.

- Improving water access for the poor: For the poor, water use is as much about access as availability. Legislative and regulatory environments are therefore important in promoting 'pro-poor' water use scenarios;
- Promoting 'growth' with equity: Promoting economic growth in the region is clearly a priority, given population projections of a doubling of the regions population by 2020. Inequality is a feature of poverty, and water use options that are not relatively equitable are likely to erode consent and exacerbate poverty in the region;
- Promoting sustainable long term development options: Water use scenarios should be sustainable in the long term, to ensure effective long term management of water resources upon which the poor depend;
- Reducing vulnerability and risk, particularly for the poorest: A critical feature of poverty is vulnerability, and water use scenarios should be evaluated in light of their impact upon vulnerability for the regions poor. If vulnerability increases significantly, then perhaps the scenario developed can be considered undesirable;
- Considering only water use options that do not result in significant social dislocation for any particular group: Even if the group involved in a particular development scenario are relatively small statistically, they should not be asked to bear the burden of development for others, particularly if they have not been fully involved in decision making processes around development options, are not satisfactorily

compensated through a process which they fully understand and take part in from the outset;

- Identifying water use options that do not promote conflict, or which actively reduce conflict: Conflict often results through a lack of consent and participation in decision making processes, or where options promoted are inequitable, or severely impact particular groups. Wherever possible, therefore, the potential for conflict should be a consideration in deciding which water use scenarios are most desirable;

- Promoting inclusive and participatory development processes: Decisions around water use in the basin in the future are likely to have both positive and negative impacts for particular stakeholders, and the challenge is to mitigate disbenefits whilst simultaneously maximising benefits for as wide a spectrum of people as possible, particularly the regions poor. A participatory process for decision making and development is critical for this, in order to maintain consent in the process, reduce any conflict potential, and to ensure all feel included in regional water governance processes.

Economics

While some of the conclusions arrived at may imply considerable doubt about economic growth and its capacity to lift a large number of people within LMB out of poverty in the medium-term, there are also major reasons to be more optimistic about the LMB future. Overall, economic activity in the LMB is notably undeveloped at present, and there is major capacity for general economic growth in levels of output, trade, employment, and income generation in the medium-term. This view is predicated on two main points:

- the existence of significant unemployed and underemployed resources, particularly labor, but also land in some areas and installed capacity in others. Even those resources committed to various activities at present frequently exhibit inefficiencies in application, resulting in poor product quality and unnecessarily high costs of production; and

- the likely expansion of product markets (national, subregional, and international) for food and other natural resource-processed products, especially as local and regional incomes rise and household consumption patterns change in favour of processed and purchased items at the expense of subsistence production.

The challenge for policy-makers and investors within LMB (as well as maintaining overall internal and external balances) is thus to pursue economic growth through specific policies, plans and projects which

- promote activities in which LMB and its constituent parts have underlying comparative advantages and/or can develop dynamic competitive advantages (and combine resources across national borders where necessary to achieve this), and

- spread the benefits of growth as widely as possible within LMB such that locally-generated incomes are spent on locally-produced products (thus reducing poverty and establishing a virtuous circle of income-demand-incomes etc).

10 Findings and recommendations/ lessons learnt

Agriculture

The Mekong River is capable of servicing all the agricultural needs of the Lower Mekong Basin if the water flow were even year round. However, the river flow is highly seasonal, flooding large tracts of land in all riparian countries during the wet season. There are also indications that water shortages may soon occur during the dry season. The months of February to May are the most critical months for agriculture in the Mekong Delta.

Agriculture in the LMB is rice-based and likely to remain so for the next 20 years or more. Past increases in productivity and existing crop potentials indicate that production will improve over the next 20 years sufficiently to outstrip population growth. Improved crop production will come from an enlarged cultivated area, increased farming intensity, more area under irrigation and small increases in grain yield. The area devoted to higher value crops, such as vegetables and fruit, will expand at the expense of rice, but will remain a small proportion of the total and irrigated agricultural area. Forecasts predict that the number and surface area under fishponds will expand significantly.

Forecasts also anticipate that wet season rice and upland crop production will be the cause of much of the expected increase in consumption of water from Mekong. In order to cope with this increase new irrigation schemes in Cambodia and Lao PDR should include on-site storage systems. It will not be possible for consumption in the Mekong Delta to increase significantly above current levels despite pressure for farmers to raise cropping intensity, change to dry season crops and to install fishponds. Government control may be required to mitigate water shortages.

Without the placement of adequate controls of discharge of agricultural, domestic and industrial waste into the river introduced, water quality in the Mekong River is destined to deteriorate.

There is currently too little information to formulate scenarios for agricultural development on a BDP sub-area basis. The areas suitable to develop economic irrigated agriculture are those with reasonably fertile soils situated beside water sources. Planning on a broad scale could utilise an existing Geographic Information Systems (GIS) generated soils map. Detail of potential areas for further expansion may be restricted to areas of flat land and rolling hills (MRC Class 5) situated beside rivers or below potential water catchment areas. Overlaying a water resources inventory on a map of soil types using GIS may provide some answers to this question.

Poverty and livelihoods

Subsistence agriculture: An expansion of irrigation support to small-scale agriculturalists, particularly in Laos and Cambodia, would significantly improve food security for the poor. Irrigation infrastructure, however, is not sufficient in itself, and a number of complimentary conditions would be required in order to make a significant impact upon poverty reduction. These include: support to small scale producers in securing or formalising land tenure rights; improvements in irrigation management, with greater development of water user associations and groups, and a process of empowerment of these groups in taking responsibility for water

management; effective agricultural extension support to raise productivity, and flexible credit mechanisms to extend investment opportunities to poor producers too, whilst limiting their exposure to risk.

Cash crop production and 'value added' agricultural processing: The economic returns of rice, the main agricultural product of the region, are limited. Both governments and farmers in the LMB recognise the potential for expanding into the production of cash crops, such as vegetables, coffee, rubber, fruits and other perennials. Also important in raising the value added in primary production, and therefore the income potential to households, is on-farm or localised processing for farm products and natural products, for national markets, and even for regional and international trade. Examples include the local processing and marketing of organic coffee and fruits, production of handicrafts from local materials, and furniture and wood processing using traditional methods and designs. Promoting both cash crops and value added processing would offer significant poverty reduction opportunities to poor communities, if supported on a long term basis with extension and credit facilities.

Upland watershed management: Upland areas of the basin are critical to the ecological and environmental health of the region as a whole. National governments have taken steps to conserve upland watersheds by restricting what are seen as destructive traditional swidden agricultural practices by ethnic groups. These have had poverty inducing consequences for upland minority groups. Large scale deforestation and damage is also caused by logging, both legal and illegal, and there is nothing inherently unsustainable about traditional practices that have been in operation for centuries. An effective poverty reduction scenario in upland areas would require a more sensitive engagement with upland communities in seeking to ensure more effective watershed management practices, and a recognition of the role state land closure policies are having in upland areas on poverty for minority peoples. Traditional upland management practices do offer considerable potential for sustainable land, forest and watershed management practices, particularly if other harmful practices, such as large scale logging, can be restricted, and support can be provided in offering traditional cultivators supplementary opportunities for livelihood enhancement.

Capture and culture fisheries: Fisheries are immensely important to livelihoods in the region, and any measures that significantly curtail wet season water availability are likely to impact upon millions of the rural poor in the lower basin. Many fishing communities rely upon traditional or informal rights to common resources, but these rights are increasingly under threat from enclosure by private interests, and the sale of fishing concessions. Extending rights of access for rural communities to fishing areas would make a significant impact upon poverty, as would the promotion of community based aquaculture initiatives.

Hydropower: A 'pro-poor' hydropower scenario would involve developing only those schemes which would not significantly impact large numbers of people. Also important would be the development of effective and genuine processes of participation in decision making around hydropower development, with those who will be primarily affected playing a full role in discussion and decision making processes. Upland communities affected by reservoir inundation are often outside of mainstream discourses on state development, and become the 'objects' of development, rather than partners in development processes. Instead of providing cash compensation measures, another form of 'transfer payment' might be the development of micro-hydro schemes for upland communities who stand to lose land or livelihood opportunities. Micro hydro and smaller schemes offer the best safeguard against large scale resettlement and dislocation of vulnerable communities.

River navigation and transport: Improving river navigability opens access to markets for rural producers, and enables remote rural communities to access the services of the state. Improved navigation, though, also requires improved river transportation. There is a high

correlation in the region between poor communities and remoteness from communications networks, and so improved navigation and transport offers the potential for poverty reduction in the region, if it is targeted at improved access for the poor. At the same time, current practices of rapid clearing in the upper basin are being conducted without adequate EIAs, and without the participation of affected riverside communities, whose livelihoods are being destroyed by changes in river ecosystems resulting from the blasting of rapids.

Water borne health: Provision of safe drinking water supply and sanitation, to rural areas of the LMB particularly, would have an important impact upon health, quality of life, and thus poverty, for many of the regions poorest people.

Tourism: Promoting tourism, and particularly small scale and 'eco-tourism', offers a significant poverty reduction potential. National governments throughout the region recognise the economic potential that tourism development offers and, where benefits can accrue to rural communities particularly, tourism development could play an increasingly important role in decision making around water, through for example the protection of scenic sites of interest along the river, and the preservation of the minority cultures of people living in the upper basin.

Flood protection: Seasonal flooding has always been a feature of the lower basin, and livelihood strategies have evolved over centuries to adapt, and take advantage of this. Wet season flooding is particularly important for capture fisheries in Cambodia, and southern Laos. Flood protection measures may protect poorer farmers from the worst excesses of flooding, through preserving irrigation infrastructure, but may also harm the livelihoods of those who rely upon the flood. Any significant changes in the flood regime resulting from developments are likely to have a detrimental impact upon the livelihoods of the poor, and so should be avoided.

Social protection policies for vulnerable groups: Increased prosperity, migration, mobility and off farm work opportunities in the region offer substantial opportunities for all, but also a heightened level of risk for those of the region's poor who are least equipped to take advantage. These include rural migrants with low levels of education and training, and young rural women and children particularly who may be prone to being trafficked or exploited. Protection against trafficking and associated ills for vulnerable peoples resulting from improved communications and development in the region would be an important component in any regional 'pro-poor' development scenario.

Economics

The following economic trends can be expected:

- Increasing agricultural commercialisation and specialisation
- Increasing non resource-based industrial developments
- Increasing urbanisation and consumer spending, and
- Increasing subregional integration.

These trends are broadly-defined and aggregated phenomena, subsuming within them (to varying degrees across the four countries) many more minor and specific tendencies (eg, towards rural industrialisation in Viet Nam and towards the development of flatland areas in Lao PDR). Some implications of each of these major trends are briefly discussed below.

The growth and economic sustainability of each of the economic activities considered in the study is largely dependent upon adequate supplies of good quality water. These activities are currently the main drivers of economic growth in the region although it is likely that agricultural production will remain a mainstay of the LMB economy for years to come. Even as crop and irrigation efficiencies improve, and agro-processing becomes a more important part of the value chain (i.e. becomes more widespread), the sector will continue to demand significant volumes of water.

Water is an important – indeed crucial – contributor to macro-level GDP but is also fundamental to more local poverty reduction and livelihood support initiatives, especially among rural communities. For many of these communities, the Mekong and its tributaries not only provide the water required to satisfy basic human needs, but also support the aquatic resources upon which many of them depend for consumption and sale. Inland water transport is another basin asset allowing Mekong countries to move heavy bulk goods around the region relatively cheaply.

Many other activities (eg industry) rely on affordable and reliable sources of energy, which the hydropower potential of the LMB may be able to support.

11 Relevance

11.1 Relevance for NMCs and/or line agencies

While each NMC and each line agency have full insight into their own national sector issues and development agendas, the regional perspective applied in the present studies provide a basin-scale context that can expand the scope of the national development efforts, and (via the subsequent planning activities) add value to these efforts.

11.2 Relevance for MRCS and/or BDP Phase 2

Just like sub-basin and national level development planning, basinwide planning must build - not on full knowledge about the future - but on *'the best knowledge available'.* While present trends can deceive, as development sometimes proceeds stepwise rather than gradual, and while any prediction will accordingly be uncertain, due to new challenges and new opportunities, the decision basis should incorporate such knowledge as is available at the time when decisions must be made.

The basinwide analyses and recommendations presented in the present document provide valuable information to other MRC programmes and a good starting point for BDP Phase 2.

12 Concluding general outlook

The analyses presented in this report provide a thorough insight in important implications of water utilization in the Lower Mekong Basin. This knowledge should be maintained and developed.

The work should be done in a continued close collaboration among the MRC programmes, the NMCs, the national line agencies, and the international scientific community. Also, there is a scope for expanded collaboration with development agencies that operate in the region.

This will contribute to well-informed, timely and appropriate strategic directions at all water management levels, in support of the MRC vision of *'an economically prosperous, socially just and environmentally sound Mekong River Basin'.*

References

References are listed at the end of each monograph (Chapters 3-7).