Economic and Social Commission for Asia and the Pacific

CAPSA WORKING PAPER No. 89

Enhancing Sustainable Development of Diverse Agriculture in Lao People's Democratic Republic

Linkham Douangsavanh
Bounthong Bouahom
Khamphou Pouyavong

United Nations
ESCAP

UNESCAP-CAPSA

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through Secondary Crops' Development
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Table of Contents

Page

List of Tables ix
List of Figures xi
List of Boxes xi
List of Abbreviations xiii
Foreword xv
Acknowledgements xvii
Executive Summary xix

1. General Introduction
1.1 Background and justification 2
1.2 Study objectives 4
1.3 Scope of the study and limitations 4

2. Research Methodology and Formation of the Study Team
2.1 Research methodology 5
2.2 Formation of the study team 6

3. Basic Socio-economic Information of the Country
3.1 Demographic profile 7
3.1.1 Population structure 7
3.1.2 Trend of population growth 7
3.1.3 Dependency ratio 8
3.1.4 Age and sex structure 8
3.1.5 Occupation structure 8
3.1.6 Education and literacy 9
3.2 Economic profile 10
3.2.1 Average GDP per capita, growth of the national economy, economic growth by economic sector and sectoral shares of national GDP 10
3.2.2 Sectoral share of national employment 12
3.3 Extent of agricultural diversification 12
3.3.1 Agricultural land 12
3.3.2 Extent of agricultural diversification 13
3.4 Poverty 15
3.5 Extent of environmental problems 16
3.6 Concluding summary 17

4. Historical and Current Status of CGPRT Crops and Other Crop Production in the Lao People's Democratic Republic
4.1 Trends of rice and CGPRT crop production 19
4.1.1 Rice 19
4.1.2 Maize 19
4.1.3 Job's tear 20
4.1.4 Cassava 21
4.1.5 Sweet potato 21
4.1.6 Pulses 21
4.2 Trends of other crop production 22

4.3 Trends of animal production 24
4.4 Trends in marketing of CGPRT crops 24
4.4.1 New developments in Job's tear processing and marketing in Luang Prabang 24
4.4.2 Provincial plans for supporting shifting cultivation substitution through marketing 25
4.4.3 Cross-border Trade in Oudomxay Province 25
4.5 Concluding summary 26

5. Overview of Agricultural Diversification Related Policies in the Country
5.1 Overview of agricultural performance 27
5.2 Policy and strategy of agricultural development 27
5.3 Concluding summary 28

6. Impact of Global Trade Orientation on CGPRT Crop Agriculture
6.1 Brief overview of the country's international trade policies for CGPRT and other agricultural products 29
6.1.1 Trade liberalization 29
6.1.2 Pattern of trade 29
6.2 Extent of exports and imports of CGPRT and other agricultural products 30
6.3 Concluding summary 31

7. Benefits of Agricultural Diversification on Poverty Alleviation in the Country
7.1 Overview of poverty alleviation strategies 33
7.2 Assessment of potential benefits of agricultural diversification for poverty alleviation 34
7.3 Basic requirements for realizing the benefits of agricultural diversification for poverty alleviation 35
7.4 Concluding summary 37

8. Demand for CGPRT Crops as Staple Foods and Their Industrial Importance in the Country
8.1 Extent of diversified ways of consuming CGPRT crops as staple foods and their demand 39
8.2 Scope to expand CGPRT crop demand as food 39
8.2.1 Production 39
8.2.2 Consumption 40
8.2.3 Market/trade 40
8.2.4 Constraints to enhance maize production regarding observations and discussions with villagers 40
8.3 Extent of scope to expand industrial uses and demand for CGPRT crops 41
8.4 Concluding summary 41

9. Potential Scope for Development of Diversified Agriculture in Lao People's Democratic Republic
9.1 Extent of driving forces for agricultural diversification 43
9.1.1 Economic factors 43
9.1.2 Agro-ecological factors 43
9.1.3 Socio-cultural factors 44
9.2 Concluding summary 45

10. **Sustainable Diversified Agriculture for Poverty Alleviation in the Region: A Search for Effective Policies** 47

11. **Conclusions and Policy Recommendations** 49

12. **References** 53

24/7 VII

ห้ามจำหน่าย

List of Tables

Page

Chapter 3

Table 3.1 Selected demographic indicators of countries which share a border with Lao PDR 7
Table 3.2 Changing life expectancy 8
Table 3.3 Age ratio of the people in Lao PDR 8
Table 3.4 Sex ratio of the population of Lao PDR 8
Table 3.5 Number of employment positions in 1992 and projected number in 2000 9
Table 3.6 Sectoral shares in national GDP 12
Table 3.7 Farm size distribution, 1998/1999 13
Table 3.8 Recent trend of SID in selected years 14

Chapter 4

Table 4.1 Job's tear production in Luang Prabang province 20
Table 4.2 Harvested area of rice and CGPRT crops 22
Table 4.3 Production of rice and CGPRT crops 22
Table 4.4 Yield of rice and CGPRT crops 22
Table 4.5 Area of non-CGPRT crops 23
Table 4.6 Production of other crops 23
Table 4.7 Yield of other crops 23
Table 4.8 Animal production 24

Chapter 5

Table 5.1 Sectoral share of agricultural output in national GDP 27

Chapter 6

Table 6.1 Trade trends of selected CGPRT crops during 1999-2003 (tons) 30

List of Figures

Page

Chapter 1

Figure 1.1 Map of Lao People's Democratic Republic 1

Chapter 2

Figure 2.1 Flow of study in AGRIDIV country study 5

Chapter 3

Figure 3.1 Real GDP per capita 10
Figure 3.2 Real GDP growth rate 11
Figure 3.3 GDP growth rates by sector 11
Figure 3.4 Recent trend of SID in Lao PDR in selected years 14
Figure 3.5 Urban poverty 15
Figure 3.6 Rural poverty 15
Figure 3.7 The changing poverty rate 16

Chapter 4

Figure 4.1 Area harvested of rice and maize 19
Figure 4.2 Production of rice and maize 20
Figure 4.3 Yield of rice and maize 20

List of Boxes

Page

Chapter 3

Box 3.1 How to calculate dependency ratio 8
Box 3.2 What is poverty line? 15

List of Abbreviations

AFTA	: ASEAN Free Trade Area
CCA	: Common Country Assessment
CGPRT	: Coarse grains, pulses, roots and tubers
CIF	: Cost, Insurance and Freight
DAFO	: District Agriculture and Forestry Office
ESCAP	: Economic and Social Commission for Asia and the Pacific
FOB	: Free on Board
IL	: Inclusion List
LDC	: Least Developed Country
LECS	: Lao Expenditure and Consumption Survey
LPG	: Luang Prabang
LRHS	: Lao Reproductive Health Survey
MAF	: Ministry of Agriculture and Forestry
MC	: Moisture Content
MFN	: Most Favoured Nation
NAFRI	: National Agriculture and Forestry Research Institute
NEM	: New Economic Mechanism
NUOL	: National University of Laos
ODA	: Official Development Assistance
PAFO	: Provincial Agricultural and Forestry Office
SERS	: Socio-economic Research Section
SID	: Simpson Index
TEL	: Temporary Exclusion List
UXO	: Unexploded Ordnance

US$ 1 = 10,400 kips (2004)

Foreword

Most Asian countries succeeded in multiplying major cereal production through the '*Green Revolution*'. This was made possible by the introduction of high yielding varieties and policy support which promoted the construction of irrigation facilities and the use of modern inputs such as chemical fertilizers and pesticides. Recently however, the growth in productivity of major cereals has reached a plateau. Agricultural diversification has a number of positive effects, among others, food security, risk mitigation, labour absorption and conservation of biodiversity. It is crucial to be aware of the driving forces and constraints to agricultural diversification to formulate policy options which realize the coexistence of sustainable agricultural development and poverty reduction in rural areas.

Responding to this vital need, UNESCAP-CAPSA conducted a three-year research project, "Identification of Pulling Factors for Enhancing the Sustainable Development of Diverse Agriculture in Selected Asian Countries (AGRIDIV)", from April 2003, in collaboration with eight participating countries, namely Bangladesh, India, Indonesia, Lao People's Democratic Republic, Myanmar, Sri Lanka, Thailand and Viet Nam.

It is my pleasure to publish "**Enhancing Sustainable Development of Diverse Agriculture in Lao People's Democratic Republic**" as a result of the first phase of the Lao People's Democratic Republic country study of the project. This volume presents a descriptive and quantitative analysis of the current secondary crop agriculture and development constraints and options. This study focuses on policy recommendations, as well as areas of/for further study.

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J.W. Taco Bottema
Director
UNESCAP-CAPSA

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Executive Summary

The Lao People's Democratic Republic (Lao PDR) is a landlocked country, covering an area of 236,800 sq km. The country is predominantly mountainous, with 80 per cent of its land surface consisting of hills and mountains rising 100 to 3,000 metres above the plains of the Mekong River. These alluvial plains range in elevation up to about 200 metres above sea level. The remaining 20 per cent of land area comprises of the lowland plains of the Mekong and its main tributaries, and adjacent flat-to-undulating plains.

The economic system of Lao PDR is based on agriculture. Agriculture is one of the most important sectors of the economy. Among the agricultural sub-sectors, rice production is the single most important activity in the economy. Crops playing more important roles in Lao PDR are rice, maize, Job's tear, cassava, mungbean, soybean and sweet potato.

Most of the farmers in the northern province still continue with "slash-and-burn" shifting cultivation. The government has a national policy to eliminate all upland rice production under slash-and-burn shifting cultivation systems and to substantially reduce the area cropped to upland rice. Non-shifting, more ecologically stable systems, with land management by villages and individual households, are to be introduced. The main development strategies are to sustain the pace of current momentum along the Mekong corridor while expanding the development process to the sloping lands. Research to develop appropriate technologies for integration into improved land use systems and mobilization of an effective extension system to disseminate them are key components of the government's strategy for support to upland farmers during the transition period.

However, the success of this policy will be dependent on the identification and implementation of appropriate alternative production systems that are able to achieve the combined objectives of income generation, food self-sufficiency and ecological stability. To support the policies of the government, CGPRT crops are significant and have become very important crops for daily subsistence after rice. CGPRT crops not only play a very important role in daily subsistence food and as sources of income for the people, but due to national policy in the uplands, CGPRT crops are a good option to be introduced into integrated farming systems to alleviate problems of food insecurity and poverty.

This paper has two main objectives, firstly is to investigate socio-economic impacts of recent development and the economic environment, including trade liberalization on upland agriculture at the village level, and secondly is to identify constraints and opportunities within sustainable development of diversified agriculture in the study areas.

In generally, most CGPRT crop production is for domestic consumption, where to sell and for what purpose is not available in statistical data because the producers and consumers are still small-scale and individuals. The present market for agricultural products, especially CGPRT crops, still follows the traditional sales pattern. Small-scale farmers bring their fresh products to the local market immediately after harvesting. For medium to large-scale farmers, middlemen visit individual households during the harvesting period and buy products, including paddy sometimes. Different regions use different marketing systems and products and sale scale.

The agricultural sector contributes the highest sectoral share to the GDP of Lao PDR. Breaking this down, rice is highest. Followed by livestock and commercial crops. To enhance GDP growth, the Fifth Five-year Socio-economic Development Plan (2001-2005) focuses on the specific development plan and targets the agricultural sector. Appropriate technologies need to be developed to improve yield together with developing the industry and services. Agricultural development should start from farming system development, improving the quality of production and processing, and establishing marketing systems.

Currently, Lao PDR exports woods, products of wood, garments, and hydro-electricity; agricultural products are very limited (except coffee and sugarcane, which are exported). The majority of agricultural production in Lao PDR is for domestic consumption and national trade. Global trade policy for other products is wider than for agricultural products. Agricultural products seem to focus on nations within ASEAN. Initially, the tariff cuts proposed by Lao PDR were of a too long duration as most agricultural commodities were excluded from tariff reductions. Lao PDR has comparative advantage in the production of vegetables, groundnut, soybean, lemon, swine, live cattle, buffalo, coffee, sugarcane, maize, beans, indigenous fruit, and plantation wood. Examination of the tariffs on agricultural items produced and exported by Lao PDR alongside ASEAN partners indicates that there are areas where products have been placed on the Temporary Exclusion Lists (TEL) whereas the same products have been placed on the Inclusion List (IL) by the other ASEAN countries.

From the point of view of the government, all development activities in the country are aimed at reducing poverty. They have, optimistically, targeted to reduce poverty by half in 2005 following the implementation of the five-year socio-economic plan. What the poor need to survive is more investment in upland agriculture such as agricultural diversification, livestock, and agro-forestry or non-timber forest products. CGPRT crops, generally secondary crops after rice, are an important farming resource, particularly for the poor in the upland areas of the northern part of Lao PDR, where other agricultural resources and employment opportunities are still limited. Agricultural diversification through CGPRT crops is the one option which can support poverty alleviation. Agricultural diversification can help poor farmers achieve food self-sufficiency, secure their sources of income and finally help them to escape from poverty. To achieve this goal it is necessary to enhance the development of infrastructure, human resources and market facilities.

Statistical data regarding consumption trends of CGPRT crops in Lao PDR is insufficient. Only the statistical data of production, harvested area and yield is available in the National Statistical Centre and this makes it difficult to have an appropriate idea about the future demand of CGPRT crops.

The government's macroeconomic policies aim to promote further economic growth by building basic infrastructure and continuing to support the role of agriculture in the national economy. In terms of social culture, Lao PDR is comprised of more than 47 official ethnic groups, each having their own indigenous knowledge on agricultural production practices, which they have practiced for generations. The constraints they face included the declining environment quality due to population pressure, and they have less opportunity to access appropriate technologies to improve agricultural production.

In Lao PDR, the major farming systems are identified as: 1) lowland rainfed, 2) lowland irrigated, 3) upland and mountain, and 4) plateau. The lowland and irrigated farming systems are seen in the five plant areas. In the plains, all cultivated land is used for lowland rice production during the wet season and for livestock grazing during the dry season. On the other hand, for irrigated farming, a two-crop system is used and many farmers grow irrigated rice in the wet season and irrigated rice or other crops in the dry season.

The upland and mountain farming systems are dominated by wet season monocropping in hilly or mountainous areas. The most important crop is upland rice prevailing in shifting cultivation areas. Other important annual crops include maize, sweet potato, cassava, ginger, groundnut, soybean, cotton and sugarcane. In this farming system, small irrigation areas are developed in valley bottoms for the production of paddy. Perennial crops are also grown in the fields, usually in scattered formations. In the plateau farming system, commercial crops are increasingly produced, while the shifting cultivation area has been reduced. The major commercial crops including coffee, tea, cardamom, fruit and vegetables cultivated under rainfed condition. The farming system is being developed in various topographic and climatic conditions. The soil fertility is also favourable compared to other areas.

In the flatlands, the approach to agricultural diversification is to improve and diversify farming systems with increased and intensified cash crops, livestock and fishery production. While in the sloping lands, farming system diversification and agro-forestry should be developed through adaptive research, trials and demonstrations on farmers' fields. The most important step for poverty reduction and commercial agriculture is to promote crop diversification on both the flat and sloping lands.

Most crop production is carried out in the traditional way, without using modern farming practices. Local crop varieties are widely cultivated and the supply of improved variety seeds is very limited, which results in a low unit yield. Improved varieties are mostly handled by the private sector.

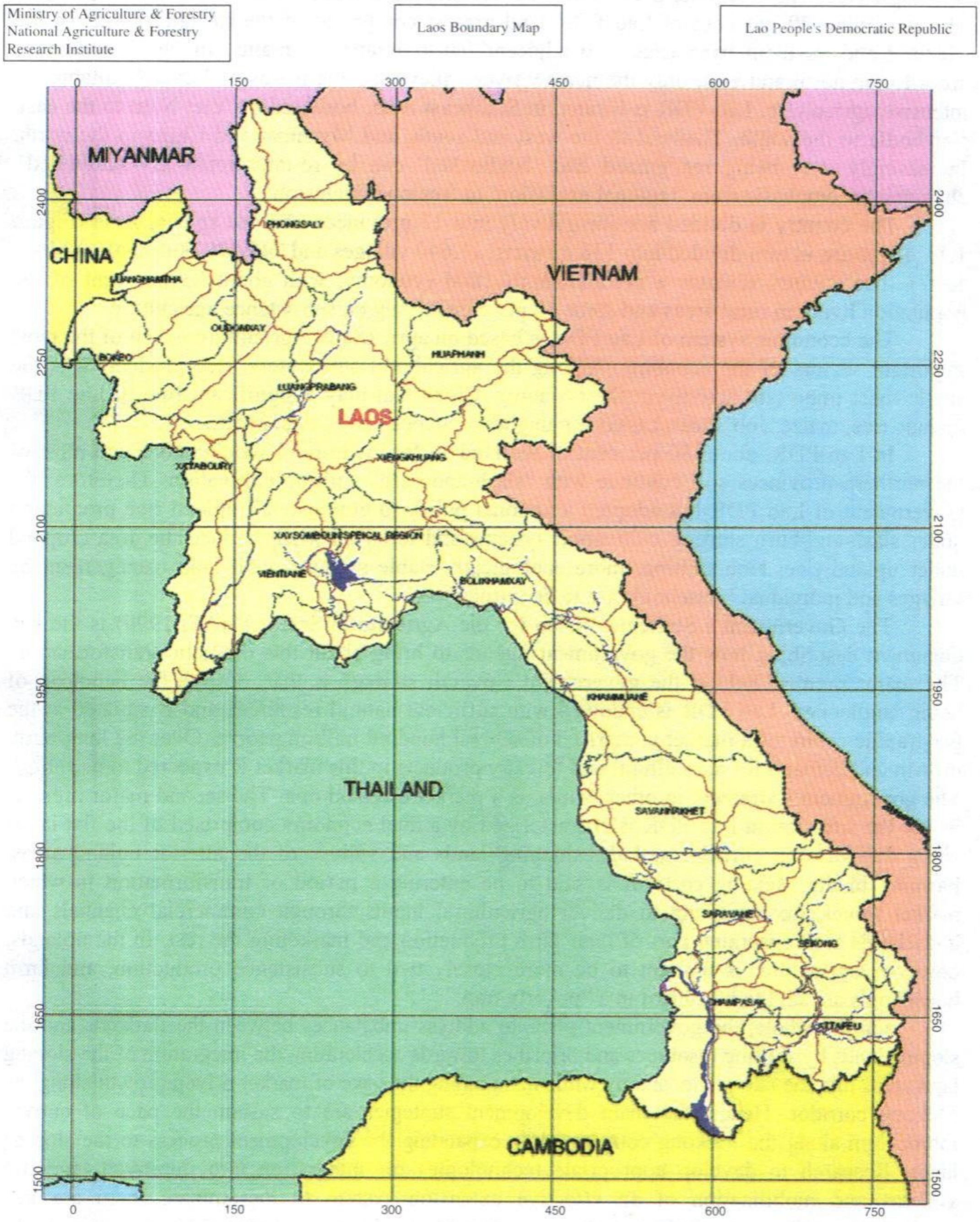
The recent high growth rate of production reveals that maize, peanut, soybean and some root crops are strong candidates for diversification. In addition, FAO (FAO, 1999) indicates that sesame, soybean and sunflower have comparative advantage. It is noted that some field crops are not only used as food crops, but also as supplemental feed for livestock since the number of livestock is increasing considerably.

Finally, policy recommendations for agricultural diversification and poverty alleviation based on the findings of this report and government strategies for agricultural crop development are as follows:

- Promote commercial crop production based on market demand and comparative advantage;
- Increase rice production through yield improvement;
- Crop diversification in disadvantaged areas;
- Technological development;
- Extension and demonstration of new technologies;
- Establishment of an appropriate seed supply system;
- Cost reduction through mechanization;
- Research activities for income improvement in shifting cultivation areas;
- Countermeasures to deforestation; and
- Other strategies for agricultural diversification need to be considered.

1. General Introduction

Figure 1.1 Map of Lao People's Democtaric Republic



1.1 Background and justification

The Lao People's Democratic Republic (Lao PDR) is a landlocked country covering an area of 236,800 sq km. The country is predominantly mountainous, with 80 per cent of its land surface consisting of hills and mountains rising 100 to 3,000 meters above the plains of the Mekong River. These alluvial plains range in elevation up to about 200 meters above sea level. The remaining 20 per cent of Lao PDR land area is comprised of the lowland plains of the Mekong and its main tributaries, and adjacent flat-to-undulating plains. In the mountainous areas to the north and east, only the narrow river valleys and the plains of Jars are suitable for intensive agriculture. Lao PDR is located in Southeast Asia, bordered by Viet Nam to the east, Cambodia to the south, Thailand to the west and south, and Myanmar and China to the north. Increasingly it is being recognized that 'landlocked' can be re-interpreted as 'landlinked', changing the emphasis from 'regional exclusion' to 'regional inclusion'.

The country is divided administratively into 17 provinces and one special zone (Figure 1.1). These are in turn divided into 138 districts, 11,640 villages and 748,529 households (MAF, 1997). The country remains a predominantly rural economy, with about 83 per cent of the population living in rural areas and some 66 per cent relying on subsistence agriculture.

The economic system of Lao PDR is based on agriculture. Agriculture is one of the most important sectors of the economy. Among the agricultural sub-sectors, rice production is the single most important activity in the economy. Crops that play a significant role in Lao PDR include rice, maize, Job's tear, cassava, mungbean, soybean and sweet potato.

In Lao PDR, about 80 per cent of the land surface is hilly or mountainous and most of the northern provinces still continue with "slash-and-burn" shifting cultivation. Therefore, the Government of Lao PDR has adopted a national policy to eliminate all upland rice production under slash-and-burn shifting cultivation systems and to substantially reduce the area cropped under upland rice. Non-shifting, more ecologically stable systems, with land management by villages and individual households are to be introduced.

The Government's Strategic Vision for the Agricultural Sector (MAF, 1999) is the key document describing how the government intends to bring about this dramatic transformation. The major premise behind the government's overall strategy is that, despite the handicap of being landlocked, Lao PDR is endowed with sufficient natural resources and is situated at the geographic centre of a market comprised of several hundred million people. Over the long term, growth and demand for agricultural and forestry products in this market is expected to be robust. The government's strategy, in other words, is a market oriented one. The second major premise is that the situation in Lao PDR is characterized by a dual economy comprised of the flat lands along the Mekong corridor and the slopping lands and valleys of the interior upland areas. Farming in the Mekong corridor is said to be entering a period of transformation in which market forces are beginning to deliver agricultural inputs through commercial channels and households are consuming part of their farm production and marketing the rest. In the uplands, however, agriculture is thought to be more closely tied to subsistence production, and farm households are said to be caught in a "poverty trap."

On the whole, the government plans to address imbalances between the flatlands and the sloping lands by shifting resources and priorities towards accelerating the integration of the sloping land areas into the national economy while maintaining the pace of market driven growth along the Mekong corridor. Hence, the main development strategies are to sustain the pace of current momentum along the Mekong corridor while expanding the development process to the sloping lands. Research to develop appropriate technologies for integration into improved land use systems and mobilization of an effective extension system to disseminate them are key components of the government's strategy to support upland farmers during the transition period.

It is envisioned that demand for government services will be farmer-driven and the capacity of the districts will be upgraded to support farmer participation in adaptive research trials in order to develop a menu of production choices which farmers can use in responding to

market signals. MAF's vision calls for the DAFO staff to be trained as Farming System Extension Workers, supported by Subject Matter Specialists at the PAFO level, connecting with Village Development Workers.

In the flatlands, the thrust of agricultural development is as follows (MAF, 1999):

- Improving and diversifying farming systems with cash crops, livestock and fishery production;
- Expanding and intensifying value-added processing enterprises by promoting local and foreign investments in agribusiness;
- Government and private sector sponsored market research, market information systems and regional marketing links among producers, wholesalers and retailers throughout the region;
- Developing internationally accepted product grades and standards;
- Strengthening and expanding rural credit facilities through free competition and market-determined interest rates;
- Supporting and strengthening rural and agribusiness lending by state-owned commercial banks and private commercial banks; and
- Rehabilitating, expanding and intensifying dry season irrigation schemes with participatory community based management.

In the sloping lands, the major development thrusts are (MAF, 1999):

- Land use zoning;
- Participatory land allocation;
- Community based natural resource management;
- Farming system diversification;
- Expansion of small-scale irrigation systems;
- Sustainable land use management;
- Rural savings mobilization;
- Competitive rural finance systems;
- Strengthening the legal capacity of state-owned commercial banks; and
- Improving communities' access to markets.

To achieve the desired development, the government is pursuing eight national priority development programmes which are (MAF, 1999):

- Food production;
- Stabilization and reduction of shifting cultivation;
- Commercial production;
- Infrastructure development;
- Improved socio-economic management and foreign economic relations;
- Rural development;
- Human resources development; and
- Services development.

To help implement the aforementioned priorities, MAF is undertaking six major programmes as follows (MAF, 1999):

- Food security;
- Support to commodity production;
- Stabilization of shifting cultivation;
- Irrigation development;
- Agriculture and forestry research; and
- Human resource development

In Lao PDR, CGPRT crops are significant and have become very important crops for daily subsistence after rice. Therefore, there are many CGPRT crops in Lao PDR such as maize, Job's tear, cassava, mungbean, soybean and sweet potato to support such agricultural policies. The success of the policy to eliminate upland annual cropping under slash-and-burn systems will depend on the identification and implementation of appropriate alternative production systems that are able to achieve the combined objectives of income generation, food self-sufficiency and ecological stability. CGPRT crops not only play a very important role in terms of daily subsistence food and providing some sources of income generation for the population of Lao PDR, but due to the national policy concerning the uplands, CGPRT crops will provide alternatives to introduce integrated farming systems to solve the problems of food insecurity and poverty alleviation for upland farmers.

1.2 Study objectives

- To investigate the socio-economic impacts of recent development and the economic environment, including trade liberalization on upland agriculture at the village level.
- To identify constraints and opportunities in the sustainable development of diversified agriculture in the study area as well as in northern Lao PDR.

1.3 Scope of the study and limitations

The purpose of this working paper is to review and investigate the history of production, marketing, consumption and policies related to CGPRT crops and non-CGPRT crops which are cultivated in Lao PDR. Review and analyse the impact of global and local trade orientation on these crops and identify the major constraints and opportunities for the production of these CGPRT and non-CGPRT crops in Lao PDR. General information for the second phase activities will also be collected. Finally, general policy recommendations to promote future production, consumption and market oriented agriculture will be formulated.

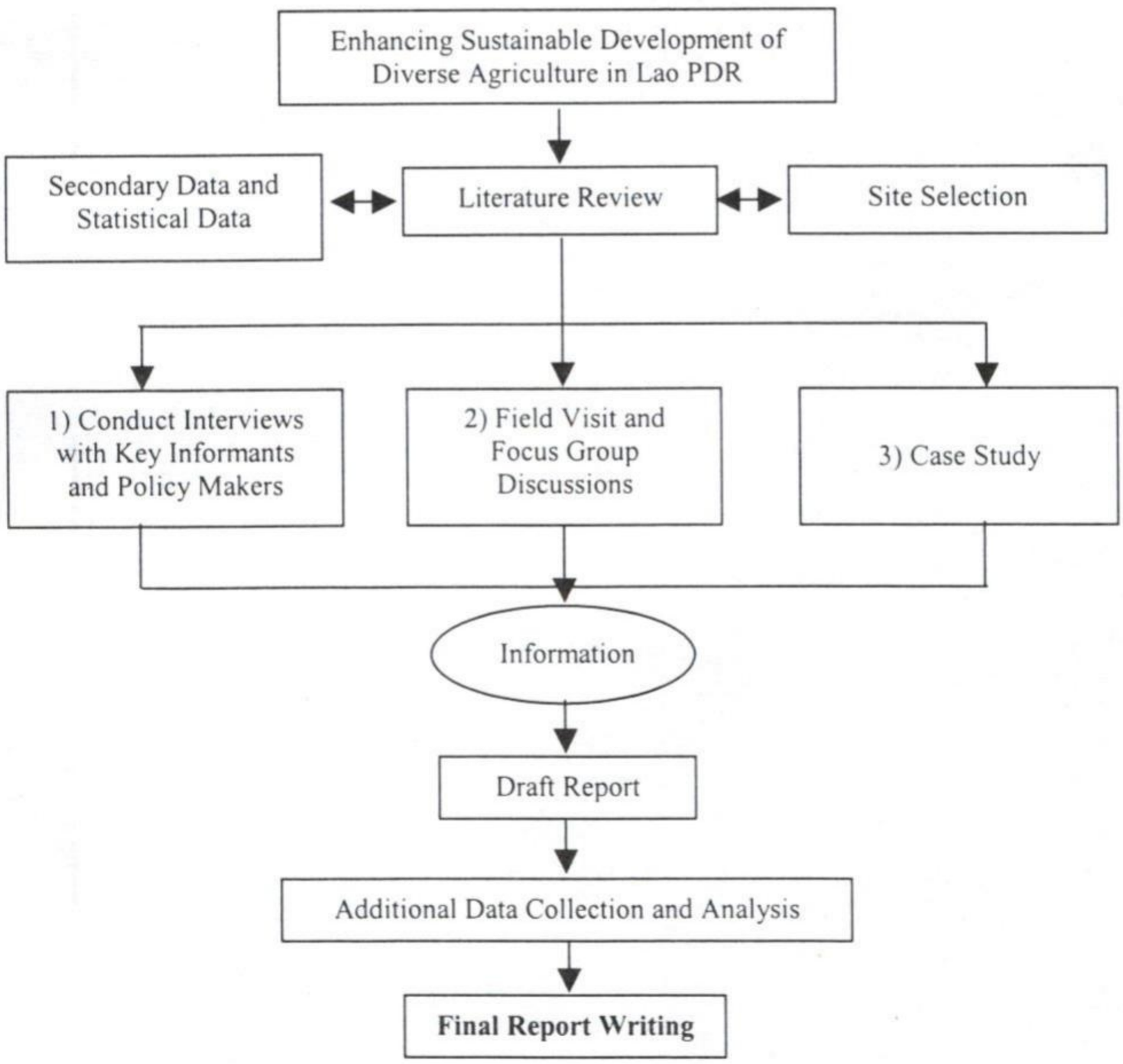
The data and information for CGPRT crops is still limited. The data is mainly from different research centres, line departments of MAF and also collected directly from the field.

2. Research Methodology and Formation of the Study Team

2.1 Research methodology

i. Collect and review the secondary data and statistical data of production, marketing, consumption and others;
ii. Site selection, field visits, conduct interviews with key informants and policy makers, group discussions and conduct the case study; and
iii. Data entry, data analysis by using Microsoft Excel and report writing. The analysis methods use descriptive analysis to clarify the production, processing, marketing and policies related to explain the situation with relevant figures and percentages where appropriate.

Figure 2.1 Flow of study in AGRIDIV country study



2.2 Formation of the study team

Using a multidisciplinary team mainly of people from the Socio-economic Research Section (SERS) of the National Agriculture and Forestry Research Institute (NAFRI) consisting of four people with DG of NAFRI as advisory. The team consisted of the following persons:

1. Mr. Linkham Douangsavanh	Head of SERS, Economist and rural planner	Team leader
2. Mr. KhamPhou Pouyavong	Socio-economic researcher	Member
3. Mr. Vongpaphane Manivong	Farming system specialist	Member
4. Mr. Vongphachan Thongpadid	SERS staff	Member

3. Basic Socio-economic Information of the Country

3.1 Demographic profile

3.1.1 Population structure

Lao PDR is a multiethnic country. Academicians have recognized some 230 ethno-linguistic groups in four linguistic families compared to 47 ethnic categories stated in the National Census of 1995. Sometimes, to encourage national unity, it is asserted that 'Lao PDR has no ethnic minorities'. A better stand, perhaps, would be to classify people into three main ethnic sub-divisions: (i) The *Lao Loum*, who live in lowlands around the Mekong river valley and account for 68 per cent of the total population, (ii) The *Lao Theung*, who live in the midlands, are thought to be the original inhabitants of contemporary Lao PDR and account for 22 per cent of the population, and (iii) The *Lao Soung*, who live in the highlands in extremely remote locations, account for 10 per cent of the population and are distinguished for their retention of traditional culture (GOL, 2002). The flatland area is becoming more and more influenced by market forces. In the uplands, agriculture is of a subsistence type and people seem to be caught in a poverty trap.

3.1.2 Trend of population growth

The Expenditure and Consumption Survey 1 and 2 estimated that the population growth rate was 2.6 per cent in 1998 (National Statistical Centre, 1999), and in mid 1997 the national population was 5,087,322 persons, while in 1995 growth was at 2.5 per cent (United Nations, 2000), and at 2.8 per cent in 2000 (United Nations, 2000). According to the changing annual population growth rate since 1995, the growth seems to be slowly accelerating. This implies that population pressure in the future on land used for agriculture will be much more serious, if no strategies on population, employment and new applied agricultural production techniques are introduced, especially to populations in remote areas where agricultural land is the main source of food and cash crops for household income. Population density (population per square kilometre) has increased from 15.1 persons per square kilometre in 1985 to 19.3 persons per square kilometre in 1995 (United Nations, 2000), and 21 persons per square kilometre in 1999 (Basic 1975-2000 mid year). Breaking down the population density by region, the highest is in central Lao PDR and the lowest is in the southern part. Compared to neighbouring developing countries, the annual population growth rate in 1998 in Lao PDR was highest while the lowest was found in Thailand as indicated in Table 3.1.

Table 3.1 Selected demographic indicators of countries which share a border with Lao PDR

Country	Annual growth rate (%)	Life expectancy at birth (year)	
		Male	Female
Cambodia	2.4	53	60
Lao PDR	2.6	53	55
Myanmar	1.8	59	63
Thailand	0.9	68	72
Viet Nam	1.5	66	70

Source: ESCAP population data sheet, 1999.

The estimates of life expectancy from the LRHS 2000 are higher than those produced by ESCAP and UNSD. This newer data is presented in Table 3.2.

Table 3.2 Changing life expectancy

Estimate	Male	Female	Average
LRHS 2000 estimates	57	61	59
ESCAP/UNSD estimates, 1999	53	55	54

3.1.3 Dependency ratio

The LECS2 estimates that around 55 per cent of the total population are aged 19 or younger, and 30 per cent of these have not yet reached 10 years of age. This means that the population aged above 19 years is less than 50 per cent. With a national dependency ratio of 0.9 (urban 0.7 and rural 1.0) it is only in Vientiane municipality that the ratio is significantly lower than one, on the other hand in Xiengkhuang, Xaysomboon and Huaphanh one adult has on average more than one person to take care of (LECS2).

Box 3.1 How to calculate dependency ratio

> The dependency ratio is calculated from the number of children below the age of 15 plus the number of people above 64 divided by the number of people in the household aged 15 to 64.

3.1.4 Age and sex structure

The age ratio of the population has been categorized here into three different levels of age regarding the dependency ratio: children under the age of 15; the age group of 15-64 years; and people of more than 64 years old, as presented in Table 3.3.

Table 3.3 Age ratio of the people in Lao PDR

Age group	Percentage of male	Percentage of female
<15	45.7	42.6
15-64	50.8	53.4
>64	3.5	4.0
All	100	100

Source: LECS2, 1999.

According to the National Census 1995 (Sisouphanthong and Taillard, 2000) the population of Lao PDR, women are larger than men and becoming nearly equality at the present years (Table 3.4). In 1985, the number of males per 100 females was 96.1, in 1995 it was 97.7 and in 2000 it was 98.5. When we consider the life expectancy at birth of women is longer than men, we can assume that there are more elderly women than men.

Table 3.4 Sex ratio of the population of Lao PDR

Indicator	Year		
	1985	1995	2000
Sex Ratio (Number of male per 100 of female	96.1	97.7	98.5

Source: National Human Development Report Lao PDR, 2001.

3.1.5 Occupation structure

Society in Lao PDR is highly dependent on agriculture. Subsistence farming is the main occupation in all provinces except the Vientiane municipality where the percentage of the population engaged in farming is 21 per cent, compared to Vientiane province (46 per cent) and

Luang Prabang (49 per cent). It is highest in Luangnamtha (74 per cent), Sekong (71 per cent), Huaphanh and Oudomxay (69 per cent). On the other hand, employment in the public sector is most prevalent in the central region of the country comprising seven provinces at 16 per cent, the highest being in Vientiane municipality (23 per cent). Huaphanh and Xaysomboon have the lowest share of government employment. The central region also has a largest number of household businesses (National Statistical Centre, 1999).

Employment distribution is shown in Table 3.5. The amount of employment in agriculture in 2000 was still the highest, but the growth rate of the agricultural sector was less than others sectors at only 1.6 per cent (estimated average growth rate during 1992-2000) except for the public sector where growth was zero. The highest growth was observed in the financial sector. The low growth rate of agriculture may be caused by limitations of agricultural land. We are aware that the population can grow and spread rapidly, but land cannot extend beyond a country's borders. Therefore, other occupations must be sought in the services and industry sub-sectors absorb the growing labour force.

Table 3.5 Number of employment positions in 1992 and projected number in 2000

Industry	1992	2000	Growth rate (%)
Agriculture	1 350 000	1 537 000	1.60
Mining	3 000	4 130	4.10
Construction	40 000	69 250	7.10
Utilities	9 000	16 890	8.20
Manufacturing	105 000	183 110	7.20
Transport and communication	34 000	57 740	7.30
Wholesale and retail	137 000	221 650	6.20
Hospitality	14 000	25 730	7.90
Finance	2 000	5 140	12.50
Services	32 000	71 120	10.50
Government	74 000	74 000	0.00

Source: National Human Development Report Lao PDR, 2001.
Note: Growth rate is estimated annual average growth rate during 1992-2000.

3.1.6 Education and literacy

In the education sector, schools and various educational institutions have been expanded; private education has been promoted and efforts have been made to expand schools into remote areas. Teacher training has been improved and reorganized in all systems. Adult education and basic vocational training for communities in the mountains are now available.

Illiteracy is declining and the literacy rate in the target group of 15-40 years old increased from 70.8 per cent in 1996 to 84 per cent in 1999. Between 1990 and 1997, the number of students completing primary education doubled, while net primary enrolment rates increased from 64 to 77 per cent

Higher education has been developed with the establishment of the National University of Laos (NUOL) in 1996, unifying high-level education with the implementation of the policy "basic education for all". Decrees on compulsory primary education; the Law on Compulsory Primary Education and the Law on Education were enacted in 1996 and 2000 respectively.

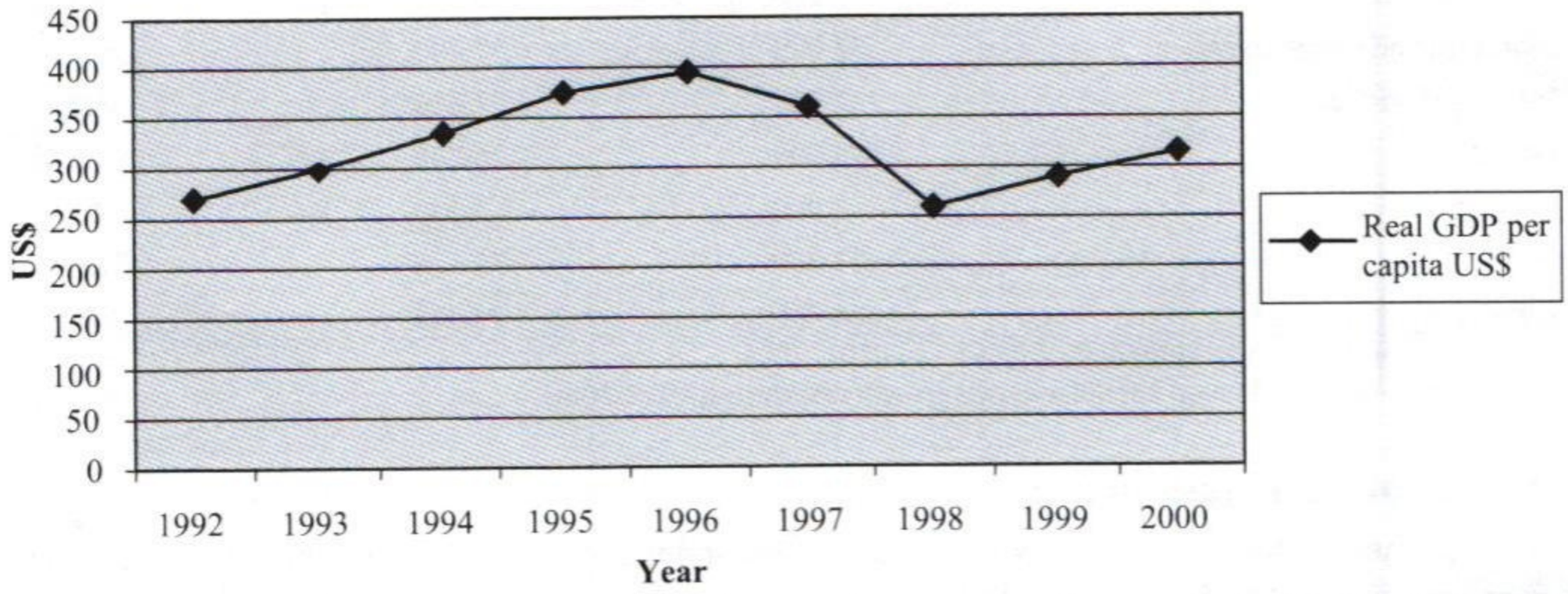
3.2 Economic profile

3.2.1 Average GDP per capita, growth of the national economy, economic growth by economic sector and sectoral shares of national GDP

Lao PDR is a 'Least Developed Country' (LDC) and as such is considered by the international community to be the one of the poorest countries in the world. Although there are signs that poverty levels are falling, poverty remains widespread throughout Lao PDR, with many household unable to meet the daily food requirement and/or satisfy human needs. Poverty is particularly severe in rural areas, especially in the northern provinces and among ethnic inhabited remote areas.

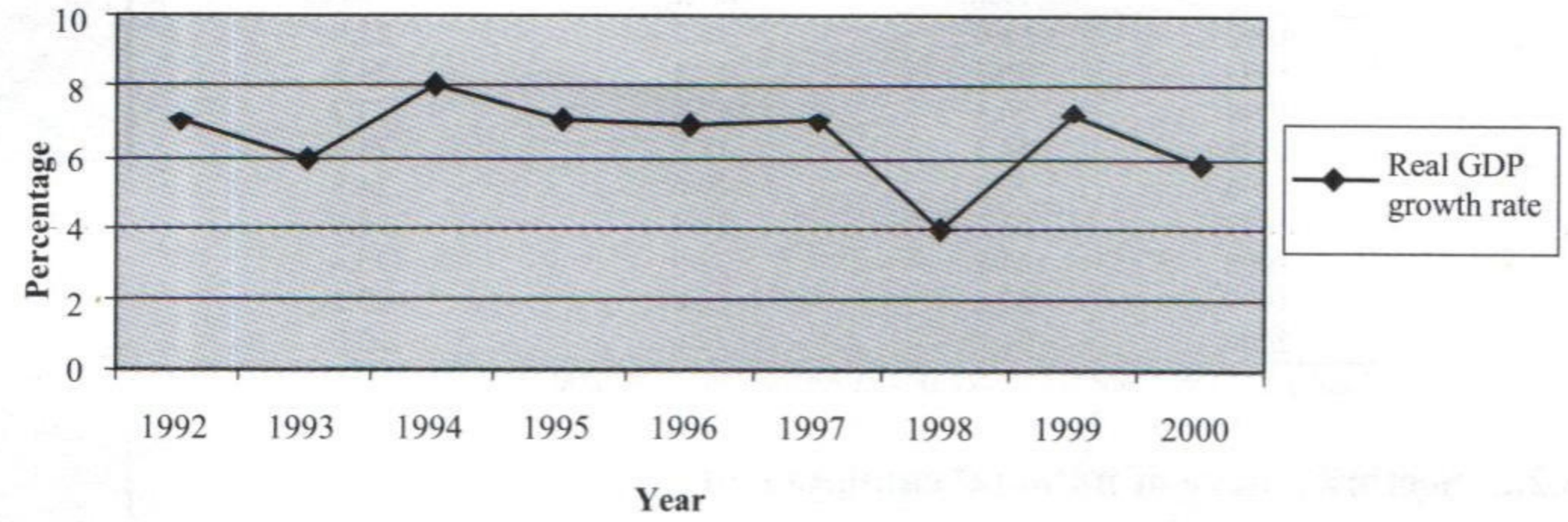
Despite more than a decade of high economic growth and following the introduction of market-oriented reform under the New Economic Mechanisms (NEM), annual GDP per capita in Lao PDR was only US$ 300 in 2000. GDP growth varies annually and was 5.8 per cent in 2000. Real GDP per capita during 1992-2000 was highest in 1996 before the economic crisis in Asia. In 1996, the sectoral share in national GDP of industry was at the highest point (17.3 per cent; Figure 3.3) during the ten years. Real GDP per capita then decreased until 1998 but started increasing again from 1999 to 2000 (Figure 3.1).

Figure 3.1 Real GDP per capita



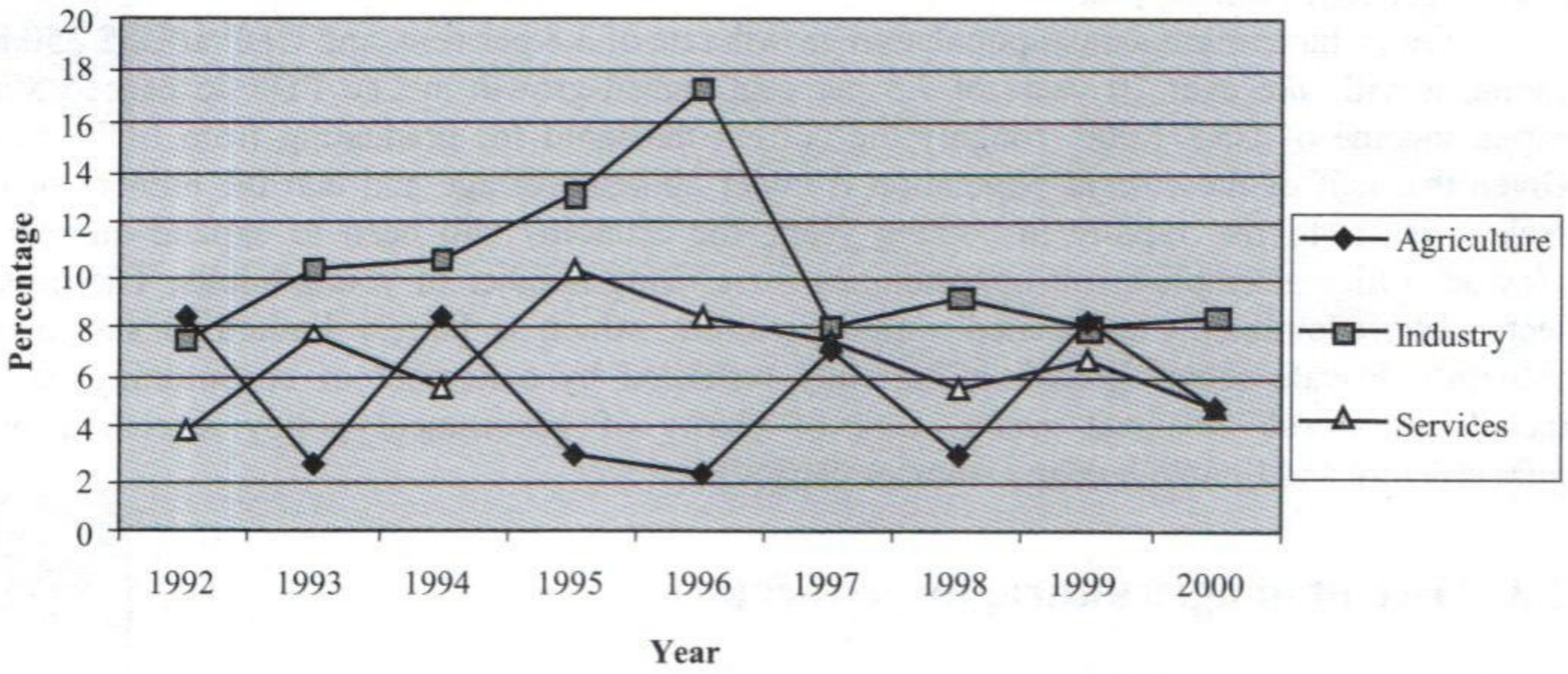
Source: Macro-Economic Profile, National Human Development Report Lao PDR, 2001.

Figure 3.2 Real GDP growth rate



Source: Macro-Economic Profile, National Human Development Report Lao PDR, 2001.

Figure 3.3 GDP growth rates by sector



Source: Macro-Economic Profile, National Human Development Report Lao PDR, 2001.

Lao PDR is highly dependent on natural resources for economic and social development. The economy remains overwhelmingly dependant on Official Development Assistance (ODA), which made up 18 per cent of GNP and around 80 per cent of public investment in 1997. The value of total exports is roughly a half of total imports and the major export products are hydropower and forestry products. In 1996, imports exceeded exports by 115 per cent. Even before the Asian crisis, export growth had begun slowing and, by 1997, become negative. However, in 2000, growth in exports rose beyond pre-crisis levels to 9 per cent. Imports decreased as a result of the crisis and export growth recovered mostly in 1999 (by 0.3 per cent). In 2000, import growth was again negative (-3.4 per cent) and the current account deficit declined from 12 per cent in 1996 to 0.7 per cent of GDP in 2000. Net service exports, which averaged only 1.5 per cent of GDP between 1995 and 1997, increased to 5.6 per cent in 1998, largely because of tourism. In addition, overseas private remittances grew substantially, from 0.6 per cent of GDP in 1994 to 3.9 per cent in 1998. The share of national GDP by sector is shown in Table 3.6.

Table 3.6 Sectoral shares in national GDP

Year	Economic sector (%)		
	Agriculture	Industry	Services
1992	58.0	16.7	23.9
1993	56.3	17.4	24.3
1994	56.4	17.8	23.7
1995	54.3	18.8	24.4
1996	52.2	20.6	24.8
1997	52.2	20.8	25.0
1998	51.8	21.9	25.4
1999	52.2	22.0	25.2
2000	51.8	22.6	25.0

Source: National Human Development Report Lao PDR, 2001.

3.2.2 Sectoral share of national employment

Based on the 1995 census, the number of people whose age is above 10 years is 3.157 million, or 69 per cent of the total population. This group breaks down into an economically inactive population of 937,000 and an economically active population of 2,220,000, i.e. 30 per cent and 70 per cent of this population group. Some 69 per cent of the economically inactive population are school or university students. Thirteen per cent perform domestic tasks and 18 per cent are retired or sick. Of the economically active population, 97.6 per cent are employed and 2.4 per cent unemployed.

Given the current annual population growth rate of 2.8 per cent, and GDP at US$ 350 per capita, it will take over 20 years of 7.5 per cent annual growth in Lao PDR to exceed a per capita income of US$ 1,000, roughly the current threshold for graduating from LCD status. Given that half of the current population is under 20 years of age and that the number of job seekers is set to rise rapidly in coming years, the economy will need to expand quickly to provide sufficient employment opportunities for a rising number of young adults. The private sector is predominantly associated with agriculture, which is largely limited to sustainable activities. Private sector growth is currently restricted by a number of constraining factors including a weak financial sector, lack of clarity of government policy direction, poor infrastructure and limited human resources capacity.

3.3 Extent of agricultural diversification

3.3.1 Agricultural land

In 1998/1999, the average size of landholding was 1.62 hectares. This includes fallow land and non-agricultural land. Farm sizes are larger in some northern provinces, such as Oudomxay and Luang Prabang, because of land left fallow under the rotating, shifting cultivation systems. For the country as a whole, 36.24 per cent of landholdings are less than 1 hectare of land; 36.35 per cent have 1-2 hectares; and 27.42 per cent have more than 2 hectares of land (Table 3.7).

Potentially, most provinces have enough agricultural land to be self-sufficient in food production. For the farm population, there is an average 0.24 hectares of agriculture land per person. The most vulnerable provinces are Phongsaly (0.14 hectares per person) and Huaphanh (0.16 hectares per person).

The distribution of land in Lao PDR is reasonably equitable. There is not much difference between provinces. In Oudomsay, the largest 20 per cent of landholdings own 55 per cent of the land; the same group in Saravane own 45 per cent of the land. In Oudomsay, the smallest 50 per cent of landholdings own 20 per cent of the land; in Saravane this group has 25 per cent of the land.

A typical landholding consists of one or more separate land parcels. Only 5 per cent of landholdings have five or more parcels. The average parcel size is 0.77 hectares. Land is most fragmented in Huaphanh province, where there is an average of 3.2 parcels per holding with an average parcel size of 0.34 hectares. It is least fragmented in Attapeu (1.5 parcels per holding).

Table 3.7 Farm size distribution, 1998/1999

Province	Percentage of landholding according to size (ha)		
	less than 1	1-2	more than 2
Vientiane municipality	38.35	28.71	32.94
Phongsaly	67.49	24.28	7.82
Luangnamtha	50.26	37.44	12.82
Oudomxay	37.05	36.45	26.51
Bokeo	58.06	30.11	11.83
Luang Prabang	26.09	40.88	32.85
Huaphanh	49.59	41.14	9.26
Xayaboury	45.57	38.56	16.08
Xiengkhuang	37.00	38.10	24.91
Vientiane province	37.89	34.29	27.82
Borikhamxay	27.84	40.78	31.37
Khammuane	42.52	35.39	22.80
Savanakhet	35.41	34.98	29.71
Saravane	20.78	36.43	42.79
Sekong	22.11	40.00	37.89
Champasack	17.75	37.13	44.97
Attapeu	34.03	48.61	17.36
Xaysomboon special region	42.47	36.99	17.81
Total	36.24	36.35	27.42

Source: Lao agriculture census, 1998/99.

3.3.2 Extent of agricultural diversification

Agricultural diversification is classified into horizontal diversification and vertical diversification according to which direction the farm economy proceeds. Horizontal agricultural diversification involves diverse activities undertaken within the farm production unit, whereas vertical diversification involves income-earning activities undertaken off-farm (Taylor, 1994).

The main concept of horizontal diversification is to increase the number of crops in fields as long as it is economically viable. Various indices have been proposed in previous studies for the quantification of the degree of horizontal diversification. In the regional study of the AGRIDIV project, Simpson Index (SID), which is one of such indices, was calculated at the national level (Sugino, 2004).

Simpson Index (SID) is defined as follows:

$$SID = 1 - \sum_{i=1}^{n} Wi^2, \quad Wi = Xi/(\Sigma Xi)$$

Where Xi is the value or area of the ith commodity and Wi is the proportionate value or area of the ith commodity in the total value or area. The minimum value of SID is zero (the least diversified), whereas the maximum value is one (the most diversified).

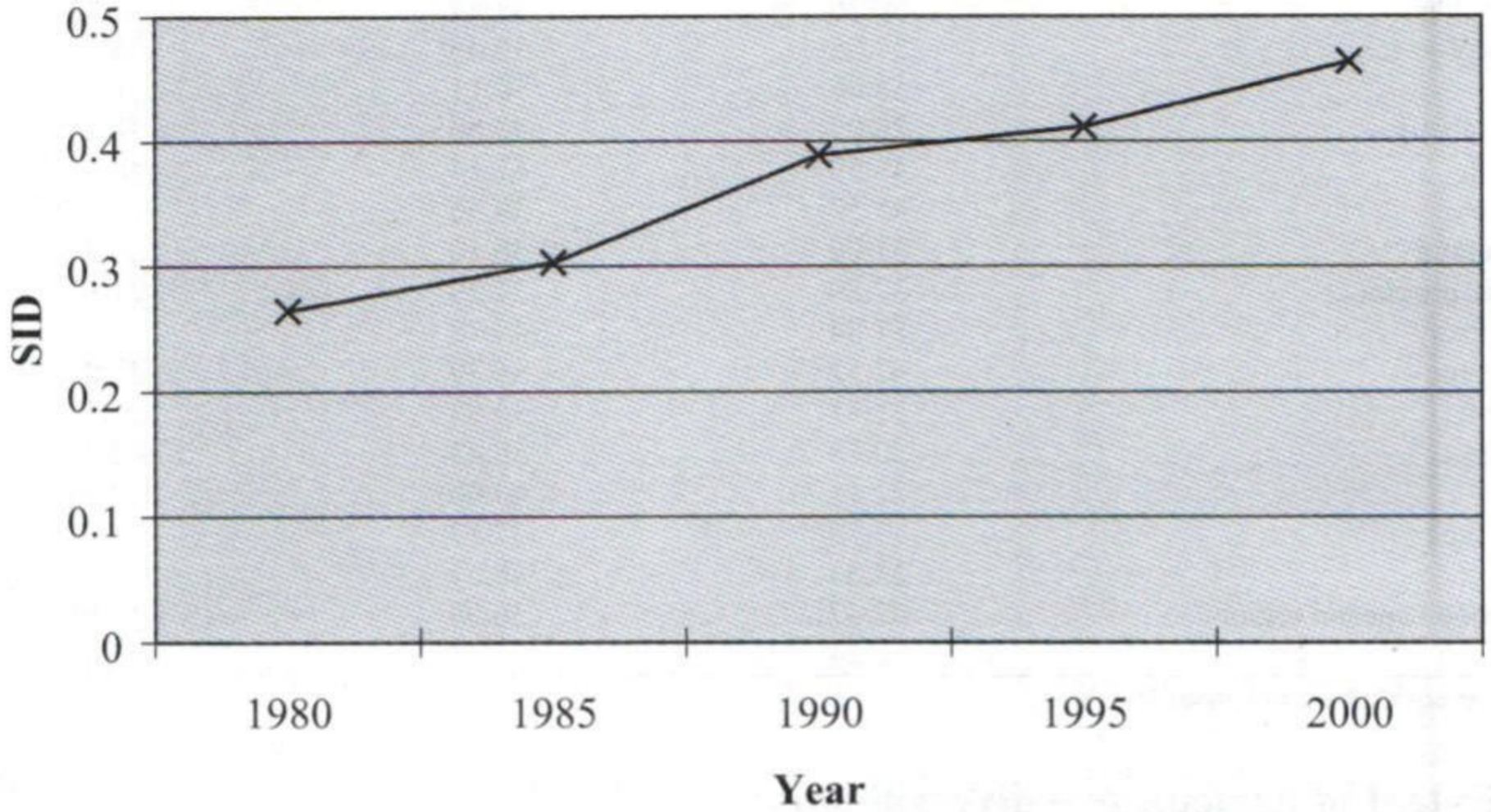
In the regional study of AGRIDIV, the SID of participating countries was calculated from the area harvested of ten crop groups, namely rice, wheat, coarse grains, root and tuber crops, pulses, oil crops, vegetables, fruits and nuts, spices and amenities of life (coffee, tea and tobacco), and rubber and textiles.

SID becomes larger if more types of crops are cultivated. This means the availability of data affects SID, especially when we calculate on a regional or national level, rather than at the farm level. The major objective of the calculation is to overview the current status of

diversification at a national level for comparison among the participating countries. Therefore, we adopted crop groups, not individual crops as a basis for calculation because the amount of available data is different in each country.

Figure 3.4 and Table 3.8 show the results of calculating SID in Lao PDR. A three year average was used to avoid the affect of annual harvest change caused by crop failure. For example, SID in 1980 is calculated based on the average area harvested in 1979, 1980 and 1981.

Figure 3.4 Recent trend of SID in Lao PDR in selected years



Data source: Sugino, 2004.

Table 3.8 Recent trend of SID in selected years

Country	1980	1985	1990	1995	2000
Lao PDR	0.2647	0.3031	0.3883	0.4114	0.4636

Data source: Sugino, 2004.

We can see during the period that the SID of Lao PDR continuously increased from 0.2647 in 1980 to 0.4636 in 2000. The cause of this came from two main reasons: government support to enhance cash crops and development of the irrigation systems. The agricultural and forestry sector is the backbone of the economy and has a step by step guide for stable food production to attain food self-sufficiency and to produce cash crops. To that end, the irrigation network has been developed. From 1995-1999, the command area of irrigation was increased from 150,000 hectares to 258,000 hectares, and from 26,000 hectares to 124,000 hectares for the wet and dry seasons respectively. In 1999, the total rice cultivation area in the country was 717,577 hectares. Other food crops, such as maize, beans, starchy roots, fruit trees, as well as livestock and fisheries (aquaculture), are expanding in several regions. Likewise, the output of non-rice crops such as coffee, sugarcane and tobacco are also expanding, particularly coffee, the harvest of which has increased from 8,576 tons in 1995 to 17,530 tons in 1999. As far as rice is concerned, in 2000, production reached 2.2 million tons of paddy-rice, enough to be classified as self-sufficient.

3.4 Poverty

To analyse poverty an estimation of the poverty line is fundamental. A person is identified as poor if his or her income or consumption is below the poverty line. A new poverty line was constructed based on the nutritional requirements of the people. Having examined poverty by region and by province, poverty in urban and rural areas was also investigated. As can be seen from Figures 3.5 and 3.6, the urban-rural disparity in the incidence of poverty is large: in 1992/1993 poverty in urban areas was 33.1 per cent, and in rural areas it was 48.7 per cent. Large differences in the percentages of poor between urban and rural areas are prevalent across regions. This implies that economic development has been biased against rural areas in Lao PDR.

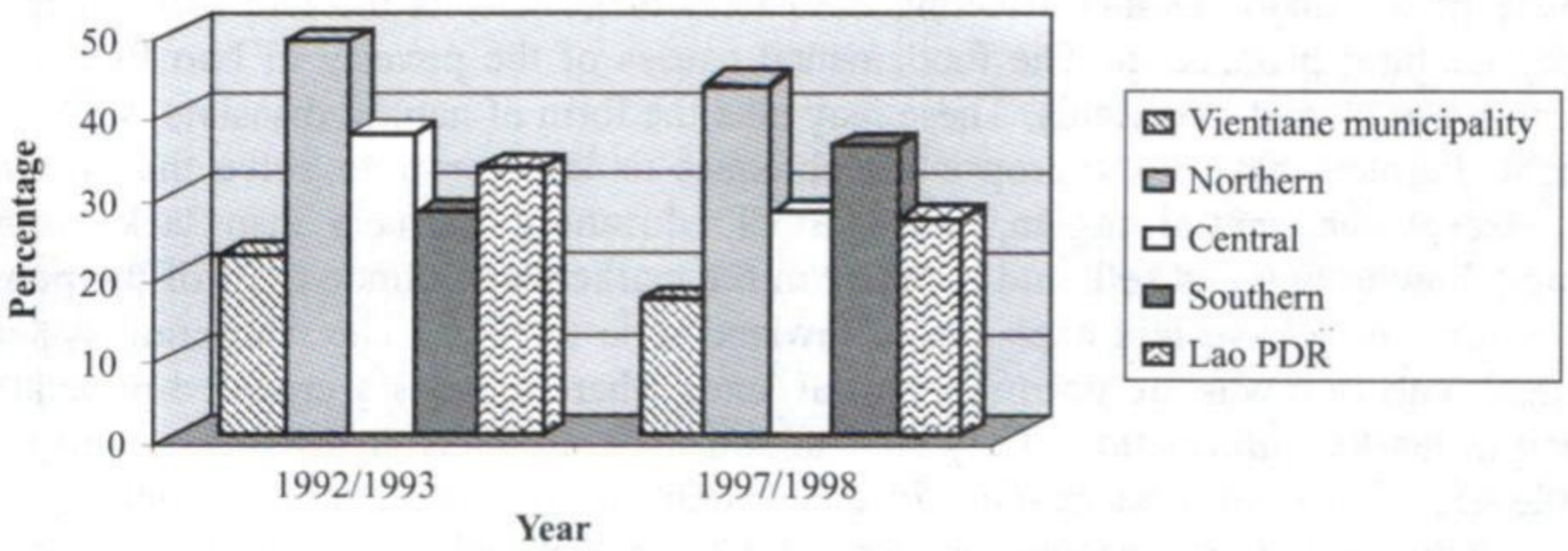
Box 3.2 What is the poverty line?

The definition of the poverty line is not an easy affair. Based on the draft version of "comparative review of poverty profiles" prepared recently for Lao PDR by J. Knowles, 2002, developing one or more poverty lines involves several choices. The main ones are:

a) Choice of base line period and region.
b) Estimation of the reference food baskets, i.e. the items and quantity of food consumed per person.
c) The cost per calorie of the items in the food basket, reflecting the spatial variation of prices.
d) Determine minimum daily caloric requirements.
e) Estimates of non-food allowance.
f) Adjusting the base line period poverty line for use in others periods.

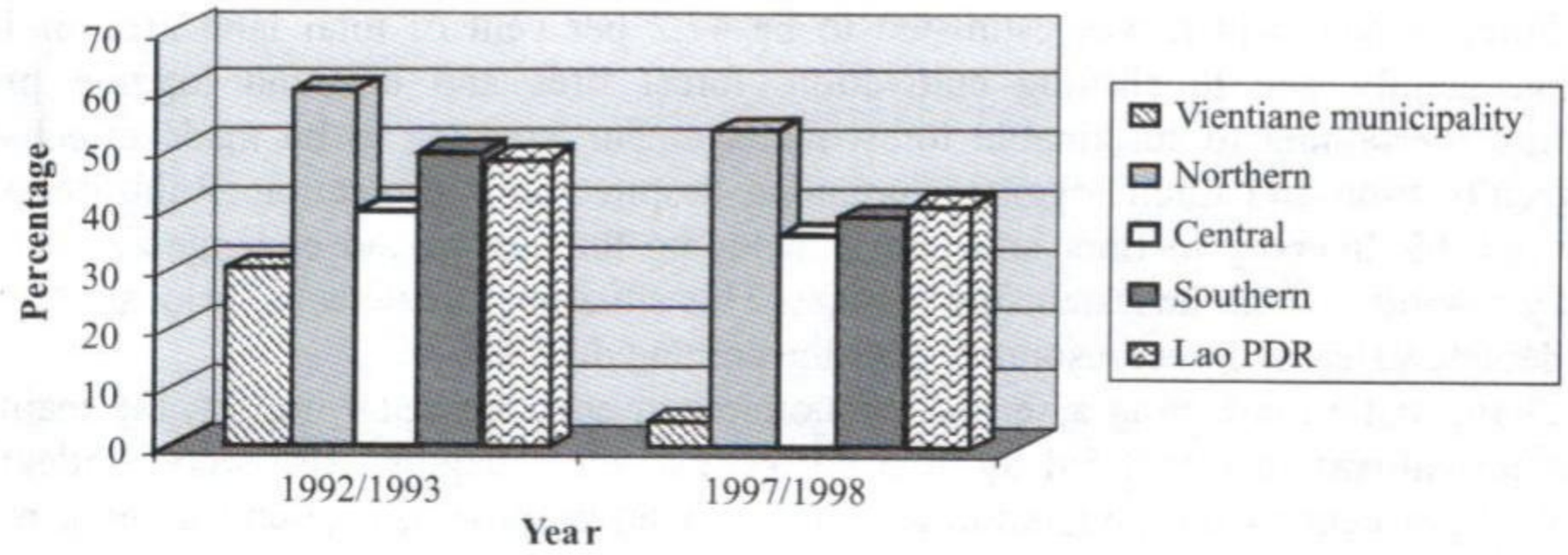
Source: National Human Development Report Lao PDR, 2001.

Figure 3.5 Urban poverty



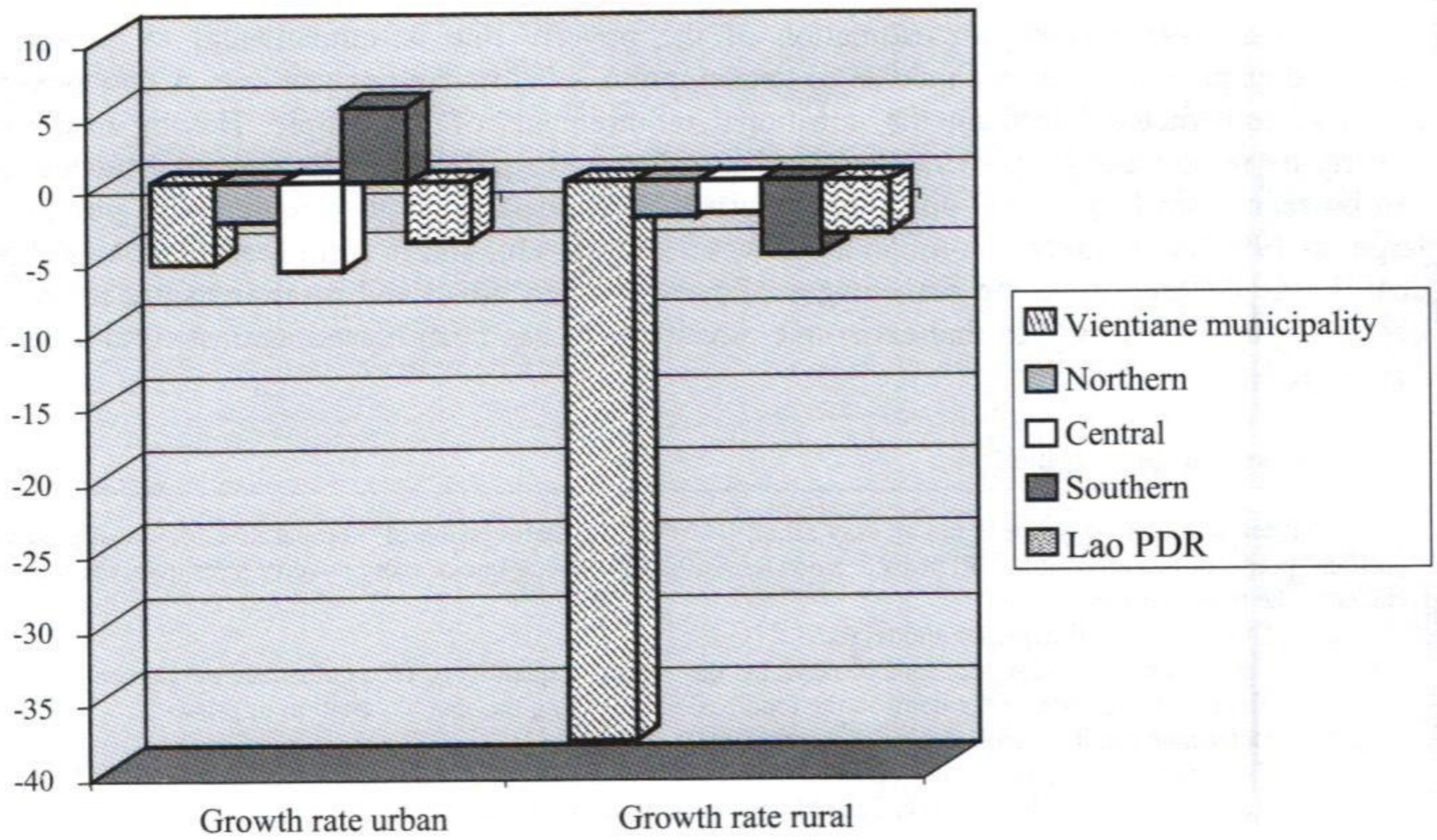
Data source: National Human Development Report Lao PDR, 2001.

Figure 3.6 Rural poverty



Data source: National Human Development Report Lao PDR, 2001.

Figure 3.7 The changing poverty rate



Data source: National Human Development Report Lao PDR, 2001
Note: Changes in the poverty rate are the percentage of "decreased number of poor during 1992/1993 to 1997/1998" to "number of poor in 1992/1993".

One of the major factors affecting the extent of poverty is the fact that it depends on natural agricultural production. The fundamental causes of the poverty in Lao PDR are those that affect livestock and rice yields. These may take the form of natural disasters, such as floods or drought. Farmers have no appropriate techniques or know-how to solve the problem. All regions, except the central region, lack formal education. Farmers also lack commercial knowledge; how to buy and sell, and compete in the marketplace. Since most of the poor are in upland regions, they have less exposure to lowland-style markets. The marketing systems that people deal with in towns are normally on flat lands where there is a crowded population and efficiency in market information. They tend to sell their products at low prices and they also have little experience with bargaining. In conclusion, the dominant factors effecting poverty, especially in the uplands are: natural disasters, and the lack of technology and knowledge.

3.5 Extent of environmental problems

Forest cover, which was estimated to be 47.2 per cent of total land area in 1989, is shrinking, mainly due to shifting cultivation, forest fires and unsound logging practices. Regulations pertaining to sustainable forest management have yet to be made effective, with shifting cultivation and illicit logging continuing despite forest protection. Rainforests, which contain rich biodiversity in flora and fauna, including threatened and endangered species, are generally despoiled in an unsustainable manner. This situation threatens to seriously downgrade and/or deplete valuable forest resources over the coming decades.

Deforestation is having a serious economic and environmental impact; the main causes are shifting cultivation (practiced by 30.5 per cent of the villagers), fire wood collection (on which 92.7 per cent of the population rely for cooking purposes), unsound logging practices, forest fires, and land clearance by farmers. The consequences of deforestation have affected large segments of the rural population and increased their vulnerability to food insecurity. Many

rural people depend on gathering forest areas to supplement their diet, particularly when crops fail. Deforestation has also increased soil erosion in upland areas, weakened water catchments and possibly contributed to the threat of flooding in lowland areas.

3.6 Concluding summary

Lao PDR is a small landlocked country bordered by Viet Nam, Cambodia, Thailand, Myanmar and China. Two-thirds of the country are made up of rugged mountains and plateaus ranging from 200 to 2,800 metres, thus making land communication between provinces and between towns in the same province difficult. The country is endowed with rich natural resources, although not yet exploited, the plateaus with a temperate climate provide grasslands propitious to cattle rearing and to growing Mediterranean fruits. With the geographic location of Lao PDR, it can become a transit route for the Southeast Asian region. The Mekong River runs through the entire length of the country and forms the border with Myanmar and Thailand; it provides fertile plains for agriculture and serves as a major way of transportation and trade with other provincial capitals and with riparian neighbouring countries.

Forests cover nearly half of Lao PDR (about 47 per cent of the total land area). They are a vital economic resource, providing an essential contribution to the consumption and income of the rural poor and conserving bio-diversity, soil and water. The rural population – eighty per cent of the total population – relies heavily on the forest for food, fuel, fiber and shelter. Despite the importance of the resources, deforestation and land degradation are becoming serious concerns in terms of the sustainable use of the country's natural resources (land, water and forest). Deforestation is caused mainly by the practice of shifting cultivation, expansion of agriculture land and unsound logging practices. About 10 per cent of the country's land area is arable land but this area is, to a significant extent, contaminated with unexploded ordnance (UXO) which is a serious cause of concern and a major obstacle for developing rural infrastructure and agriculture (GOL, 2002).

The country has a population 5.2 million inhabitants (GOL, 2002), made up of three main ethnic groups with different development levels, and scattered over an area of 236,800 square kilometres, most of whom, particularly those living in remote areas, still operate in a non-monetized economy. Population density in scarce, about 21 people per square kilometre, and the lack of access for remote villages to town and to main roads inhibit the expansion of domestic markets.

Despite its abundant natural resources and efforts made by the government with economic reforms during the last decade, Lao PDR remains poor. According to the recent Expenditure and Consumption Survey (1997-1998), about 39 per cent of the population still live below the established poverty line. The factors effecting poverty, especially in upland areas are: natural disasters (flooding, drought, insect/pest, crop diseases), lack of technology (difficulty accessing the appropriate technology), and knowledge (limited access to education). Education and health standards are lower than in most developing countries; there is a severe shortage of trained personnel and the physical and socio-economic infrastructure is inadequate. There are also severe budget and trade deficits. Nevertheless, Lao PDR has the advantage of enjoying socio-political stability. It is against this backdrop that the country is preparing to enter the new millennium.

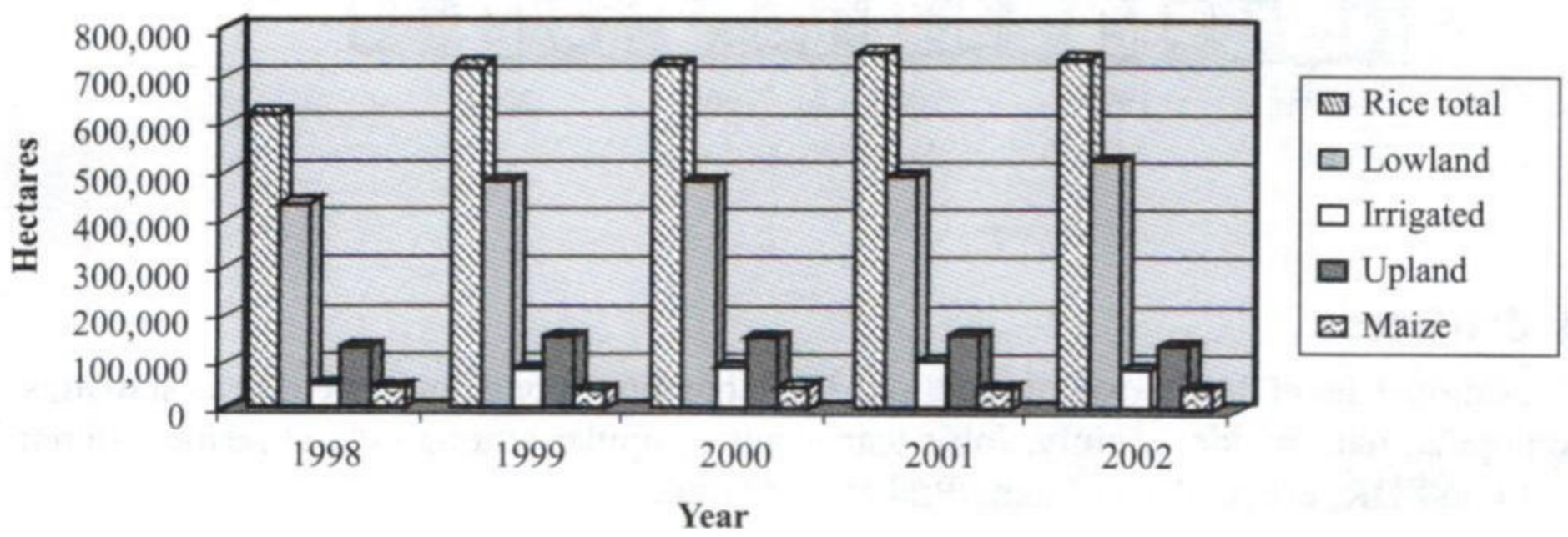
4. Historical and Current Status of CGPRT Crops and Other Crop Production in the Lao People's Democratic Republic

4.1 Trends of rice and CGPRT crop production

4.1.1 Rice

Rice production systems are classified into three main different parts; rainfed upland, rainfed lowland and irrigated lowland. Normally, upland rice cannot be produced during the dry season, and lowland rice in the dry season is more spread along central and southern parts, which have irrigation. Approximately 85 per cent of the rainfed lowland rice areas are in central and southern agricultural regions, mainly in provinces adjacent to the Mekong River. This region is the focus of the government's efforts to realize national rice self-sufficiency. The remaining rainfed lowland area is along narrow river valleys in the northern provinces. Most upland rice cultivation is concentrated on slopes with altitudes ranging from 300-800 metres above sea level, with the upper limit being about 1,500 metres above sea level. Slope gradients range from zero to 120 per cent, with most between 15 and 60 per cent. The government has a policy to reduce upland rice, which negatively impacts the environment, by adopting sustainable agriculture practices, reducing slash-and-burn, and encouraging the planting of native trees such as teak. One new option for farmers in Luangnamtha and Oudomsay, is Pala rubber planting for export to China instead of upland rice.

Figure 4.1 Area harvested of rice and maize

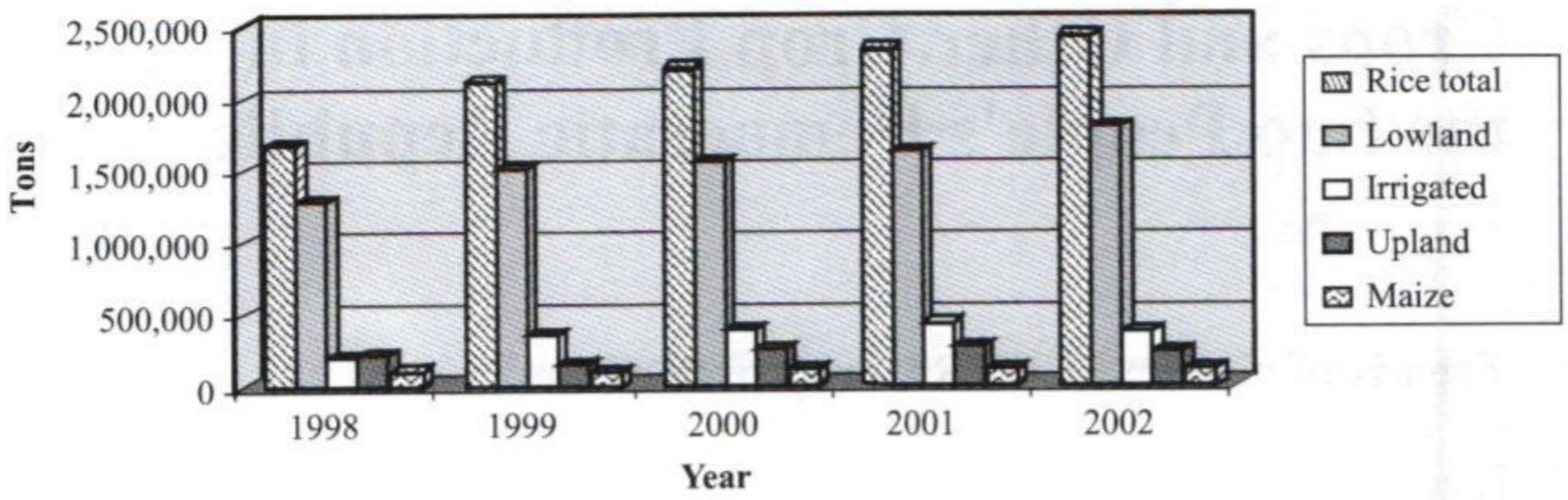


4.1.2 Maize

Maize is the second most produced crop after rice. Generally, maize can be planted in upland and lowland areas. Farmers have to plant more in upland than lowland areas; not many farmers are engaged in producing maize as the main source of food or income for their families.

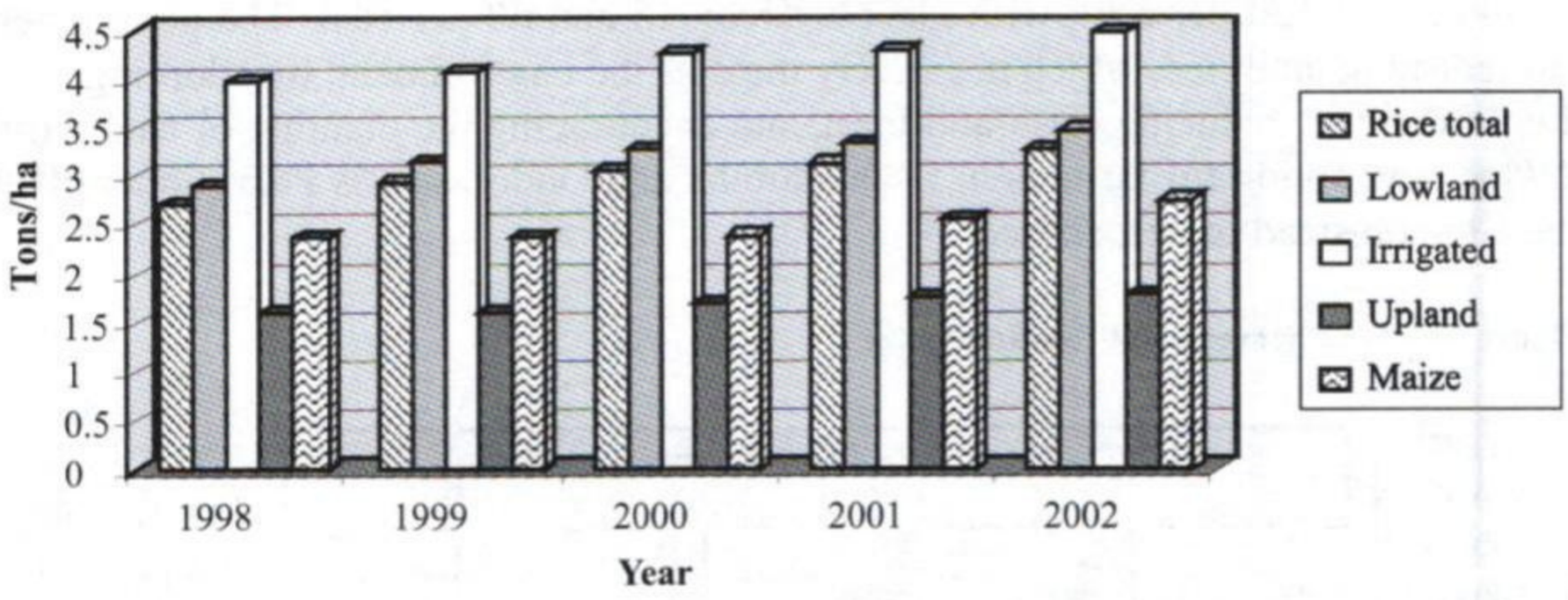
In 2002, maize was grown on 44,956 hectares with 124,122 tons produced and a 2.76 tons/ha yield. However, the area in each province varies from 100 to 5,000 hectares. Most of the maize concentration is in the northern part of the country in the mid hills with reasonably high productivity, such as Luang Prabang, Xiengkhuang, Oudomsay, Phongsaly, Hoaphanh, Sayabouly and Bokeo covering 56.53 per cent of the maize area and contributing about 60 per cent of total production. The yield in the mentioned provinces varies from 2.4 tons/ha to 3.79 tons/ha. The highest yield is found in Oudomsay province.

Figure 4.2 Production of rice and maize



Maize production is more popular with the Lao Soung people in the north (Oudomsay province). Some households produce on a large area and export to China, and some produce using traditional techniques, inter-cropped with rice for household consumption only. In addition to the northern provinces, in 2002, 34.45 per cent of maize area was found in the central and 9 per cent in the southern part of the country.

Figure 4.3 Yield of rice and maize



4.1.3 Job's tear

National level Job's tear production data does not appear in agricultural statistics. It is not so popular nationwide. Mainly, Job's tear is more popular among upland farmers in northern parts of Lao PDR, especially in Luang Prabang province.

Table 4.1 Job's tear production in Luang Prabang province

Year	Production (tons)
1999	7-8 000
2000	1 800
2001	2 000
2002	> 2 000*

Provincial Agriculture and Forestry Office (PAFO) Luang Prabang, 2002.
* Incomplete harvest at the time of data collection.

According to an interview with a representative of Phattana Kasikham Import - Export Company; Paul Overgoor, (April 2002), Job's tear is exported to Thailand for processing and then some is exported to Taiwan. At the end of 2001/early 2002 there was a problem with the quality of Job's tears arriving in Taiwan as the moisture content was too high. This was mainly

caused by immature harvesting by farmers due to many companies in Lao PDR competing for the same product at harvest time. The whole shipment of Job's tears was subsequently sent back to Thailand/Lao PDR. There was a misunderstanding on the moisture content: the Lao PDR side assumed that the agreed moisture content (MC) of 13 per cent referred to the MC of the outside of the product while in Taiwan, they measured the MC within the seed husk. In Taiwan preference has been expressed for Job's tears from Lao PDR but recently shipments of black seeded non-Lao Job's tears have resumed to Taiwan. Job's tears from Lao PDR can be assumed to be an organic product grown without the use of pesticides. Taiwan has received samples of traditional Job's tears from Lao PDR and defines them as being of medium size and mixed black and white colour.

4.1.4 Cassava

Cassava can be planted in both upland and lowland areas, but in lowland areas it seems to be more productive, with a soil type ranging from light to heavy. For better root development, deep, well-drained, friable sandy loam to loamy soil is ideal. Soil, which is very hard to work on deforms roots and makes harvesting difficult. When planting in sandy soil, measures must be taken to minimize soil erosion and maintain soil productivity. Large-scale cassava plantations are not so common, the growers are generally small holders. The main techniques used come from indigenous knowledge. Cassava production areas in the north are larger than in other parts. According to the statistics for area production from the Department of Agriculture (MAF, 2002) in 2000, harvested area of cassava was nearly 100,000 hectares, however it decreased to only 1,170 hectares in 2001 (Table 4.2). It is not clear why farmers ceased production in 2001. It is interesting to note that in 2002, the yield of cassava significantly increased from 4.1 tons/ha in 2001 to 20.11 tons/ha in 2002. The shrinking cultivation area positively affected yield increase by expanding cassava production in favourable areas, while disadvantaged areas ceased production. As a result of the survival of production area, yield dramatically increased in 2002. (see Table 4.4)

4.1.5 Sweet potato

Sweet potato is more productive on lowlands and along the riverbanks, which flood in the rainy season. Sweet potato grows in different types of soil but higher yields are found in sandy loam soil rich in organic matter. Planting can be done at any time, however, it is best during the onset of the rainy season. In 2002, the area planted with sweet potato was 19,498 hectares (Table 4.2). Areas in the north comprised 44.14 per cent, central 38.32 per cent and southern 17.53 per cent.

4.1.6 Pulses

Mungbean has been produced in Lao PDR for many years, but not too much swidden. From 1999 to 2000, the area planted was less than 2,000 hectares nationwide, compared to the soybean, which is more popular with a planted area each year of more than 5,000 hectares (Table 4.2). The reason why soybean is more practicable in Lao PDR is that soybean has more diversity in its uses for food. One of the most popular soybean products is soymilk.

In 2000, the area planted with peanuts was 12,000 hectares. Area in the north made up 42.70 per cent, central 23.08 per cent and south 34.20 per cent. Peanut farming is currently popular in La district, Oudomsay province (Table 4.2).

Table 4.2 Harvested area of rice and CGPRT crops

	Harvested area (ha)				
	1998	1999	2000	2001	2002
Rice total	617 540	717 580	719 370	746 775	738 104
Lowland	430 210	477 180	475 470	486 770	519 471
Irrigated	53 140	87 030	91 800	102 200	84 000
Upland	130 200	153 370	152 100	158 005	134 633
Maize	46 400	40 730	49 000	43 870	44 956
Cassava			99 999	1 170	4 125
Job's tear					
Sweet potato			19 400	16 320	19 498
Mungbean	2 050	1 740	1 300	2 360	3 393
Soybean	5 870	6 800	6 400	3 280	3 565
Peanut	14 900	12 910	12 000		

Sources: Agricultural Statistics 1975-2000 and Agricultural Statistics 1999-2002.

Table 4.3 Production of rice and CGPRT crops

	Production (tons)				
	1998	1999	2000	2001	2002
Rice total	1 674 500	2 102 815	2 201 700	2 334 680	2 416 500
Lowland	1 284 890	1 502 025	1 552 800	1 619880	1 801 200
Irrigated	212 100	354 000	390 150	436 200	375 000
Upland	213 500	146 790	258 750	278 600	240 300
Maize	109 900	96 110	117 000	111 869	124 122
Cassava			99 999	7 010	82 947
Job's tear					
Sweet potato			117 500	100 761	193 615
Mungbean	1 700	1 510	1 100	2 809	3 025
Soybean	4 300	5 850	5 400	3 002	2 992
Peanut	15 000	12 950	13 200	16 779	16 377

Sources: Agricultural Statistics 1975-2000 and Agricultural Statistics 1999-2002.

Table 4.4 Yield of rice and CGPRT crops

	Yield (tons/ha)				
	1998	1999	2000	2001	2002
Rice total	2.71	2.93	3.06	3.13	3.27
Lowland	2.9	3.15	3.27	3.33	3.47
Irrigated	3.99	4.07	4.25	4.28	4.46
Upland	1.59	1.61	1.7	1.76	1.78
Maize	2.37	2.36	2.39	2.55	2.76
Cassava	-	-	1	4.1	20.11
Job's tear	-	-	-	-	-
Sweet potato	-	-	6.06	6.17	9.93
Mungbean	0.83	0.87	0.85	1.19	0.89
Soybean	0.73	0.86	0.84	0.92	0.84
Peanut	1.01	1	1.03	1.39	1.2

Sources: Agricultural Statistics 1975-2000 and Agricultural Statistics 1999-2002

4.2 Trends of other crop production

Trends of other crop production are shown in Tables 4.5 to 4.8. Coffee production is the most important permanent crop, mainly grown on the Bolaven plateau. There are 24,000 coffee growers, with coffee planted on 41,000 hectares, especially in Saravanh, Sekong, Champachack and Attapue. This area is suitable for growing coffee. Since it is known that the region has potential area, the government including MAF are promoting planting this crop as much as possible to support local and international requirements.

Of the other temporary crops, sugarcane (23,000 growers), groundnut (21,000 growers), and tobacco (18,000 growers) are grown around the country. There are 9,000 cotton growers,

mainly in Huaphanh, Xayaboury and Savanakhet. Only a few areas in northern Lao PDR produce mainly for consumption with some surplus to sell in the local market.

Fruit trees are common, but usually only scattered trees rather than plantations. The most common fruit trees are mango, banana, jackfruit and tamarind. Three are 1.4 million mango trees in Lao PDR and about the same number of tamarind trees.

Vegetable crops are also common, usually planted in small kitchen gardens on riverbanks. In 1998/1999, 36 per cent of holdings grew some vegetables. Vegetable growing is common in some northern provinces. The most commonly grown vegetables around the country are chilli, cabbage, cucumber, onion and eggplant. The type of vegetables grown are similar throughout the country.

Table 4.5 Area of non-CGPRT crops

	Area (ha)				
	1998	1999	2000	2001	2002
Tobacco	6 580	4 300	6 700	5 060	5 476
Cotton	7 240	4 200	4 700	3 510	3 330
Coffee	28 640	29 250	29 402	32 220	36 254
Tea	910	930	560	440	345
Sugarcane	5 370	4 730	8 400	6 590	6 631
Sesame				5 280	5 509
Vegetables	-	-	-	-	-
Chilli	-	-	-	1 560	6 724
Water melon	-	-	-	320	4 918
Other vegetables	-	-	104 700	109 590	98 241

Source: Statistical data, 2000. National Statistical Centre (NSC).

Table 4.6 Production of other crops

	Production (tons)				
	1998	1999	2000	2001	2002
Tobacco	25 600	23 350	39 926	30 081	27 497
Cotton	7 500	4 260	40 600	3 381	2 944
Coffee	16 999	17 530	23 500	25 796	32 197
Tea	260	350	1 226	160	172
Sugarcane	170 200	173 600	296 960	208 850	222 036
Sesame				3 321	3 748
Vegetables					
Chilli				10 041	46 454
Water melon				4 310	82 945
Other vegetables			636 000	630 649	762 540

Source: Statistical data, 2000. National Statistical Centre (NSC).

Table 4.7 Yield of other crops

	Yield (tons/ha)				
	1998	1999	2000	2001	2002
Tobacco	3.89	5.44	5,96	5,94	5,02
Cotton	1.04	0.96	0,98	0,96	0,88
Coffee	0.59	0.6	0,80	0,80	0,88
Tea	0.29	0.38	2.19	0.36	0.5
Sugar cane	31.72	36.7	35.35	31.69	33.48
Sesame	-	-	-	0.63	0.68
Vegetables					
Chilli				6,44	6,91
Water melon				13.47	16.87
Other vegetables			6.07	5.75	7.76

Source: Statistical data, 2000. National Statistical Centre (NSC).

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4.3 Trends of animal production

Trends of animal production are shown in Table 4.8. In previous years, as with today, animal husbandry in Lao PDR is a priority to enhance food security and to contribute to rural development, poverty reduction and reduced slash-and-burn agriculture. At the end of 2003, the volume of livestock and fisheries increased by 5.2 per cent compared to 2002, with about 226,270 tons of meat and fish (live weight) calculated to be worth approximately 33,000 billion kips (present market price), (MAF, 2004).

Table 4.8 Animal production

Animal (heads)	1998	1999	2000	2001	2002
Buffalo	1 092.74	1 008	1 028	1 051.40	1 089.40
Cattle	1 126.60	1 000	1 100	1 216.60	1 220.50
Swine	1 464.42	1 320	1 425	1 425.90	1 608.10
Goats and sheep	122.17	112.41	121.4	124.20	127.50
Poultry	12 110.85	12 353	13 094.20	14 063.20	18 320.60

Source: Department of Livestock and Fishery, 1999 and 2002.

4.4 Trends in marketing of CGPRT crops

Subsistence agriculture, which is dominated by rice production, continues to characterize agriculture in Lao PDR. The agricultural sector is characterized by low inputs and low output, and limited market orientation. Agricultural land is limited because Lao PDR is covered by mountains more than flat land. CGPRT crop marketing is not clear because no clear export data nor consumption data exists in the country. Trading of CGPRT crops just takes place regionally and for specific crops. The present market for agriculture products, especially CGPRT crops, still follows traditional sales patterns. Small-scale farmers bring their fresh produce to the local market immediately after harvesting. For medium to large-scale farmers, middlemen visit individual households during the harvesting period and buy products, including paddy sometimes.

As a first observation, (but not from official sources) Luang Prabang province trades Job's tear, and Vientine and Oudomsay provinces trade maize. In this section we introduce the results of interviews with officials of local government and literature reviews about CGPRT crop marketing.

4.4.1 New developments in Job's tear processing and marketing in Luang Prabang

A Provincial Agriculture and Forestry Officer (PAFO) explained that the main priority of agricultural policy in the province is firstly to accomplish self-sufficiency in what the province needs and convert monocropping into more diversified agriculture.

According to the Commerce Department in Luang Prabang, the export demand for Job's tears is sufficient to absorb the provincial supply, but quality control needs to be established. As we currently understand it, the marketing chain for Job's tears goes from a group of buyers in Luang Prabang to a processor in Leuy province, Thailand. What is not consumed in the Thai market (for kinds of candy *kanom* and drinks) is exported from a company in Bangkok to Taiwan. We do not know what happens to it in Taiwan. Reportedly, the Taiwanese also consume Job's tear, but it is also possible that some is exported to the North American market, where it is used as an ingredient in specialty foods, foods for diabetics and organic foods. We know that it retails on the Internet market for US$ 16 per pound.

In 2001, a shipload of low quality Job's tear was refused by buyers and returned from Taiwan. It is necessary to collect more information about this, such as the cause of the problem,

loss to Job's tear producers and actions to improve Job's tear quality through post-harvest technologies.

There is an officially recognized group of businessmen who have entered into an agreement with a Taiwanese company in which they agree to buy US$ 400,000 worth of Job's tear processing equipment from Thailand under a loan agreement. The group will sell the processed Job's tear directly to Taiwan while paying back the loan. In this way they will be able to cut out two steps in the marketing chain in Thailand (a processor in Leuy province and an export company in Bangkok who sells to Taiwan).

From the Head of the Thongkhang Research Station we heard of another joint venture, this one funded by the Vietnamese, to process Job's tears into flour in Luang Prabang in order to sell to Japan.

4.4.2 Provincial plans for supporting shifting cultivation substitution through marketing

The Planning Department, Luang Prabang province has both short-term and long-term plans for supporting shifting cultivation substitution through marketing.

Short-term plans focus on:

- Small livestock (poultry, swine, goats)
- Sesame
- Peanut

Long-term plans focus on:

- Eagle wood (Mai ketsana) for Phonsay, Phukun and Viengkham
- Paper mulberry (Po sa) and Bong Oil (yang bong) for Pak Ou and Pak Seng
- Benzoin (Nyan) for Nambak and Ngoi
- Large livestock (buffalo and cattle) through controlled grazing in areas with potential (cattle are favoured over buffalo because they reach a marketable size in a shorter time).

4.4.3 Cross-border Trade in Oudomxay Province

The trade route to Viet Nam connects with Dien Bien Phu through Phongsaly. The China trade channel passes through the international border at Bor Ten and also through the provincial border gate at Meo Chai in Namor on the new road going through the NAFRI research villages of Namor Nua, Phousang and Mixay. Interestingly, the provincial officials expressed the opinion that trade passing through provincial border gate to China was more beneficial than that passing through the International Border at Bo Ten because the latter has higher quality standards requiring full testing and the payment of high customs duties. Not all of the produce from Oudomsay could meet the high quality standards of the main international border without substantial improvement of post-harvest processing, storage and quality control. It is clear that the strictness of trade regulations at the international gate has increased recently with China's entry into the World Trade Organization. China in general, has higher quality standards than Viet Nam, for example. The rule of thumb for commodities exported to both countries seems to be: "If you have high quality, China, if not, Viet Nam."

The trade passing through the Meo Chai border gate seems to be a classic example of cross-boundary trade, which is characterized as small-scale traditional trade under the control of the local authorities. The Meo Chai gate is administered by provincial authorities on both sides of the border. Customs duties are much lower and quality regulations are more "trade friendly" or lenient. Presumably the encouragement of this kind of a vigorous cross-border trade is

sanctioned by the agreement between Lao PDR and China which designates Oudomsay as part of a "Special Development Zone."

China's development is exerting a variety of different influences on its neighbours in Southeast Asia. Increased demand for products of higher quality is one of the most important influences. For example, the Chinese Embassy has placed a standing order for coffee, so now Oudomsay is promoting coffee growing. Sugar production is another new development in Namor, specifically to meet demand from a sugar factory across the border in Mengla. The director of the Commerce Department admitted that there is a big opportunity for swine production in areas bordering tourist districts in China, since there is no longer a place for "aromatic" swine farms on the Chinese side (Marketing Survey, 2002).

4.5 Concluding summary

In Lao PDR, the agricultural sector is the main component of the economy. Nowadays, CGPRT crops are significant and have become very important crops for daily subsistence after rice. CGPRT crop production and consumption tend to be increasing, generally, among upland farmers in order to substitute shifting rice cultivation and for cash income, which is the source of money to buy rice when facing rice shortages. However, in general most CGPRT crop production is for domestic consumption, where to sell and for what purpose are not included in statistical data because the producers and consumers are still small-scale or individuals. The current market of agriculture products, especially CGPRT crops, still follows traditional sales patterns. Small-scale farmers bring their fresh products to the local market immediately after harvesting. For medium to large-scale farmers, middlemen visit individual households during the harvesting period and buy products including paddy sometimes. Different regions have different market systems, products and scale.

5. Overview of Agricultural Diversification Related Policies in the Country

5.1 Overview of agricultural performance

Agriculture is the main economic activity in Lao PDR and covers a wide range of activities from subsistence production to agricultural related industries. In 1999, the sector accounted for 53 per cent of GDP. Rice is the most important crop of the agricultural sector; it accounted for 38 per cent of Agricultural GDP in 1999, livestock rearing is the next most important agricultural activity and in 1999 accounted for 34 per cent of agricultural output. Commercial crops contributed 14 per cent of agricultural output (Table 5.1).

Table 5.1 Sectoral share of agricultural output in national GDP

GDP share	Million kip	Percentage of GDP	
		National	Agriculture
Agriculture	5 541 551	53.4	100
Paddy	2 132 727	20.5	38.5
Other cereals	120 625	1.2	2.2
Commercial crops	796 592	7.7	14.4
Livestock	1 889 621	18.2	34.1
Fisheries	78 098	0.8	1.4
Forestry	523 888	5	9.4

Source: Master plan study, Progress 2, Volume 1.

Subsistence agriculture provides rural dietary needs, small commercial ventures supply income and urban markets, and forest products and cattle are major export items. The current development policy places emphasis on improving living standards in rural areas by establishing productive agro-forestry industry and services, and developing the accompanying infrastructure and human resources. There are currently 31 enterprises, mainly small enterprises of under 30 employees, active in the agricultural, forestry and fisheries sector. How well the agro-forestry sector is developed will significantly influence long-term economic and social success. The sector is managed by the Ministry of Agriculture and Forestry.

Rice must be imported to meet staple needs. The lowland flood plains in the rainy season account for 70 per cent of rice production, lowland irrigated rice produced in the dry season accounts for 2 per cent, and upland rainy-season rice for the remaining 28 per cent. Farmers grow small amounts of household vegetables and raise water buffalo, swine and poultry. Maize, cassava and vegetables are rice substitutes during shortages. Diversification to other cash crops is occurring, especially with increasing urbanization but still only contributes a minor portion to agricultural production and covers about 17 per cent of cultivable land. Expansion of mungbean, peanut, tobacco, sugarcane, cotton, coffee and tea is evident. Farmers only try other crops after they are secure with a rice surplus. Upland farmers use shifting cultivation and practice different fallow methods. Opium is grown in the northern mountains and is a major cash income source. Coffee is the only export crop of consequence. There are opportunities for local production to replace imported food items, such as for tea and oil seed crops.

5.2 Policy and strategy of agricultural development

According to the Fifth Five-year Socio-economic Development Plan (2001-2005) focusing on the specific development plan and targets of the agricultural sector, especially on

Food and Commodity production, the 2005 food production target is 3 million tons including 2.7 million tons of rice grown on 770,000 hectares comprising of 620,000 hectares in the rainy season and 150,000 hectares in the dry season. Large-scale animal production is also promoted, with a target growth rate of 4-5 per cent. Community crop production will be promoted. The plan focuses on maize, cassava, soybean, green bean, peanut, sugarcane, cotton, sugar palm fruit, sesame and vegetables depending upon the regional potential and market requirements (MAF and JICA, 2001b)

Under the plan, the objective and strategy for sub-sectors based on agricultural development focus on marketing and agro-processing to provide a market environment to enable producers, consumers and agribusiness to make decisions within the framework of the market economy. This objective is to support the facilitation of regular services and market information to assist free and open competition, the transmission of market signals, and the exchange of goods and services thereby increasing internal and external trade.

In the plan, the major objective of agro-processing is: (i) to improve the quality and reduce losses of agricultural products through proper post-harvest activities including collection, sorting, storing, drying, packing and transportation and (ii) to add more value to agricultural products through agro-processing activities (MAF and JICA, 2001b).

5.3 Concluding summary

The agricultural sector contributes the greatest sectoral share to GDP. Rice is the main crop followed by livestock and commercial crops. To enhance GDP growth, the Fifth Five-year Socio-economic Development Plan (2001-2005) focuses on the specific development plan and targets of the agricultural sector. Appropriate technologies to upgrade yield together with developing industry and services are needed. Agricultural development should start from farming system development, improving the quality of production, and processing, and establishing marketing systems.

6. Impact of Global Trade Orientation on CGPRT Crop Agriculture

6.1 Brief overview of the country's international trade policies for CGPRT and other agricultural products

Lao PDR has taken initial actions in a move to comply with AFTA accession. Initially, the tariff cuts proposed by Lao PDR were of a too long duration as most agricultural commodities were excluded from tariff reductions. With the tariff reduction across ASEAN, each country is driven towards producing and exporting products that have competitive advantage. Phasing tariffs early would acclimatize business and producers to increased competition. Many studies have indicated that Lao PDR has comparative advantage in the production of vegetables, groundnut, soybean, lemon, swine, live cattle, buffalo, coffee, sugarcane, maize, beans, indigenous fruit, and plantation wood. Examination of the tariffs on agricultural items produced and exported by Lao PDR alongside ASEAN partners indicates that there are areas where products have been placed on the Temporary Exclusion Lists (TEL) where the same products have been placed on the Inclusion List (IL) by the other ASEAN countries. The effect of this is to deny Lao PDR access to any rate reduction below the Most Favoured National status (MFN) rate by the other countries, until Lao PDR places certain items on the Inclusion List.

6.1.1 Trade liberalization

Trade liberalization has been one of the pillars of economic reform and Lao PDR has just applied for WTO accession. There has been significant progress in trade sector reforms: basic tariff and non-tariff trade barriers have been removed or minimized; export and import licensing procedures and regulations have been simplified; exchange control and transfers have been liberalized; transport infrastructure and services to facilitate trade and investment in the country and region are being modernized; one-stop services at customs border checkpoints have been introduced to reduce bureaucratic procedures and provide better export and import services; and price controls have been removed (except on fuel and a few others). The government has made significant efforts to boost local production for import substitution and exports to help reduce the trade imbalance.

6.1.2 Pattern of trade

Total imports (CIF) to Lao PDR have been consistently more than exports (FOB) resulting in a negative balance ranging from US$ 368 million to US$ 214 million annually for the last four reported years (1996-1999). Major items of export are garments, wood products, hydropower and coffee, which account for 85 per cent of exports amounting to about US$ 311 million in 1999. The principle import items in 1999, totalling US$ 525 million, were bicycles and motorcycles, rice, sugar, paper and electric power.

What Does Lao PDR Export?

Exports are highly concentrated in only a few product categories. In 2002, garments were 33.6 per cent of the total, electricity 33.3 per cent, wood and wood products 20.6 per cent, and coffee 5.5 per cent. From 2003, however, gold and copper will become key exports and will drive future export growth.

Where Are Lao PDR's Markets?
Current export markets are limited to Thailand and Viet Nam, France, Germany Italy and Belgium. China is becoming a potential export market, especially for wood, forestry and agricultural products, and exports of mining products to Australia are expected to grow rapidly in the near future.
(www.worldbank.org/lao)

6.2 Extent of exports and imports of CGPRT and other agricultural products

The trends of selected CGPRT crops' trade are shown in Table 6.1. Currently, data on exports-imports of CGPRT crops is very limited. Normally, the production is only for domestic use.

Table 6.1 Trade trends of selected CGPRT crops during 1999-2003 (tons)

	1999	2000	2001	2002	2003
Imports					
Maize	1 300	400	15	13 335	1 230
Soybean	n.a.	n.a.	n.a.	n.a.	n.a.
Groundnut (in shell)	0	0	0	0	0
Cassava (equivalent)	1 565	8 230	9 450	11 390	15 665
Potato	0	17	17	17	153
Exports					
Maize	1 610	900	2 620	1 117	8 445
Soybean	450	400	0	48	16
Groundnut (in shell)	1 300	380	670	168	188
Cassava (equivalent)	n.a.	n.a.	n.a.	n.a.	n.a.
Potato	n.a.	n.a.	n.a.	n.a.	n.a.

Source: FAOSTAT.

The country's traditional exports comprise agricultural commodities, logs and sawn timber, wood and wood products, livestock and hydro-electricity. However, since 1999/2000, cash crops, particularly coffee, have become important export products. With new foreign investment in the 1990s which helped the expansion of export-oriented manufacturing (e.g garments) exports from Lao PDR have, to some extent, become more diversified. Likewise, trade liberalization in both Lao PDR and its trading partners has encouraged non-traditional exports. Beside, significant informal cross-border trade has been going on, which the authorities cannot prevent due to difficult terrain, poor infrastructure and poor law enforcement capacity.

Lao PDR's major trading partners are Thailand and Viet Nam. In 1997, Thailand absorbed about 22 per cent of the exports and contributed 51.9 per cent to imports. Viet Nam is the largest export market for products from Lao PDR, taking 47.1 per cent of all exports in 1998. Imports are composed of consumption goods such as fuel, gas, electrical appliances, investment goods such as machinery and equipment, and intermediate goods, especially raw materials for the garment industry. Despite efforts made to develop and diversify export products, Lao PDR still faces a deficit in its trade balance. From 1994 to 1998, the average annual deficit was about US$ 217 million (or about 12 per cent of GDP), (GOL, 2002).

The problems and constraints are:

1. Narrow export base dependent on low, value-added agricultural exports.
2. The dominance of informal cross-boarder trade makes it difficult to identify actual trade performance and the loss of the tax revenues from these activities.
3. Lack of competitiveness in foreign markets, mainly due to low quality standards.
4. Lack of sales promotion and incentives of export.
5. Ineffective law enforcement as a result of an underdeveloped legal framework.

6.3 Concluding summary

Currently, Lao PDR exports wood, wood products, garment and hydro-electricity; agricultural products are very limited (except coffee and sugarcane, which are export products). Agricultural production is predominantly for domestic consumption and national trade. Global trade policy for other products is wider than for agricultural products, agricultural products seem to focus on the nation being within ASEAN as Lao PDR has taken initial actions in the move to comply with AFTA accession. Initially, the tariff cuts proposed were of too long duration as most agricultural commodities are excluded from tariff reductions. Lao PDR has comparative advantage in the production of vegetables, groundnut, soybean, lemon, swine, live cattle, buffalo, coffee, sugarcane, maize, beans, indigenous fruit and plantation wood. Examination of the tariffs on agricultural items produced and exported by Lao PDR alongside ASEAN partners indicates that there are products placed on the Temporary Exclusion Lists (TEL) in Lao PDR, whereas the same products in other ASEAN countries have been placed on the Inclusion List (IL).

7. Benefits of Agricultural Diversification on Poverty Alleviation in the Country

7.1 Overview of poverty alleviation strategies

The government considers the Five-year Socio-economic Plan and its budget as the best means of managing the development of the country. The most recent plan adopted by the National Assembly covers the years 2001-2005. The main targets of the socio-economic development plan for 2001-2005 are: to achieve food security; to solve the problems of slash-and-burn cultivation and to strictly prohibit opium growing by allocating new permanent jobs to the affected people; to enhance national saving; to pay critical attention to both state and private enterprise reforms; to develop human resources in various areas; and to support modern industrial development. The objectives of the Five-year Socio-economic Development Plan (2001-2005) are as follows (MAF and JICA, 2001a-c):

- 7-7.5 per cent annual GDP growth;
- Sectoral GDP annual growth of 4-5 per cent for agriculture, 10-11 per cent for industry, and 8-9 per cent for services;
- Sectoral product share in GDP of 47 per cent for agriculture and forestry, 26 per cent for industry and 27 per cent for services;
- Single digit annual inflation rate and a stable exchange rate;
- Increased annual budget revenue with 18 per cent of GDP during 2004-2005 and maintaining budget deficit at around 5 per cent of GDP;
- Reduce trade deficit to 6 per cent of GDP;
- Public investment at 12-14 per cent of GDP and saving at about 12 per cent of GDP in 2005; and
- GDP per capita at US$ 500-550 in 2005 with a population of 5.9 million.

The specific development plans and targets for the agricultural sector are as follows:

Food production

The 2005 food production target is 3 million tons, including 2.7 million tons of rice grown on 770,000 hectares comprising of 620,000 hectares in the rainy season and 150,000 hectares in the dry season.

Commodity production

Commodity production will be promoted, focusing on maize, cassava, soybean, peanut, sugarcane, cotton, sugar palm fruit, sesame, vegetables and fruit depending upon the regional potential and market requirements. After satisfying domestic consumption, exports of livestock will be promoted with targets of 44,000 cows, 45,000 buffalo, 150,000 swine, 5,000 tons of fish and 3,000 tons of miscellaneous by-products, by 2005.

Elimination of slash-and-burn cultivation

Slash-and-burn cultivation should be eliminated by 2005. The focus will be on provinces where slash-and-burn cultivation exceeds 10,000 hectares, such as Luang Prabang, Oudomxai, Phongsali, Louangnamtha, and Xiangkhouang.

Irrigation

It is planned to increase the irrigated areas in the wet season to 400,000 hectares and in the dry season to 300,000 hectares by 2005.

Research in the agricultural and forestry sector

Various improvement activities will be promoted, namely technical agricultural centres, training centres, seed production units, agricultural machinery units, enhanced provision of credit to farmers and co-operatives and the enhancement of information at both the macro and micro levels, such as land use and production standards.

Rural development and poverty reduction

During the next five years, rural development will be undertaken, focussing on the poorer areas in conjunction with poverty reduction, eliminating slash-and-burn and opium production. The GOL is to collect data and information, and conduct surveys and studies to monitor the poverty reduction strategy. The results will be incorporated into the implementation of national priority projects.

7.2 Assessment of potential benefits of agricultural diversification for poverty alleviation

Poverty is measured either through consumption or income. If measured through income, poverty is measured as the percentage of individuals in the population whose income falls below a pre-determined poverty line. If measured through consumption per capita, real consumption of food and non-food items is used to measure the extent of poverty and compared to a poverty line constructed using nutritional requirements. Poverty measured through consumption has the advantage of presenting a more stable result than income due to less annual variation and it is also more precise. Measured through consumption, 45 per cent of the population lived in poverty in 1992-1993, whereas in 1997-1998, the percentage of poor people fell to 39 per cent (MAF and JICA, 2001a-c).

Rapid Poverty Assessments undertaken in 1997 and consumption expenditure surveys established the characteristics of poor rural farmers. A significant number of households do not produce enough rice to feed themselves throughout the year and more than 80 per cent of villages report that the most important crop is not sold but eaten within the household. The degree of rice self-sufficiency is the primary determinant of poverty. Off-farm activities are an important factor to supplement household incomes. About 20 per cent of rural households have to supplement their farm income with off-farm sources such as handicrafts or NTFPs to be able to meet all their food needs. Crops after rice such as maize, cassava, mungbean, soybean and sweet potato are supplementary crops and only a few areas plant them for income. Household food deficiency is due to low-input/low-output systems where irrigation is rare. Double cropping is common due to the scarcity of land with landholdings on average only 1.4 hectares. The reasons for low productivity are a combination of supply and demand factors. Determinants of poverty are a lack of arable land (both paddy and swidden), livestock disease, poor health, lack of labour, lack of technical knowledge and skills, lack of market access (especially roads) and poor housing. As for access to funds, credit for ploughing was identified as the main credit need followed by credit for forest activities. Absence of credit facilities as well as lack of confidence in loan procedures for group loans were given as important factors for low productivity. While extension services are available, the quality of the service is considered to be poor, as visits of extension workers to villages are mainly just to monitor production of target commodities (MAF and JICA, 2001a-c).

The Rapid Poverty Assessments of 1997 showed that it was widely accepted by farmers that facilitating access of the poorest people to agricultural extension services would have a

critical bearing on the social impact of agricultural change and modernization, and consequently on poverty alleviation. In addition, most farmers do not use modern inputs such as fertilizers and pesticides.

Considering the mentioned factors which determine low agricultural productivity and the extent of poverty, agricultural diversification seems to be an effective measure to reduce poverty in the country. Water and fertilizer requirements of secondary crops (mainly CGPRT crops) are usually less than of rice. This characteristic is beneficial to rural poor farmers who face difficulty in securing irrigation and inputs. Some kinds of secondary crops can be cultivated using lower labour inputs which is helpful to farmers who lack sufficient labour for their farming. As we can learn from the case of Job's tears, secondary crops also have large opportunities in the international commodity market. If there is confidence in the market, it will provide huge benefit to farmers.

As discussed in Chapter 4, the yields of secondary crops are low and fluctuation is very wide. Though secondary crops can be cultivated even with low technologies, it is crucial to strengthen extension activities to improve and stabilize productivity.

7.3 Basic requirements for realizing the benefits of agricultural diversification for poverty alleviation

Given the demographic and ethnic diversity of the country, in its development plan strategy, the government must take into consideration the regional, economic structure by effectively exploiting natural potential, the labour force and the other potential of each region

For development purposes, the country is divided into three main regions (North, Central and South) having unique features and, therefore, specific needs of their own. These are briefly described below:

The North comprises of seven provinces with 30 per cent of the whole population, and 40 per cent of the country's land area. The majority of the land is mountainous, and it is the most underdevelopment part. Some key-areas to be addressed are:

- Infrastructure development, especially a communication network;
- Preservation of forest resources and deforestation;
- Food security;
- Settlement of shifting cultivation for rice growing and stopping opium poppy and cannabis cultivation;
- Commercial production, such as cash crops and animal husbandry represent the region's potential;
- Arrangement of a sedentary life for villagers and poverty eradication;
- Development of tourism services, particularly scenic and eco-tourism; and
- Establishment of a special economic area in Oudomxay province and a study-free trade area in Boten, Luang Namtha province.

The Centre comprises of seven provinces, with 46 per cent of the population and 40 per cent of the country's land area. It is the most developed part of the country, having vast potential for further development, particularly in the field of agriculture and hydro-electricity. The key-areas to be developed in this region are:

- Development of infrastructure, especially the transversal communication network;
- Development of hydro-electricity; agriculture and forestry production; production of construction materials and utility and export goods;
- Development of transit services, especially trade, tourism, transit transport; and
- Establishment of a special economic area in Savannakhet.

The South comprises of four provinces with 24 per cent of whole population, and 18 per cent of the country's land area. It is a very important strategic area, featuring large plains favourable for rice cultivation, cattle rearing, fisheries, and cash crops, especially coffee and fruit trees.

Key-areas to be addressed for development are:

- Development of infrastructure, turning the area into a transit route;
- Development of food production;
- Expansion of commercial crops and fruit trees, promotion of cattle rearing, and manufacture of export products based on agriculture, mainly coffee, cardamom and rice;
- Development of agro-processing industry and mining;
- Development of trade, tourism, handicrafts and common services; and
- Establish a special area in Champasack province (GOL, 2002).

The most important policy related objective in the government's overall agricultural development strategy is rural poverty alleviation and the development of household food security. In this regard, further analysis of the World Bank's poverty study showed that the higher the level of education of the household head, the lower the incidence of poverty. Poverty declines with the age of the household head and poverty in female-headed households was less than in male-headed households. The findings also show that in many areas, the integration of rural people into the market economy is marginal and that there are limited opportunities for diversification. Improving the standard of living of the rural population requires development in rural infrastructure, particularly access roads, increased public sector investment to support agricultural development and actions to foster rural market development. In keeping with these objectives the top priorities of agricultural investment from the point of view of poverty alleviation are:

1. Resolution of the rice cultivation issues, in particular, increase the size of production area. This could be achieved, amongst others, through the implementation of enforceable tenure rights for land and forest resources.
2. Increase in livestock holdings, solving livestock disease problems, and providing funding mechanisms for increasing livestock holdings.
3. Reliable production of cash crops.
4. Access to rural markets; specifically, lifting any restrictions on the free movement of people within Lao PDR to develop an efficient rural labour market; and
5. The development of access roads.

In addition, the following objectives should be pursued:

6. Human resource development in matters of extension services regarding farming systems and livestock to respond to farmers needs;
7. Trial and error experimentation in the upland areas, where poverty is most acute and identification of the most appropriate farming systems; and
8. Support for small-scale farmers in market driven, lowland areas.

To realize poverty alleviation through agricultural diversification it is important to expand rice cultivation in lowland areas where rice is the most suitable crop in terms of the farming conditions and market access. On the other hand, in upland areas, especially in the northern part of Lao PDR where other agricultural resources and employment opportunities are still limited, rice is less competitive and the environment is more vulnerable. It is fundamental to identify the strengths and weakness of each area and if secondary crops are confirmed to provide more benefits to the rural poor, they should be recognized as priority crops in the respective areas and the above mentioned strategy should focus more on secondary crops.

7.4 Concluding summary

From the point of view of the government, all development activities in the country are aimed at reducing poverty. They have, optimistically, targeted to reduce poverty by half in 2005 following the implementation of the 2001-2005 Five-year Socio-economic Plan. What the poor need to survive is more investment in upland agriculture such as agricultural diversification, livestock, and agroforestry or non-timber forest products. CGPRT crops, generally secondary crops after rice, represent an important farming resource, particularly for the poor upland areas in the north, where other agricultural resources and employment opportunities are still limited. Agricultural diversification through CGPRT crops is one option which can support poverty alleviation. Agricultural diversification can help poor farmers achieve food self-sufficiency, secure their sources of income and finally help them to escape from poverty. It is necessary to enhance the development of infrastructure, human resource and market facilities.

8. Demand for CGPRT Crops as Staple Foods and Their Industrial Importance in the Country

8.1 Extent of diversified ways of consuming CGPRT crops as staple foods and their demand

CGPRT crops like maize, Job's tear, cassava, sweet potato, soybean and other secondary crops like sesame are very important crops, especially as maize is the second crop after rice. Maize is primarily consumed as poultry and animal feed, very little is consumed as food. Consumption as food is restricted to the northern part of the country. Total maize production in the central and southern regions is sold to animal and poultry feed factories. Maize is also consumed as green ears, baby corn and sweetcorn. Quality Protein Maize (QPM), which is much better as food and feed is not grown due to a lack of cultivars and production technology.

Job's tear production is similar to maize production and it is possible to cultivate in both lowland and upland areas. Job's tear was popular in 1999 in Luang Prabang, when farmers produced the largest amount of Job's tears. A company has conducted a study on Job's tears for the last 13 years. Initially, Job's tears were grown in Sibsongpanna, Yunnan in China (black variety) and also some small quantities were produced in Thailand. The company introduced a Chinese black variety into Lao PDR in 1998, this however was not successful as the plant grew very tall, lodged and flowered, and set seed very late. Local traditional varieties, however, did do well and were commercially grown from 1998 onwards. Job's tears are primarily consumed as sweet food but Job's tear milk is very popular in Thailand. In North America it is used as an ingredient in specialty foods for diabetics. It is sent to Taiwan to be consumed as food and distilled into beer.

Cassava can be planted in upland and lowland areas. Cassava cultivation on a large scale is not so popular and the growers are generally smallholders. The main techniques used are indigenous techniques. Cassava production areas are larger in the North than in other parts of the country 66 per cent, 7 per cent in the Centre and 26 per cent for the South. The people consume cassava as food, cook it, use it for animal feed and send to animal feed factories. When there are food shortages, especially for upland people, cassava is also used as a common food (steaming).

Soybean has a diversity of uses. One popular product of soybean production is soymilk. In spite of its diversified ways of consumption, only in a few areas is soybean planted, as mentioned in section 4.1. The crop is generally sold to local markets.

8.2 Scope to expand CGPRT crop demand as food

This section introduces a summary of the interview with Mr. Daovane Sihalath, a farmer in Ban Chum, Tulakhon district, Vientiane province.

8.2.1 Production

Tulakhom district is around 60 km from Vientiane, with the district town situated on the left bank of the Ngum River. Upstream is Nam Ngum Dam and reservoir. The road from Vientiane is good (it was upgraded in 1975) and the journey takes a little more than one hour by private car, perhaps twice as long by bus. There is plenty of public transport and links with the capital are good. The district has a total of 74 villages. Ban Chum village was selected for the

case study because the main agricultural activity in this village is maize production. All the villages have about 330 households, each household in the village has land for maize production (about 300 hectares of land for maize production in the village).

8.2.2 Consumption

Maize is primarily consumed as food, and for poultry and animal feed. For this village, consumption as food is restricted to mainly strong and sweet (maize name) maize planting. The majority of the products are sent to animal feed factories in Tha Ngone (about 45 km from Ban Chum village). Maize in general in this area is consumed as green ears, baby corn and sweetcorn. Quality protein maize which is much better as food is not grown due to a lack of cultivars and production technology.

Regarding the discussion with Mr. Daovane and some producers in the village, he said cassava is grown in the village due to the demand from a factory in Tha Ngone, which needs more raw material to support the factory. For this reason, in the near future, the village will have to find ways of how to extend the cultivated area of maize and may well extend to nearby villages which are suitable for planting maize. One thing which needs more consideration is the quality of seeds and chemical fertilizer application for more quality and quantity of the product.

8.2.3 Market/trade

- The problem of maize production is that there are not many markets, therefore the entire production is only sent to the animal feed factory in Tha Ngone and for consumption in a few households.
- The rainy season prices of maize are cheap, because more petrol is needed to dry maize, but in the dry season the price is more expensive and easier to dry, according to Mr. Daovong.
- Quality and quantity also can affect the price of maize.
- In the village only a few households use fertilizer and they produce more. The majority of households do not use fertilizer.
- Transporting the produce to the factory takes more than one hour.
- Two varieties of maize are used in this village: from Viet Nam and Thailand (17,000 kip/kg and 25,000 kip/kg, price of maize grain).
- The price of maize if the factory comes to collect from the village is about 850,000 to 900,000 kip/ton (farm gate price). If it is sent by the villagers the price may be about 1,000,000 to 1,200,000 kip/ton (factory gate price). The villagers can produce about 1,000 tons per year, but the demand from the factory is 10,000 tons per year. The village mainly produces strong maize to support the animal feed factory.
- In the future they intend to extend maize production to nearby villages such as Than Pio, Hatsouan and Ban Cheang.

8.2.4 Constraints to enhance maize production regarding observations and discussions with villagers

- Most farmers use local seeds and a few depend on seeds from abroad;
- Environmental conditions for maize production should be studied by research activities;
- Majority of farmers continue to use traditional varieties;
- Poor water management;
- Drought, diseases and insect pest infestations;
- Post-harvest losses at time of harvest;
- Lack of adequate farming technologies and mechanizations for maize farming; and
- Soil erosion leading to losses of soil nutrients and moisture.

8.3 Extent of scope to expand industrial uses and demand for CGPRT crops

According to the observation and discussion with some farmers in the study area about the situation of the animal feed factory (state enterprise), the product from this factory is only for domestic consumption. The products are generally provided to the small-scale and large-scale farm enterprises and individual farmers throughout the country, mainly for swine, poultry and small animals. The amount of produce cannot satisfy consumption demand because of the limited amount of maize provision to the factory. The amount of maize supplied to the factory comes from many provinces in the North but it is still not enough. This is one reason animal feed is imported from Thailand (PC animal feed). On the other hand, the produce from the factory is consumed by animal raising, because it makes the livestock grow more quickly, and this factor can lead demand of raw material from maize farmer according to the interview to Mr. Daovane and some farmers in the study area.

8.4 Concluding summary

The statistical data about consumption trends of CGPRT crops is insufficient. Only statistical data of production, harvested area and yield is available from the National Statistical Centre and this makes it difficult to gauge an accurate idea about the future demand of CGPRT crops.

As we can see from the case study for maize and the data in Chapter 4, it is suggested that the demand for CGPRT crops will continue to increase as in previous years. Generally, among upland farmers, CGPRT crops are planted in order to substitute rice shifting cultivation practices and for cash income to buy rice when facing rice shortages. Therefore, the consumption of CGPRT crops is expected to expand as the secondary food after rice. To support poverty alleviation is upland areas it is important to increase food production, especially by increasing CGPRT crop production. Above all, maize is most promising since demand is rapidly increasing to support the animal feed industry.

9. Potential Scope for Development of Diversified Agriculture in Lao People's Democratic Republic

9.1 Extent of driving forces for agricultural diversification

9.1.1 Economic factors

The government's macro-economic policies aim at promoting further economic growth. By building up basic infrastructure the government will continue to support the vital role of agriculture in the national economy, paying at the same time due attention to the diversification of the country's production. The agricultural sector accounts for more than half of national GDP and would therefore make a significant contribution to the achievement of this GDP target. The government plays a facilitating role in agricultural development while producers (farmers), the agribusiness sector and consumers make the investment, production and consumption decisions. In addition, the government is expected to regulate the market in situations where it is in the interest of the public, for example, inspection or regulation of the manufacture and sale of food products or monopolistic trading practices (MAF and JICA, 2001 b).

Expansion of external economic co-operation is of vital interest for the country, therefore, Lao PDR has increased co-operation with SE Asian and other friendly countries, as well as international organizations in order to tap its natural advantages and development potentials.

Likewise, Lao PDR has widened its participation in regional and sub-regional association. The most important achievement in this field has been full membership of ASEAN and ASEAN Free Trade Area (AFTA) as of July 1997. As a member of ASEAN, the country will further integrate itself into the regional economy and will benefit from the larger market.

9.1.2 Agro-ecological factors

Forests of the country are believed to harbour at least 10,000 species of vascular plants and animals. Agrobiodiversity is no less exceptional. Lao PDR lies within the primary centre of origin and domestication of Asian rice (*Oryza sativa* L.). Almost 90 per cent of genetic stock of rice in the International Rice Research Institute is drawn from Lao PDR and India. Lao PDR and India have made almost an equal number of contributions, even though India is a much larger country compared to Lao PDR (NAFRI and IRRI, 2000).

Ethnic minorities play a major role in agrobiodiversity conservation. There exist about 3,160 distinct names of varieties of rice in the minority languages. Farmers distinguish varieties based on endosperm type (glutinous, non-glutinous), ecosystem (upland, lowland, gardens), crop duration (early, medium, late maturity), morphological features (colour of spike, shape of spikelet, plant height, the presence/absence of hairs on leaves and glumes, aroma and tolerance to drought/flood (NAFRI and IRRI, 2000). As many as 18 lowland varieties may be planted in a single village in order to reduce risks of crop failure, distribute labour demand evenly and meet specific grain quality/consumption standards. By far the greatest diversity, however, is found in upland rice. We could sample 13 phenotypes in one upland field.

Ethnic groups differ in respect of cultivation methods and seed selection practices. The Khamu ethnic group selects all phenotypes for seed purpose. Varieties grown by the Hmong ethnic group are very uniform in external appearance.

CGPRT crop products are mainly associated with poverty, but they have important nutritional significance, especially maize. However, this crop still has no systematic research programme regarding agro-ecological factors and conserving agro biodiversity. Systematic testing procedures do not exist in-country to test the material in different ecologies, such as, highland, midland and lowland tropical areas.

The northern mountainous region of Lao PDR has a moist to dry sub-tropical climate with annual rainfall of 1,500-2,000 mm. Slopes are steep and elevation higher than 1,000 metres above sea level. The area experiences a cooler dry season and higher range of variation in temperature variation during the year than the rest of the country. Soils tend to be acidic and heavily leached with low water retention capacity, and hence not suitable for any intensive agriculture. The central and southern mountainous region is spread over 500-1,000 metre elevation and is generally characterized by moderate slopes. It has a tropical monsoon climate with annual rainfall of 2,500-3,500 mm, except for the rain shadow area of the Boloven Plateau. Soils are similar to those in the north with the exception of the Boloven Plateau which has deep, well structured and less acidic soils with good water retention capacity. The floodplain region of the Mekong River supports more than 50 per cent of the population, experiences a moist, tropical climate with annual rainfall of 1,500-2,000 mm and is characterized by recent alluvial deposits which are acidic, shallow and low in organic matter. The younger alluvial soils are more fertile than the older terrace soils, but are flooded frequently (STEA, 2000).

Considering the climatic situation, full season maize with high productivity can be grown during the winter (dry) season successfully. This season also offers good opportunity to produce seed without many problems, such as, diseases and insect pest, as damage from insect pests and diseases are not reported in this season. Since the dry season also helps to produce good quality seeds without any post-harvest hazards, such as contamination of the grain due to fungus or insect infestation. With a high level of germination percentage, dry season maize offers very good potential to produce seeds of high quality in the central and southern plains regions. The seeds produced during the dry season can very well be sold during the wet season without going though the process of long-term storage.

9.1.3 Socio-cultural factors

In Lao PDR, a country with more than 47 official ethnic groups, the importance of culture is more divestible of indigenous knowledge regarding agricultural production. The culture domains represented by the main ethno linguistic distinctions are broadly separable into highland and lowland, with the majority of Lao Lum groups inhabiting the lowlands and cultivating paddy rice, while the Lao Thueng and Lao Soung live in the mountains and practice shifting cultivation. Mountain ecosystems are fragile and livelihoods are heavily dependant on soil regeneration made possible by long fallow periods and nutrient recycling in swidden cultivation cycles.

The people from Lao PDR have potential themselves for agricultural production; they have been being practicing for generations. The constraint here is declining environmental quality due to population pressure, and the people are still limited in appropriate techniques to solve this issue.

Based on this study, the major constraints and development potential of agricultural diversification can be summarized as follows:

Major constraints

- Insufficient quality control and a lack of grading and classification systems for commercial crop production;
- Unavailability of improved varieties and dependence for seed on Viet Nam (maize) /hybrid seeds and planting material;

- Lack of knowledge of improved technology including crop maintenance, insect and pest control, irrigation water management;
- Crop cultivation under slash-and-burn systems (except lowland rice);
- Soil erosion leading to losses of soil nutrients and moisture (upland);
- Insufficient development of adaptive research for integrated agriculture with horticulture, livestock and fisheries;
- Lack of access to credit and new investment;
- Farmers' reluctance to use fertilizer and agro-chemicals due to high costs compared to crop income;
- Limited market channels and market information;
- Decreasing price incentives for commercial crop cultivation due to frequent oversupply in the domestic market and low international prices;
- Limited or insufficient post-harvest and agro-processing facilities for commercial crops;
- Limited availability of manpower or agricultural machinery for intensive agriculture; and
- Limited information on suitable crops to be introduced based on area-specific natural conditions.

Development potential

- Maize having highest productivity and wider adaptability among cereals offers ample opportunities to increase production in Lao PDR;
- Favourable natural conditions (soil and climate) to produce various commercial crops under rainfed conditions;
- Increasing private sector investment in agro-processing and marketing;
- Potential to further expand cultivated area under irrigation; and
- Increasing number of farmers adopting a market oriented outlook thanks to gradual infiltration of market information to rural areas.

9.2 Concluding summary

The government's macroeconomic policies aim to promote further economic growth by building basic infrastructure and continuing to support the role of agriculture in the national economy. Expansion of external economic co-operation with ASEAN countries as well as international organizations has promoted the advantages of natural resources in sustainable ways. Lao PDR has full membership of ASEAN, and as a member of ASEAN, the country will further integrate itself into the regional economy and will benefit from the larger market. Looking into the ecosystems, Lao PDR is a tropical forest with two seasons; dry and rainy. There is different geography among regions, the country is predominantly mountainous with 80 per cent of its land surface consisting of hills and mountains rising 100 to 3,000 metres above the plains of the Mekong River. In social culture, Lao PDR comprises of more than 47 official ethnic groups, each have their own indigenous knowledge on agricultural production practices, which they have been practicing for generations. The constraints they face here are declining environment quality due to population pressure, and less opportunity to access appropriate technologies to improve agriculture production.

10. Sustainable Diversified Agriculture for Poverty Alleviation in the Region: A Search for Effective Policies

In Lao PDR, the major farming systems are identified as: i) lowland rainfed; ii) lowland irrigated; iii) upland and mountain; and iv) plateau. The lowland and irrigated farming systems are seen in the five plant areas, i.e. the Vientiane plains (58,000 ha), the Pecan plains (12,000 ha), the Xeban Fai plains (49,000 ha), the Xebang Hegh plains (83,800 ha) and Xedong plains (45,500 ha). In the plains, all cultivated land is used for lowland rice production in the wet season and for livestock grazing in the dry season. On the other hand, for irrigated farming, a two crop system is developed, and many farmers grow irrigated rice in the wet season and irrigated rice or other crops in the dry season.

The upland and mountain farming systems are dominated by single, wet season crop production in hilly or mountainous areas. The most important crop is upland rice prevailing in shifting cultivation areas. Other important annual crops include maize, sweet potato, cassava, ginger, groundnut, soybean, cotton and sugarcane. In this farming system, small irrigation areas are developed in valley bottoms for the production of paddy. Perennial crops are also grown in the fields, usually in scattered formations.

In the plateau farming system, commercial crops are increasingly produced, while the shifting cultivation area has been reduced. The major commercial crops including coffee, tea, cardamom, fruit and vegetables are cultivated under rainfed conditions. The farming system is being developed in various topographic and climatic conditions. The soil fertility is also favourable compared to other areas.

On the flat land, the approach to agricultural diversification is to improve and diversify farming systems with increased and intensified cash crops, livestock and fishery production. While on the sloping lands, farming system diversification and agro-forestry should be developed through adaptive research, trials and demonstrations on farmers' fields. The most important step for poverty reduction and commercial agriculture is to promote crop diversification on both flat and sloping lands.

Most farm households cultivate crops in the traditional way, without using modern farming practices. Local crop varieties are widely cultivated and the supply of improved variety seeds is very limited, which results in a low unit yield. The improved varieties are mostly handled by the private sector.

The recent high growth rate of production reveals that maize, peanut, soybean and some root crops are strong candidates for diversification. In addition, FAO (FAO, 1999) indicates that sesame, soybean and sunflower have comparative advantage. It is noted that some field crops are not only used as food crops but also as supplemental feed for livestock because the number of livestock is increasing considerably.

11. Conclusions and Policy Recommendations

The policy recommendations for agricultural diversification and poverty alleviation based on the findings of this study and government strategy for agricultural crop development are as follows:

i) Promoting commercial crop production based on market demand and comparative advantage.

Basic government strategy on agricultural development is to move rapidly towards diversification by increasing commercial crop production and alleviating poverty. Emphasis is being placed on vigorous research and promotion programmes to encourage market driven product development where there is clear demonstration of comparative advantage. The public sector is expected to work closely with the private sector in this area. The amount of maize supplied to feed mills by local farmers is not enough. Considering the expansion of meat consumption in line with economic development in the region, maize is one of the most promising crops for future production within secondary crops.

ii) Increasing rice production through yield improvement.

There would be little need for development of new paddy fields (including irrigated fields), particularly for the next ten years if yield could be improved. Area expansion in upland rice is especially difficult since the government has a policy to reduce upland rice production which leads to environmental deterioration as mentioned in section 4.1.1. The increase of paddy/rice consumption, which is linked to population growth, could be met through increased unit yield. Measures to be taken to increase unit yield include: i) identification and distribution of improved varieties of rice seed suitable for area-specific conditions; ii) strengthening extension services to improve farmers' cultivation and water management technology; and iii) supply of more credit for purchasing farm inputs.

iii) Crop diversification in disadvantaged areas.

The areas which are not suitable and not used for paddy should be utilized as possible areas for diversification. Therefore, the target area of crop diversification is around 80,000 hectares. (MAF and JICA, 2001c). The potential crops are fruits, vegetables and industrial crops.

iv) Technological development.

A lot of previous research work on horticulture and industrial crops is very limited with the exception of that for coffee. Therefore, research outputs from the trials of new crops/varieties and the development of applicable technology on crop diversification are in rather short supply. To realize crop diversification, the development of adaptive technology is essential and urgently needed and the National Agriculture and Forestry Research Institute (NAFRI) should carry out various research programmes. Potential crops for diversification include: maize, root crops, mungbean, soybean, peanut, tobacco, cotton, vegetable, coffee and tea, which the exception of rice. The proposed programmes include the Coffee Cultivation Technology Research Programme, and the Upland Crop Cultivation Technology Research Programme which includes maize, mungbean, soybean and peanut.

v) Extension and demonstration of new technologies.

In parallel with the technological development to be carried out by NAFRI, manageable and small demonstration plots using trial species and/or adaptive technology on crop diversification should be established under the full management or guidance of government extension staff. Of course, trial species and/or adaptive technological development by NAFRI or by other neighbouring countries should be applied. The farmers could then see first hand the technical possibilities and financial attractiveness of diversification. As a result, farmers will gradually lose their risk aversion through the observation of demonstration plots. Accordingly, some farmers will start crop diversification practices on the basis of visual knowledge from demonstration plots. To enhance their technical level, it is recommended that these demonstration plots could be used for training local extension staff and farmers on the basis of "Teach by showing" and "Learning by doing".

vi) Establishment of an appropriate seed supply system.

It is also reported that there are shortages in improved seeds and planting materials for promoting crop diversification (see section 8.2). This is caused by the absence of private seed companies and the high price of imported seeds. To resolve this seed constraint, the government may need to take responsibility for developing and supplying foundation seeds for some crops. Private seed farms should implement multiplication of these foundation seeds to minimize government interference in the market economy. In this connection the Department of Agriculture (DOA) and NAFRI will implement a project on Foundation Seed Technological Development.

vii) Cost reduction through mechanization.

Crop diversification and combined agriculture with livestock and fishery needs more manpower to be properly maintained. In future, more large-scale integrated agriculture will be introduced to enhance and stabilize farm income. In this situation, mechanized farming will be required in order to decrease production costs and increase work efficiency.

viii) Research activities for income improvement in shifting cultivation areas.

Stabilization of shifting cultivation cannot be achieved by only taking measures to increase unit yield of upland paddy. Other important measures include research and extension activities to convert shifting cultivation to permanent farmland. From this point of view, research work should be strengthened so as to identify cropping patterns and cultivation technologies that are applicable to the major shifting cultivation regions. The research work should be comprehensive, covering a wide range of products in addition to upland rice, namely other annual crops, CGPRT crops, tree crops (including fruit trees) and several kinds of livestock. Priority should be given to increasing farm income.

ix) Countermeasures for deforestation.

Deforestation is a serious environmental problem. In the context of agricultural diversification, deforestation increases soil erosion and weakens water catchment areas both causing serious problems to agricultural diversification. We introduced a view from the National Agriculture and Forestry Research Institute (NAFRI) on measures to prevent deforestation (NAFRI, 2001).

Forest allocation, especially for production forests, has been based on the needs of wood industries, markets and the government revenue estimate. A lack of appropriate principles of sustainable forest management and a code of practices have been adopted, except in a few production forest areas like in JFM and village forestry

areas where a certain amount of effort has been made towards sustainable management. Experienced forest managers are generally lacking at all levels in every aspect ranging from management planning, approval of plans, management monitoring and post-harvest management. Harvesting is thus exceeding the estimated reproductive capacity of the forests. Log production has been increasing and concentration has been quite high in certain parts of the country. However, about 60 per cent of the annual quota has come from the areas where infrastructure development has taken place. Harvesting operations have often been sub-contracted out to saw millers and traders who are only interested in short-term profits and not committed to the long-term sustainability of the forest resources of the country. These practices have reduced the willingness of investors to invest long-term in forestry and will eventually lead to further degradation of the existing natural forests if continued. Policy review is needed and principles and practices of sustainable forest management should be introduced.

The control system has been generally lax. Existing regulatory frameworks are fragmented and inadequate and cannot ensure strict enforcement. Devolution of authority has been put in place by the government. However, under the present situation where there still exists a big gap in capacity and manpower, very little progress has been observed, even with the reallocation of forestry staff in order to reinforce manpower at the district level. Harmonization of regulations at the implementation levels (lower levels) is needed to improve the situation.

x) Other strategies for agricultural diversification

- Upland rice, maize and Job's tear cultivation under the slash-and-burn system must be decreased and stopped. The additional grain production has to come from irrigated dry season crops;
- Replacement of low potential/pest susceptible older varieties with newer, high yielding varieties in medium and low productivity areas;
- Encourage cultivation of hybrid varieties in high productivity areas during the wet and dry seasons;
- Better crop management with popularization of line sowing in crop areas through suitable seeding devices to establish the desired level of plant population, and adoption of other management technologies;
- Promoting integrated pest management for effective and timely control of pests and disease by emphasizing the need-based application of pesticides, especially during the wet season;
- Ensuring timely and adequate availability of inputs, namely, seeds, fertilizers, irrigation water, and credit to the farmers;
- More emphasis on the development of location-specific crop production technologies, especially through the adoption of non-monetary inputs like timely sowing, method of sowing, maintaining optimum plant population, water management, efficient use of fertilizers, and need-based plant protection measures; and
- Increase the area under irrigation in the dry season in order to realize higher yields, because of less disease and pest problems for maize.

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