

# Rice-based farming systems in Lao PDR—opportunities and challenges for food security

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## Abstract

This paper presents results from research that focused on better understanding rice-based farming systems in Lao People's Democratic Republic (PDR) with the aim of developing appropriate and effective agricultural policies. The study took place in Savannakhet and Champassak provinces in southern Laos in selected villages in lowland rainfed and irrigated areas. Farmers, rice traders, millers and retailers were interviewed, together with authorities from provincial and district agriculture, industry and commerce, to understand production and trade systems in the study area. In total, more than 297 people were interviewed in this study. We found that rice growers have potential to produce rice for the market, but nevertheless face problems associated with seed quality, limited access to and inefficient use of fertiliser, high electricity costs for water pumping to the paddy field, and limited access to credit. These constraints lead to low rice yields. Furthermore, the low quality of rice combined with sudden changes in government rice-related policy adversely affects the incomes of farmers and millers, and acts as a disincentive to production and the improvement of postharvest facilities.

## Introduction

This paper draws from Australian Centre for International Agricultural Research (ACIAR) Project ASEM/2009/023 (*Developing agricultural policies for rice-based farming systems in Lao PDR and Cambodia*), and its earlier small research activity ACIAR Project ASEM/2009/039 (*Agricultural policies affecting rice-based farming systems in Bangladesh, Cambodia and Lao PDR*). The aim of the larger-scale ASEM/2009/023 project was to contribute to improved agricultural policies for rice-based farming systems in Laos and Cambodia, while taking into account trends in Thailand and Vietnam. The research question focused on identifying how field research on farming and marketing systems can be used to inform more effective agricultural policy development. Decisions about household activities at the farm level depend on the inputs available to

realise specific outputs, whether for domestic consumption or for the market. Policies that influence access to inputs will have flow-on effects for farm outputs. By studying farm households' access to their main inputs, we were able to better understand farmer decision-making processes and to develop policies that better respond to the needs of farm households in order to realise their desired outputs.

## Overview of agriculture and farming systems in Laos

Laos is located in mainland South-East Asia, in the heart of the Indochina Peninsula. It has a surface area of 236,800 square kilometres (km<sup>2</sup>) and a population of 6.9 million, which equates to a relatively low density of 29 people/km<sup>2</sup>. Two-thirds of its surface area is mountainous and the remaining third is plains. These geographical and demographic characteristics present both opportunities and challenges for economic development in Laos. Much of Laos' economy relies on agriculture and natural resources extraction.

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Economic growth rates have been among the highest in South-East Asia, at an annual rate of 7.9% from 2005 to 2010 (Alounmai Journal 2011), as a consequence of regional and international economic integration since the late 1980s. Despite advancements in both economic and human development, Laos remains a ‘least development country’ (LDC)—a status classification that the Lao Government aims to surpass by 2020. According to the Lao Expenditure and Consumption Survey, progress has been made on poverty reduction, with the percentage of poor households reduced from 27.7% in 2002–03 to 20.4% in 2009–10.

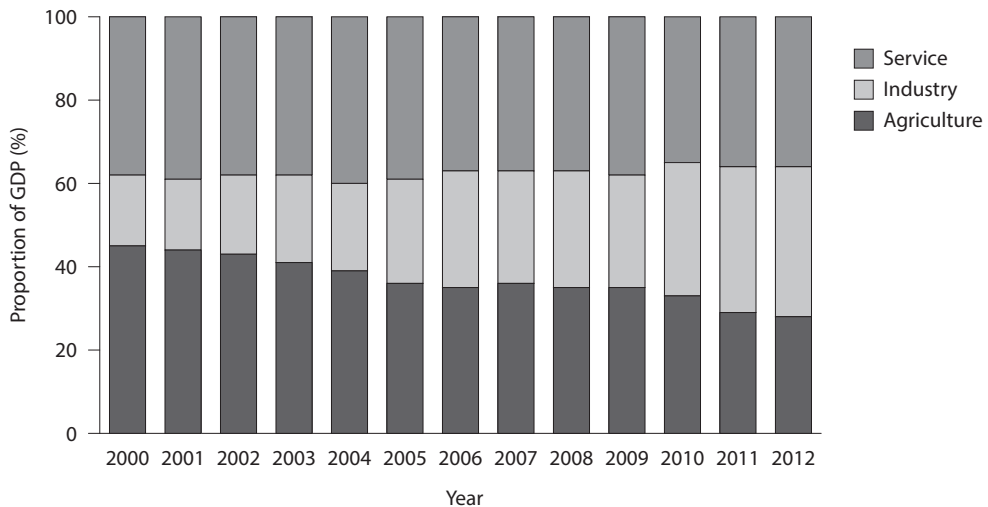
Most of Laos’ poor live in small farming households. Therefore, agricultural development and improving agricultural income are the focus of food security and poverty eradication. Agricultural production has increased by only 3.4% per annum on average since 2000–01, despite the fact that the agricultural sector employs 72% of the active population. Although other sectors have grown more rapidly, the agricultural sector’s share of gross domestic product (GDP) declined to around 28% in 2011–12 (World Bank 2014) (Figure 1).

### Farming systems

Farming systems in Laos are divided into five main types—lowland rainfed farming, lowland irrigated

farming, upland farming, plateau farming and highland farming.

- *Lowland rainfed farming* is characterised by production of lowland rainfed rice during the wet season (WS). The land is used in the dry season (DS) for grazing of large animals (e.g. cattle, buffalo) or growing post-rice crops (e.g. sweetcorn, long bean, cucumber, tobacco). Fruit trees (e.g. banana, tamarind, coconut) and sugarcane are grown in the garden around the house or in the upper lowland for home consumption and the surplus for market sale. In many lowland rainfed farms, animals are variously considered as a source of income, for consumption, for soil fertility improvement and, in increasingly fewer cases, to support land preparation.
- *Lowland irrigated farming* is dominated by supplemental irrigation for rice during the WS and cultivation of a small area of rice and other cash crops during the DS. This is a more specialised rice-farming system, which uses more inputs (e.g. improved seed, fertiliser—for DS rice primarily) and is less reliant on livestock, due to limited access to grazing land and labour. Fruit trees can be seen in the garden around the house or in the upper lowland with limited surface area. Many farm households produce WS rice for home consumption while DS rice is produced for the market.



**Figure 1.** Proportion of national gross domestic product (GDP) by major sector from 2000 to 2012. Source: World Bank (2014)

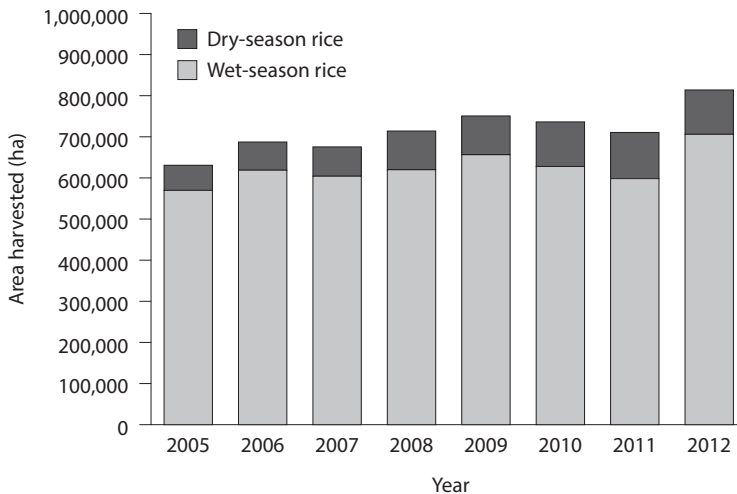
- *Upland farming* includes upland rice, cash crops (e.g. maize, cassava), leguminous and agro-industry tree plantations (e.g. rubber, jatropha, banana, agroforestry trees). Upland rice cultivation is based on a short fallow period of 2–7 years. Rice is mainly produced for home consumption, while other crops are for cash income. Household income is also generated from other sources such as livestock and non-timber forest product collection. The young fallow land from previous upland rice cultivation plots is used as grazing land for cattle. More recently, upland rice rotation cropping systems have progressively transformed to permanent cropping systems like maize or rubber production in response to market opportunities. This transition reduces scope for livestock grazing.
- *Plateau farming* is practised mainly in the Boloven plateau. It is dominated by coffee cultivation and, to a lesser degree, tea, cardamom and some vegetables. Rice growing is used to clear fallow land for cultivation of cash crops and, in the case of some households, for rice security. Livestock serves as savings capital for households—the animals are used to graze the young fallow land or the coffee plantation to allow soil fertility improvement. Cultivation of coffee, tea and vegetables provides cash income to buy rice from the lowlands.
- *Highland farming* is characterised by sloping land and the practice of swidden agriculture associated with livestock. Subsistence farming, with some

surplus for the market dominates, in this landscape; however, crops like tea and agroforestry (e.g. cardamom) have been produced for the market over more than two decades and this form of production continues to expand. Household income is mainly generated through the sale of livestock and non-timber forest product collection.

Agriculture in Laos is undergoing a process of transformation from subsistence farming to market-oriented farming. The agro-processing industry is in the early stages of development. Farm produce is either sold unprocessed in the domestic market or sold to regional markets, where value is added.

### Overview of rice sector in Laos

Rice, as Laos’ main staple food, is a core component of each of its five different farming systems. According to Ministry of Agriculture and Forestry (MAF) statistics in 2012, rice is grown on more than 49% of cultivated land. From 1986 to 2011, the total area of rice harvested increased by 47.7% from 619,000 to 914,540 hectares (ha). From 2005 to 2012, the area of rice harvested from lowland rainfed and lowland irrigated land increased by 29% from 630,780 ha to 813,995 ha (Figure 2). Over the same period, production increased by 39% from 2.35 million tonnes (Mt) to 3.27 Mt of paddy rice per year (Figure 3).



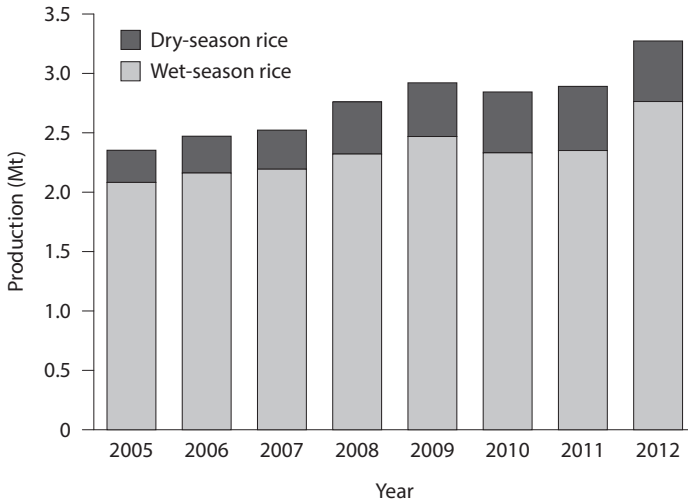
**Figure 2.** Lowland rainfed and irrigated rice cultivated area between 2005 and 2012. Source: MAF (2012)

According to MAF statistics in 2012, more than 51% of rice paddy was produced in central Laos (mainly in Savannakhet and Vientiane provinces and Vientiane Capital), about 27% in the southern provinces (such as Champassak and Saravanh) and 21% in the northern provinces (mainly in Sayaboury).

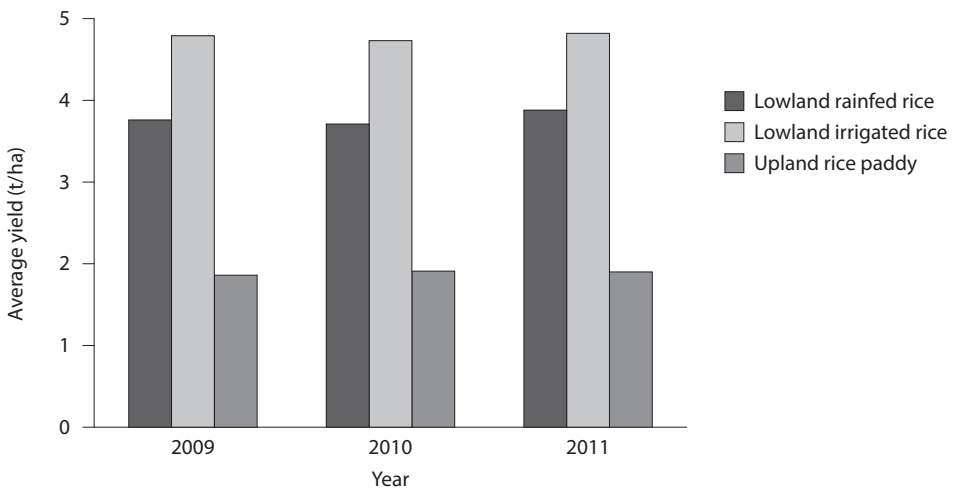
Statistics show a slight increase in the yield of lowland rainfed and irrigated rice since 2009, and stable

yield in the case of upland rice (Figure 4). In 2011, the average rice yield in the northern provinces was 4.40 tonnes (t)/ha. The difference between lowland rainfed and lowland irrigated rice yield was about 1 t/ha (Figure 4).

We now examine the agricultural strategies and policies that have shaped rice production as it exists in Laos today.



**Figure 3.** Lowland rainfed and irrigated rice production between 2005 and 2012. Source: MAF (2012)



**Figure 4.** Average rice yield from 2009 to 2011. Source: MAF (2012)

## Lao Government rice policy

Historically, Laos' rice production has been insufficient to meet demands from domestic consumers, especially from urban communities, and has imported rice from neighbouring countries. Shortly after the establishment of the Lao People's Democratic Republic (PDR), the country faced significant rice insecurity due to severe drought in 1977 and flooding in subsequent years (Sacklokham 2003; Paavo and Santos 2012). Border trade with Thailand was closed from 1976 to 1980 in order to ensure in-country rice supplies, and the Lao Government encouraged farmers to establish agricultural cooperatives, especially in the case of rice production. These cooperatives collapsed only a few years after their establishment due to organisational production difficulties and the inequitable distribution of benefits to their members. However, Laos' total area of land under rice production expanded under the system of cooperatives (Sacklokham 2003).

By the late 1980s, the Lao Government was accelerating the expansion of rice cultivation and production by investing in lowland irrigation development, in research on new rice varieties, and in facilitating the importation of agricultural inputs and equipment, such as chemical fertilisers and tractors. This policy doubled rice production from 1.7 Mt in 1991 to 3.3 Mt in 2011 even though many irrigation schemes did not function well technically. Laos became self-sufficient in rice at the national level in 2000—based on 6.5 million inhabitants consuming 216 kg/year/person of milled rice (or almost 450 kg of paddy rice).

The Lao Government has set a target of 4 Mt/year for paddy rice production in its 7th socioeconomic development plan (2011–15). The objective of the target is to ensure in-country rice security and a surplus for export. The specific policies and measures for reaching this target are not clear, apart from improving irrigation schemes and implementing fertiliser and rice varietal trials. Problems that continue to confront current rice production in Laos are ongoing rice insufficiency from climatic disasters—with annual losses of 10% of harvested rice (Paavo and Santos 2012)—and transportation difficulties in moving rice from surplus to deficit areas.

## Rice production and trade

Rice production inputs (e.g. seed, fertiliser, access to water, credit, technology, information) are highly

important factors in successfully meeting the Lao Government's target for rice self-sufficiency and surplus export. Some lessons for policy on rice production inputs, including opportunities and challenges, are drawn here from studies on rice-farming systems in lowland rainfed and irrigated areas in Savannakhet and Champassak provinces.

### Rice seed

Three key institutions—the Crop Research and Multiplication Centre in Thasano, the Rice Research and Seed Multiplication Centre in Phon Ngam and the Agricultural and Forestry Research and Extension Centre in Nong Deng, Saravanh—produce and distribute rice seed to millers, rural development projects and farmers in the southern Laos. Most seed varieties produced and multiplied by these centres are Thasano (TSN) and Phon Ngam (PNG), and are not yet certified.

Improved rice seed (R2 varieties) flows from the centre to farmer seed production groups to produce R3 seeds. The centre buys back R3 varieties from these rice production groups and sells them to the Provincial Agriculture and Forestry Office (PAFO), the District Agriculture and Forestry Office (DAFO), millers and rural development projects. R3 seeds produced by rice seed farmers can also be distributed to neighbouring farmers or those in nearby villages (Figure 5).

For seed production, the centres still confront a range of constraints, notably lack of rice breeding specialists, inadequate infrastructure, poor pest management systems and insufficient resources for purchasing inputs and buying back R2 and R3 seeds from farmer seed-production groups. Systems for tracing and certifying rice seeds are also lacking (NAFRI and Helvetas 2011). The centres, millers and development projects have sometimes distributed seed of poor quality to farmers.

### Fertiliser

In Savannakhet, our study showed that 94% of farmers applied chemical fertiliser for DS rice production and around 75% in the case of WS rice production. In addition to applying chemical fertiliser, producers in the study area continued to apply animal manure to their rice fields; however, sourcing animal manure is made increasingly difficult with declining livestock numbers.

The different types of chemical fertilisers used by farmers were applied in differing proportions of

nitrogen (N), phosphorus (P) and potassium (K), as well as for a variety of purposes. For example, NPK fertiliser ratios of 16:20:00, 16:08:08, 46:00:00 and 15:15:15 are commonly used for rice production. The average quantity of fertiliser application by farmers was 72 kg/ha in the WS and 128 kg/ha in the DS, representing 18–20% of total rice production costs. The quantity of fertiliser applied by farmers is determined by climatic risk factors coupled with the household’s cash availability. Only 5% of producers applied fertiliser type 15:15:15 NPK, while the majority (68%) applied the more inexpensive type 16:20:00 NPK—the price difference between the two fertiliser types being about 20%. The choice of fertiliser application type by farmers was not due to soil type.

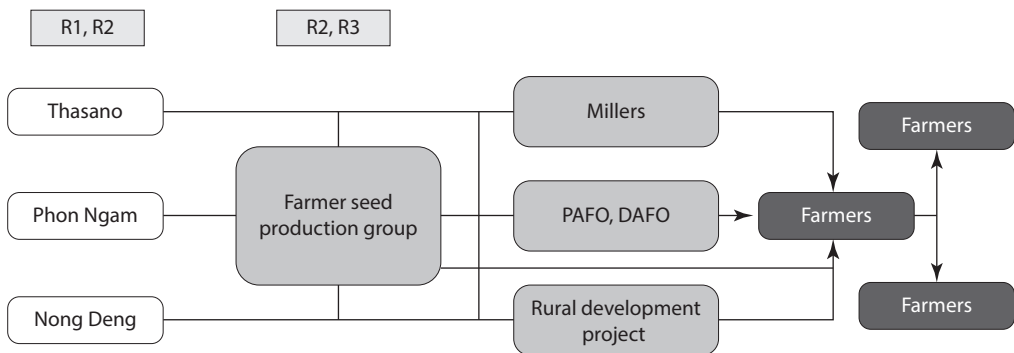
Fertilisers used in Savannakhet and Champassak are mainly sourced from neighbouring countries such as Thailand, Vietnam and Taiwan (Kousonsavath 2012) through border checking points at Savannakhet–Mukdahan (Laos–Thailand), Lao Bao (Laos–Vietnam) and Pakse–Chongmek (Laos–Thailand). The suppliers of fertilisers to farmers include Laos’ rice research and multiplication centres, millers, Lao and Vietnam traders, and rural development projects (Figure 6). In the case of development projects, supplies may be free of charge, whereas payment in cash, in kind or by credit is needed when sourcing fertiliser from traders. Rice producers without residual cash to buy fertiliser directly from the market may seek credit from traders and make progressive repayments, often with high interest rates and long payback periods.

## Irrigation

The development of irrigation systems in Laos started in the late 1980s, initially by the Lao Government and later through the participation of villagers, international development aid and international loans. In 1996–97, the government’s investment alone in irrigation scheme development was around US\$235 million (Department of Irrigation, MAF, cited in Sacklokham 2003). These low-to-moderate cost irrigation schemes were referred to as *son la pa than beb leng lath*; that is, shortcut or urgent irrigation. Water users have experienced problems with the technical design and implementation of the schemes (Somphou et al. 2010), which are based on pumping or gravity feeding water into irrigation canals from rivers, streams, lakes and dams.

Most pumps and spare parts are imported from foreign countries, such that repair or replacement by DAFO and PAFO as the responsible authorities is often protracted. In the Vientiane irrigated plains study area (Sacklokham 2003), there are examples of delays in field irrigation of 3–7 days due to lack of spare parts.

In Savannakhet province, there are two main types of irrigation systems: pumping water from rivers and streams, and gravity feeding from dams and reservoirs. One of the major concerns of rice producers in the DS is the cost of electricity to pump water into the irrigation scheme, and related management costs—gravity-fed irrigation costs were approximately US\$50/ha compared with pumping system costs of US\$65/ha (Sacklokham 2012). These



**Figure 5.** Production and distribution chain for rice seed (R1, R2, R3 = rice selections at different levels of improvement; PAFO = Provincial Agriculture and Forestry Office; DAFO = District Agriculture and Forestry Office). Source: data from 2011–12 field work in Savannakhet, ACIAR Project ASEM/2009/023

costs are very high when compared with current rice yields at 2,800–3,000 kg/ha (i.e. irrigation costs are about 10% of the production yield per ha). Water user groups also experience tensions arising from disputes and inefficiencies, such as the staging of water access and canal cleaning. Some disputes arise because the users of water and the landowners are not always the same people.

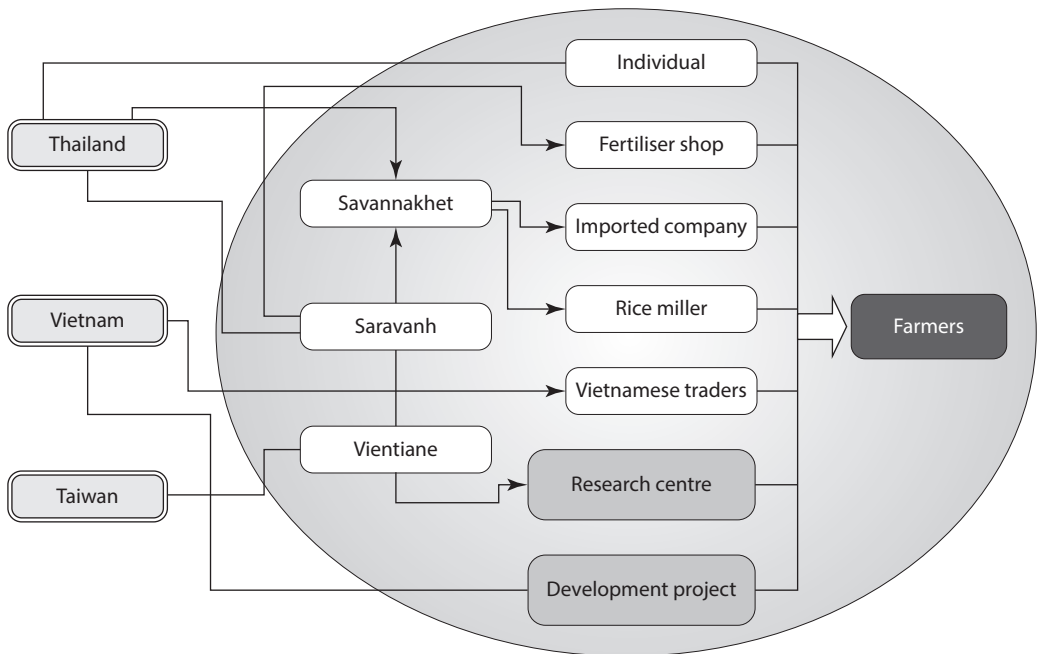
**Credit**

The Agricultural Promotion Bank was established to provide government-subsidised credit to farmers for agricultural production. The Na Yo Bai Bank was subsequently established to extend loans at a subsidised rate of interest to farmers in Laos’ poor districts. Since 2008, the Agricultural Promotion Bank has privatised its services and its clients are no longer exclusively farmers. Before the bank’s reform process, farmers could borrow funds based on the formation of a group and a business plan signed by the village chief. Now, farmers require collateral to access a loan, in line with the usual practice of commercial banks. However, few rice producers have

land title or other assets to advance as collateral, such that farmers are increasingly borrowing money from traders with exorbitant interest rates (exceeding 30% per year).

**Rice yields**

Our study found that the average yield in Outhoumphone and Champhone districts for 2010–12 was 2,200 kg/ha for WS rice, which increased to 3,000 kg/ha in the DS. This average yield was much lower than the national average (3,500 kg/ha for WS rice and 4,500 kg/ha for DS rice) and far behind the national target of 5,000 kg/ha. The total cost of rice production for the aforementioned average yields represents 51% of total rice production in the WS and 66% in the DS. The labour productivity of rice production was about US\$3.00–3.50 per working day. This remuneration was lower than selling labour in the villages for rice transplanting and harvesting at US\$4.50–5.00 per working day, and much lower than selling labour in the town of Savannakhet at US\$6.50–10.00 or in Thailand.



**Figure 6.** Input chain studies in Savannakhet. Source: Kousonsavath (2012)

## Rice markets

A study by the National University of Laos showed well-developed rice marketing chains in the areas of Savannakhet and Champassak over the period 2011–12. Some buyers were found to purchase products at the farm gate, which reduced transport costs for farmers who did not need to take their goods to marketplaces. In addition, an increase in the number of prospective buyers has enabled farmers to link to the new markets, which has increased the quantity of produce sold. The marketing chain comprised collectors, millers, retailers and consumers. Horizontal integration was found between traders, enabling collective marketing approaches to influence trade negotiations. The geographical position of Savannakhet province was seen as particularly advantageous for the expansion of exports to Vietnam.

The main constraints to the rice marketing chain in the study area were (Sacklokham and Manivong 2011; Sacklokham 2012):

- the difficulty in setting up quality standards recognised by international actors—the quality of polished rice in the study area is not up to export standard due to poor processing procedures and facilities (most rice mills in study area are small scale)
- the market is fragmented—the lack of horizontal integration at the production level limits the bargaining power of farmers and causes the market to fragment
- millers have little incentive to invest in their rice mill facilities to improve rice quality—the price of rice is too low and bank interest rates are too high
- sudden changes in rice policies create significant financial losses for millers and rice producers.

## Policy priorities

After studying rice-based farming systems and marketing in the southern provinces of Laos, we propose the following policy priorities for improving the livelihoods and wellbeing of rice-based farmers:

- *Improve the facilities in, and the knowledge base of, Laos' research and multiplication centres.* These centres need capacity to research new rice varieties, establish quality assurance systems for seed supply, and increase seed production. Rice-breeding objectives should be for greater resilience in the face of pests and diseases rather than for maximum yield.

- *Improve access to credit for fertiliser.* Producers need access to formal credit systems, as previously provided by the Agricultural Promotion Bank, rather than the informal system of loans from traders with exposure to very high interest rates.
- *Provide information and training on fertilisers to rice producers.* Farmers need information and advice on the potential benefits of fertiliser use, together with appropriate fertiliser selection and effective application for their particular soil type. Practical training for rice producers is needed on how and when to apply fertiliser.
- *Advise farmers on efficient water use practices.* The price of local rice is not high and irrigation is expensive, so it is imperative that irrigated water is used efficiently. Some research on growing alternative crops on paddy land has been conducted in southern Laos, as a diversification option for improving farmer incomes, but replicated trials and on-farm testing are needed.
- *Improve access to postharvest technology.* To increase the volume of rice sold in the domestic and international markets, there is a need to enhance access to postharvest technology (e.g. drying technology) from farm to miller level to improve rice quality and increase prices.
- *Provide finance to millers to upgrade facilities.* As our study found, the quality of rice in Savannakhet province did not meet recognised international standards and the rice price was therefore low. Providing rice millers with better access to credit in order to improve rice-milling quality may be an effective policy option.
- *Clarify government rice policy.* Policy linkages between food security and rice markets are not clear (what type of rice, and what quality and quantity?) and change from one year to the next: The incentive to invest in rice production and trade will increase in the absence of sudden shifts in rice trade policy that adversely impact on rice producers and millers.

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