Subsistence-oriented rice farming in the rainfed lowlands of central and southern Laos—a policy dilemma

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Abstract

Despite rapid economic, social and political change in the Lao People's Democratic Republic (PDR) in recent decades, the cultivation of glutinous rice for subsistence remains the basis for rural livelihoods in the rainfed lowlands. Even with increased output from the partial adoption of green revolution technologies, lowland rice production in central and southern Laos remains an economically marginal activity, providing limited economic incentive for farmers to intensify production beyond household consumption needs, particularly as the opportunities for employment in non-farm activities increase. In this paper, we demonstrate that attempting to improve rural livelihoods and overcome poverty by increasing rice production per unit area through increased application of modern inputs and the commercialisation of rice production systems is unlikely to be a successful approach. Nevertheless, there is a need to improve the productivity and stability of this important subsistence-oriented activity to enhance the capacity of rural households to engage in both farm and livelihood diversification.

Introduction

Rural communities of Lao PDR have one of the highest per capita consumption rates of rice in the world, with rural households estimated to consume around 200 kg per capita annually (Eliste and Santos 2012). As such, the cultural and economic importance of paddy rice production for households in the lowlands of Laos cannot be overstated. Despite various processes of economic, social and political change over several decades, the cultivation of glutinous rice remains the platform on which rural livelihoods in the rainfed lowlands are based. Although rice production remains an important 'core' activity of the household, lowland farmers continue to face a number of constraints at the farm level, including low soil fertility, droughts and floods, and various pests and diseases (Linquist and Sengxua 2001; Schiller et al. 2001; Fukai and Ouk 2012). However, equally important are factors beyond the farm boundary—such as rising input costs, fluctuating output prices and uncertain trade policy—that continue to limit farmers' incentive to intensify production beyond that required to achieve household self-sufficiency.

Over the past decade, lowland rice farmers have adopted a range of technologies to improve the productivity of their farming systems, including the cultivation of modern varieties, use of inorganic fertiliser and limited mechanisation (Newby et al. 2013). This has enabled individual households, lowland rice-growing regions and Laos as a whole to achieve rice self-sufficiency. However, rice farming in Laos is subject to significant economic drivers of change, with the domestic economy increasingly integrated

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into the regional economy. Despite the achievements of the green revolution technologies in terms of increased yield and output, lowland rice production in many parts of Laos remains an economically marginal activity, providing limited economic incentive for farmers to intensify production beyond household consumption needs. This poses a challenge for the Lao Government, which seeks to keep the price of rice affordable for urban consumers and net buyers of rice in rural areas, while providing incentives for farmers to intensify production to achieve food security objectives. At the same time, there is also a trade-off between the objective of achieving rice self-sufficiency and the objective of promoting economic development and poverty alleviation in the countryside.

In this paper, we aim to explain farmers' livelihood strategies in the rainfed lowlands of central and southern Laos in the context of current resource endowments, product demand, and yield and market risks. We demonstrate that although the rainfed production system remains largely subsistence-oriented, farmers have selectively adopted a range of new technologies and continue to respond to changing incentives. To date, however, this has largely involved the adoption of low-input, more labour-efficient and more stable production systems rather than commercially oriented, high-input, high-yield systems. We argue that this strategy makes good economic sense in the context of a diversifying rural economy and does not necessitate government intervention to promote more intensive, market-oriented rice production systems.

Framework

Socioeconomic evaluation of various technical innovations is an essential part of the farming systems research cycle. Before recommendations are made to farmers and policymakers, results from farm trials need to be subjected to economic analysis. However, it is important that the metrics used in this process actually reflect the goals of farming households. Induced innovation theory predicts that farming systems will respond both to changes in resource endowments and to growth in product demand, with new technologies developed that facilitate the substitution of relatively abundant and low-cost factors for those that are relatively scarce (Hayami and Ruttan 1985). In practice, this depends on the extent to which farmers' goals and circumstances and national government policies align, and the ability of farmers to influence research and development priorities. It is important to reflect on the extent to which farmers' needs are driving research priorities, and research is informing policy, rather than the other way around.

It has long been accepted that smallholders manage a 'portfolio' of farm and non-farm activities that contribute to the household's livelihood. Therefore, evaluating the impacts of a technology on a particular activity needs to be considered at the whole-farm scale. Activities in the livelihood portfolio contribute to various short-term and long-term goals, and so are subject to different evaluation criteria by farmers (with variation even between members of the same household). McConnell and Dillon (1997) identify two main operating extremes of farm households—profit maximisation (or expected profit where risk is also considered) on market-oriented farms, and household sustenance on subsistence-oriented farms. In reality, smallholders rarely operate at these extremes, with the relative importance of each objective varying between farm types.

Furthermore, different activities within a household portfolio may be more closely aligned to the different ends of the spectrum—for example, a subsistence-oriented wet-season rice crop (for sustenance), followed by a commercial non-rice crop (for profit), alongside long-term tree–crop investments elsewhere in the farming system (for the accumulation of assets, perhaps between generations), with livestock having multiple functions (sustenance, short-term income and capital accumulation). It is also clear from various adoption decisions that farmers also place value on having adequate leisure time or the avoidance of drudgery and are willing to trade-off the extra effort required against the potential benefits. These multiple objectives make evaluation difficult as the impact of a technology on one activity cannot be separated from the impact on the whole livelihood portfolio.

Beyond the two objectives of profits and sustenance, most farm households will have a range of other objectives, including the maintenance of their culture, customs and social norms. Farming households are embedded in formal and informal networks of social and economic relations. It is important to understand how current local institutions work and how they govern access to key resources and influence the relative advantage of various technologies.

The voluntary adoption of practices is a good first indicator that the technologies are meeting farmers' needs. Alternative technologies and farming systems

have different characteristics in terms of productivity, profitability, stability, diversity, flexibility of product disposal, time-dispersion of costs and returns, sustainability, and complementarity with the existing farming system (McConnell and Dillon 1997). Pannell et al. (2006) identify two broad characteristics of a technology that influence the adoption decision: its relative advantage over existing practices and the degree of trialability. When recommended technologies are not adopted by farmers, researchers and policymakers are often confused as to whether there is a problem with the extension of the technology (related to its trialability as well as the extension process itself) or whether the technology does not offer a relative advantage to farmers in achieving their objectives.

Methods

This paper is based on the analysis of data collected in several phases of field work in the lowland plains of central (Savannakhet province) and southern (Champassak province) Laos, including key informant interviews with district agricultural staff, village group discussions, household surveys and household case studies. The project fieldwork was conducted along transects reflecting different farm types, from irrigated lowland through rainfed lowland to upland. However, only data from lowland villages are considered here in order to focus the analysis on the main form of rice growing in Laos and the one that is the target of rice-intensification policies—rainfed lowland rice.

Thus, for present purposes, the study region included six villages in Outhoumphone, Phalanxai and Phin districts in Savannakhet province and six villages in Phontong and Soukhouma districts in Champassak province. A household survey was carried out with 30 randomly selected households in each village, making 360 households in all. Information was sought regarding household composition and assets, cropping practices, livestock practices, off-farm and non-farm employment, migration and remittances, forest collection and hunting activities, access to water, access to credit, group membership, information sources and rice security. Case studies were conducted with 13 households in Savannakhet and 18 households in Champassak. Survey and case-study data were supplemented with agronomic trial results in order to construct model enterprise budgets for various input scenarios. These included data from fertiliser response trials conducted by the International Rice Research Institute (IRRI) and the National Agriculture and Forestry Research Institute (NAFRI) over more than a decade (Linquist and Sengxua 2001, 2003; Haefele et al. 2010).

A range of indicators was used in an attempt to capture the criteria for farm-household decision-making with regard to input use. The gross margin (GM) was defined as the gross value of rice production at market prices, or gross income (GI), less variable input costs (VIC)—that is, the cost of all current inputs, whether in cash or kind, but not including household labour. This measured the income earned by the household's resources of land, labour and capital. When divided by the number of days of household labour (GM/day), it gave the best indicator of the relative advantage of the practice to the farmer as it could be readily compared with the prevailing wage rate (W)—an upper limit estimate of the opportunity cost of household labour. Hence, GM/day can be considered a useful proxy for the return to labour. The net income (NI) or, strictly, the margin after labour costs, was defined as the GM less the imputed cost of household labour (LC), valued at the rural wage rate (W). Total variable costs (TVC) were defined as variable input costs plus household labour cost (VIC + LC). Hence, NI equals GI less TVC, and can be considered a proxy for the return to land. Sensitivity, threshold and risk analyses were also conducted to take account of yield and price fluctuations. In 2013, the model budgets were presented to farmer focus groups for validation and updating with input and output prices relevant to the 2012 wet season. Farmers confirmed that measures such as GM/day that took account of their labour were particularly useful.

Intensification, mechanisation and diversification

A range of innovations has been investigated within the Australian Centre for International Agricultural Research (ACIAR) Rice-based Systems Research (RSR) program in Laos. These can be classified into three groups: intensification, mechanisation and diversification.

Intensification—more fertiliser?

'Intensification' is used here in the sense articulated by Boserup (1965) to encompass both greater use of labour and other inputs to increase yields per cropped hectare and increased utilisation of land—notably through irrigated double cropping—to

increase annual production from the available area (i.e. increased cropping intensity). In other words, the term is used to indicate a 'land-saving' rather than a 'labour-saving' path of technical change (Hayami and Ruttan 1985). Pandey (1999) argued that, in situations with low population density and low-income levels, farms tend to be subsistence-oriented, with limited demand for improved nutrient management technologies that increase yields and returns to land. Such technologies will be adopted only if they also help save labour—the relatively scarce resource. He also argued that, in order to stimulate farmers' demand for yield-increasing technologies, policies need to focus on improving the profitability of rice production. In this section, we assess whether intensification strategies would in fact improve the profitability of rainfed lowland rice production in Laos.

The use of both organic and inorganic fertilisers has been promoted in Laos for many years. Linquist and Sengxua (2001) developed broad fertiliser recommendations based on fertility management research throughout the country. Importantly, their recommendations recognised that the rainfed lowlands constitute a risky environment. As such, recommendations were formulated based on relatively low investment and high nutrient efficiency rather than attempting to obtain maximum yields. Although the percentage of households using inorganic fertiliser has increased significantly over the past decade in the study villages, the level of use remains well below these recommended rates. The limited use of fertiliser reflects the high cost of purchasing inputs, the limited access to credit, the high level of production risk and market uncertainty should a rice surplus be produced. Physical access, counterfeit products and limited knowledge about appropriate rates and timing contribute to the problems. The overall average fertiliser application rate (nitrogen–phosphorus–potassium, NPK) among the survey households was 15:5:1.5 kg/ha NPK; well below the conservative recommendation developed by Linquist and Sengxua (2001) of 60:[8/26]:25 kg/ha NPK, with the P rate varying according to soil texture.

To help understand the adoption patterns for fertiliser use, enterprise budgeting scenarios were developed based on household survey data and agronomic field experiments. Four scenarios were developed, from no to high fertiliser use (Table 1). The no-input and low-input scenarios correspond to the range of farmers' practice as found in the surveys, the medium-input scenario corresponds to the current conservative fertiliser recommendation and the high-input scenario corresponds to the level of fertiliser needed to achieve the government's target yield for wet-season rice. In all scenarios, although the gross margin (GM)/ha is positive, the net income (NI)/ha is negative, indicating that the GM/day is below the wage rate of 40,000 kip/day. The highest GM/day is achieved under the medium-input scenario (37,000 kip/day). However, moving up to this level of input use achieves a low marginal rate of return (less than 50%)—that is, the increment in NI as a percentage of the increment in total variable costs (TVC). We note that the high-input scenario performs worse than the medium-input scenario on all criteria.

Though not shown in Table 1, the situation was made worse in 2011 and 2012 when the farm-gate price of paddy rice fell to as low as 1,200 kip/kg. At this price, the GM/day was less than half the market wage rate. On the other hand, during the price spike in 2010, when farm-gate prices reached 3,300 kip/kg in some regions, the returns to labour from intensification strategies looked promising. However, farmers in focus groups did not have high expectations that prices would again reach this level.

Threshold analysis was conducted on the farm-gate price of paddy rice (P_r) to determine at what price: (a) the NI would become positive; (b) the GM/day would be 50,000 kip/day (reflecting the trend to increasing wage rates); (c) there would be a positive marginal rate of return (MRR) from moving to the next scenario; and (d) the MRR would be greater than 50% (considered a minimum acceptable rate of return in this context). The analysis showed that the price of paddy would have to rise to unrealistically high levels (2,500 kip/kg) for the high-input scenario to just break even with current wage rates at 50,000 kip/day, and to 4,000 kip/kg for the rate of return generated by moving from the medium-input to the high-input scenario to be above the benchmark rate of 50% (Table 1).

Risk analysis was conducted to assess the stability of the results to fluctuating paddy prices coupled with uncertain grain yields. The risk modelling shows that, across all scenarios, there was a low probability of generating a GM/day comparable to the market wage rate (Table 1). The low-input scenario provides the best (or least bad) outcome on average, and the highest probability of achieving a positive NI, a GM/day above the market wage (whether 40,000 kip/day or 50,000 kip/day), and a marginal return over the next lowest input level of above 50%.

The budget models show that, given their resource endowments and the high degree of production and market risk they encounter, households in the rainfed lowlands have been rational in adopting a low-input system rather than intensifying rice production to achieve government yield and production targets. The analysis thus highlights the marginal nature of rainfed lowland rice production and hence the difficulties in finding a viable commercialisation pathway for rice-growing households in the current biophysical and economic environment.

Maintaining yields with less labour

Rising labour costs are arguably the factor that is currently most responsible for driving farming system adaptations in the lowlands. Mechanisation of rice production in Laos remains in its infancy, but with labour becoming increasingly scarce, changes are rapidly occurring as technology spills across the borders. Around 75% of households surveyed utilised two-wheel tractors for land preparation rather than relying on draught animal power (mainly buffaloes). Other forms of mechanisation were less common, with the first transplanters, drill seeders and harvesters only beginning to be utilised in the past few years and only in small areas. Currently, in order to minimise cash outlays, households tend to extend the period of transplanting to cope with the declining household labour resource rather than hire labour or transplanters (with obvious trade-offs in terms of yield). It is expected that mechanisation will continue to expand as labour becomes increasingly expensive, but the demand for contracted harvesting services will be determined by contracting rates relative to the opportunity cost of harvesting labour (and mechanical harvesting of the wet-season crop may still face technical problems). Thus, cash flow will continue to be a constraint to mechanisation for subsistence-oriented households without non-farm income sources.

The critical role of the cost of labour can be seen by returning to the analysis in Table 1. The data show that intensification consistent with the current fertiliser recommendation (the medium-input scenario) has the potential to improve the productivity of rice production and the economic performance of the crop. However, the return to labour was still only around 37,000 kip/day. As the opportunity cost of labour increases to 50,000–60,000 kip/day, rice production is becoming unattractive as a commercial activity under any of the four scenarios considered

Table 1. Analysis of fertiliser scenarios using enterprise budgets and risk analysis

	No-input	Low-input	Medium-input	High-input
Fertiliser applied (kg/ha of $N:P_2O_5:K_2O$)	0:0:0	31:10:0	60:30:30	120:60:60
Yield of paddy (t/ha)	1.5	2	3	3.75
Gross income (kip/ha)	3,000,000	4,000,000	6,000,000	7,500,000
Total variable cost (kip/ha)	4,180,000	4,950,000	6,335,000	8,265,000
Net income (NI) (kip/ha)	–1,180,000	–950,000	–335,000	–765,000
Gross margin (GM) (kip/ha)	2,320,000	2,770,000	3,825,000	3,725,000
GM per day (kip/day)	26,514	29,785	36,779	33,185
Marginal rate of return (MRR) (%)		30	44	D
Threshold analysis				
Threshold P_r for positive NI (kip/kg)	2,884	2,525	2,118	2,215
Threshold P_r for GM of 50,000 kip/day (kip/kg)	3,539	3,039	2,482	2,530
Threshold P_r for MRR > 50% (kip/kg)		2,335	2,153	4,011
Risk analysis	***Probability of occurrence (%)***			
NI > 0 or GM/day > 40,000 kip	20	32	30	23
GM/day > 50,000 kip	8	16	16	12
MRR > 50%		28	15	5

Note: Labour cost = 40,000 kip/day; paddy price (P_r) = 2,000 kip/kg; US$1 = 8,000 kip; MRR = change in NI over change in total variable costs from moving to next-most-costly scenario, expressed as a percentage; D = dominated scenario, i.e. NI of this scenario is less than NI of medium scenario and no MRR is calculated (CIMMYT 1988)
Source: Newby et al. (2013)

at current paddy prices. Threshold analysis shows that for the medium-input scenario, a GM/day of 50,000 kip can be achieved if the price of paddy increases to 2,500 kip/kg (Table 1). Similarly, the yield required to achieve a GM/day of 50,000 kip at current paddy prices is over 4 t/ha for the medium-input scenario and 3.4 t/ha for the low-input scenario, provided that costs remain constant (Newby et al. 2013). These are unlikely scenarios.

Alternatively, by reducing the amount of labour used by 28 days/ha, the medium-input scenario also produces a positive NI (equivalent to a GM/day of at least 50,000 kip) (Newby et al. 2013). Again, this assumes that yields are maintained and material costs do not increase. Direct seeding is one method that could produce these savings by obviating the need for labour for seedbed preparation, nursery management and transplanting. However, this gives rise to other trade-offs that need further assessment—notably, the extra time and cost needed for weed management. There may also be trade-offs associated with introducing herbicides into an environment where the paddy land is utilised for collecting fish, frogs and other wildlife for consumption.

If yields are not maintained at a comparable level to a transplanted crop, the allowable trade-off depends on the price of paddy and the actual opportunity cost of household labour. However, there is a range of realistic price and yield combinations that result in a profitable farming system, provided around 25–30 labour days can be saved—so long as any labour saved is employed and earns a return of at least 50,000 kip/day. The timing of labour saving is also important if it enables people to secure employment for longer periods rather than repeatedly returning for crop maintenance activities. Mechanisation and the timely establishment and harvesting of the wet-season rice crop may also enable further changes to the cropping pattern, which may be attractive provided the returns to labour are adequate, and yield and marketing risks are acceptable. However, there are many basic agronomic and postharvest issues that need to be resolved to ensure these significant changes in the farming system offer a clear relative advantage.

Farm-scale diversification

The diversification of the cropping and farming systems is an important means of improving household incomes. Crop diversification and improved livestock management are activities that can potentially generate good returns to family-owned resources. Again, we argue that this is tied to households being able to achieve household rice subsistence objectives in terms of the efficient utilisation of land, labour and capital.

Access to water is often the limiting factor for increased farm diversification. Water resources have traditionally been managed relatively successfully by informal community institutions—for example, the sharing of water resources and the redistribution of land close to water resources during the dry season. As market opportunities increase, some of these existing institutions will be challenged (Souvannavong 2011). The rapid increase in access to groundwater is one of the major recent trends in southern Laos. Households now have individual bores connected to electric pumps. With the exception of a few villages, this water has largely been used for domestic purposes and maintaining small home gardens. However, it is likely that households will expand production in areas with good market linkages, potentially putting pressure on the groundwater resource, which remains poorly understood.

Economic analysis of farmer field trials conducted by the crop component of ACIAR Project CSE/2009/004 (*Developing improved farming and marketing systems in rainfed regions of southern Lao PDR*) has shown that the income from small-scale production of crops such as sweetcorn and vegetables can provide a very attractive return to household labour—often double the market wage rate. However, these crops are often associated with greater production and market risks. This was reflected in the results of field trials in which some households generated very low returns due to poor crop performance. Further, as production levels increase, it is also likely that local markets will become saturated and longer value chains will need to be exploited. Assessing the returns to directing land, water and labour into irrigated forage plots rather than vegetable plots is also ongoing. Several case-study farmers are just beginning this transition into more intensive livestock systems. These two activities (non-rice crops and intensive livestock) offer different characteristics in terms of flexibility of product disposal, the time profile of costs and returns, and complementarity with the existing farming system.

Livelihood diversification

Economic growth in Laos and neighbouring countries has created considerable employment

opportunities away from the farm. Migrating to Thailand is now a well-established livelihood strategy for young people from lowland households—43% of households surveyed in Champassak had a least one member working in Thailand (Manivong et al. 2014). Likewise, in Outhoumphone, Savannakhet, 42% of households had at least one family member working in Thailand, with the incidence falling away as distance from the border increased (Newby et al. 2013). At the same time, employment opportunities within Laos, both in urban areas (including the construction and service sectors) and rural areas (such as working in rubber plantations) are also drawing labour away from traditional, semi-subsistence agriculture. According to Manivong et al. (2014), the positive inducement of higher incomes from non-farm employment, especially through international migration, is transforming rural livelihoods, despite the risks and personal hardships involved.

To date, however, the diversification of livelihoods has not been associated with agrarian differentiation as such, but has provided an alternative to landed wealth or 'natural capital' as the basis for household prosperity. Nevertheless, it would not be true to say that the study villages have become 'de-agrarianised'—a mere 'shell' to accommodate non-farm labour—as argued by Rigg (2005). Rice farming still remains an essential foundation for the diversified livelihoods that rural households are pursuing. Hence, innovations and interventions that can enable households to achieve their subsistence goals in more labour- and cost-efficient ways will strengthen this foundation and thus give more scope to improve household livelihoods. However, such interventions are unlikely to be consistent with a policy focused on rice intensification.

Conclusion

The overwhelming impression from this research is that Lao farmers are caught up in, and contributing to, a much larger regional process of agrarian transition which government intensification policies will be hard-pressed to counter. To the extent that farmers' judgements about the relative returns to their resources are correct, rural households in Laos are spontaneously following trajectories that, if not exactly a 'pathway out of poverty', are at least making them somewhat better off, in the sense of having higher and more diversified income streams and greater food security. This does not mean farmers are abandoning rice, let alone agriculture—rice production for subsistence and perhaps a small surplus is still central to the strategies most households are following, as well as the production of non-rice crops and livestock. However, the changes underway are transforming the rural economy from one based almost entirely on rice production for subsistence to one that is increasingly integrated with, not just a rapidly developing Lao economy, but a wider regional economy. In this context, attempts to intensify and commercialise rice production by increasing per hectare yields and cropping intensity need to take account of the implications for labour use and the returns to labour, and hence for household incomes. The opportunity cost of using family labour for rice production is increasing and labour has become the binding constraint. Hence, the level and reliability of returns to labour (rather than land) should be central to the assessment of new agricultural technologies and practices, as well as the evaluation of agricultural policies towards rice farmers. We conclude that the subsistence orientation and low intensity of rainfed lowland rice farming is not a reason for policy concern; rather, this activity provides the stable platform on which to build resilient livelihoods through both farm and livelihood diversification.

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