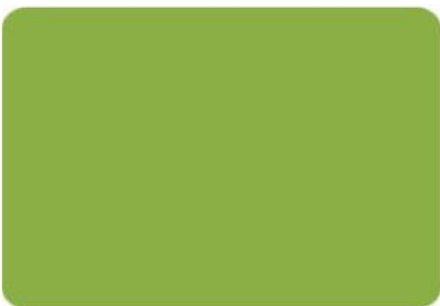


Report on the Prosperity Initiative Baseline Survey on Household Livelihoods and Bamboo-related Activities in Houaphanh

Bob Baulch, Rachna Chowdhuri, Sommai Faming and Charles Davis

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Abstract

A baseline survey on household livelihoods and bamboo related activities was conducted in two districts in Houaphanh in early 2010. While dependence on agriculture is high, and more than half of the population live on incomes of less than \$1.25/day, land and other assets appear to be distributed relatively equally. The bamboo sector in Houaphanh is found to be at an early stage of development: while nearly all the surveyed households harvested bamboo, most of it was consumed within the household. Less than 8% of households sold bamboo and, at 7%, the average share of income derived from bamboo is low. However, there are some households who earn much more than this from selling bamboo, and the poverty gap is significantly lower among these households. With appropriate policies and interventions, there is considerable potential for bamboo to raise incomes and reduce poverty in Houaphanh.

Introduction

This report presents the key findings from the baseline survey on Household Livelihoods and Bamboo-Related Activities in Houaphanh that was conducted in February and June 2010. This survey was designed and analysed by the Prosperity Initiative CIC (hereafter PI) and implemented by Indochina Research Limited (IRL).¹

The objectives of the baseline survey were threefold:

1. To understand how bamboo fits into the farming system, and rural livelihoods more generally, in Sopbao and Viengxay districts, Houaphanh.
2. To identify farm and village level constraints to the future development of the bamboo industry in Houaphanh.
3. To establish a baseline against which future development of the bamboo industry in Houaphanh, and in particular its impact on incomes and poverty can be assessed.

This report focuses on the first two of these objectives, although Appendix 3 assesses and confirms the suitability of the baseline survey for assessing the impact of PI's future activities in the province. After providing an overview of the provincial context and project background, the sampling, organization and conduct of the baseline survey are described. This is followed by an analysis of household characteristics and livelihoods, the education and employment of household members, housing and sanitation, and asset ownership. After examining land holding patterns and non-timber forest products, the report then goes on to examine the distribution of bamboo activities and species in the baseline survey. Finally, the sources of income and poverty of households in the baseline survey are analysed distinguishing between households who do and do not sell bamboo.

Context and Project Background

Houaphanh is the poorest and one of the most remote provinces in northern Lao. According to the most recent poverty assessment based on the Lao Expenditure and Consumption Survey of 1997-98, it was the second poorest province in the whole of Lao (after Sekong in the South) with 50.5% of its population living below the national poverty line (Engvall et al., 2010). Houaphanh has a common border with three Vietnamese provinces (Son La, Thanh Hoa and Nghe An) and is much closer to Ha Noi, the capital of Vietnam, than it is to Vientiane (a 10 to 11 drive compared to two day respectively). Houaphanh is home to 27 ethnic groups (notably the Tai, Kheumu and Dao), many of whom are also present in neighbouring provinces in Vietnam. The population of Houaphanh in mid-2008 was 302, 809 people (Department of Statistics, 2009).

¹ The authors thank the authorities in Houaphanh (in particular the provincial and district Departments of Planning and Investment and the Provincial Statistics Office) and the staff of the PI field office in Xamneu for their assistance in conducting the baseline survey, Jim Delaney, Nina Fenton, Jaime Frias and John Marsh for comments on the draft version of this report, and Nguyen Hoang Trung for preparing the map.

Houaphanh has a total land area of 17,186 km², approximately 76% of which is forested (Delaney, 2010). The major crops grown are glutinous rice, maize, soybeans, cassava and vegetables. Some cotton and sugarcane is also grown, while livestock (especially pigs and cattle) and aquaculture are popular agricultural activities. Houaphanh has abundant bamboo resources, most of which are unexploited. According to the bamboo resource mapping exercise carried out by PI and the Centre for Agriculture Resource and Environmental Studies, there are more than 1.2 million hectares (ha) of bamboo in Houaphanh, most of which is in mixed forests (Nguyen et al., 2010). Once protected areas are excluded and taking account of current market conditions and harvesting practices, approximately 485,000 ha of these bamboo resources are 'market accessible' for culms or shoots. If these areas were harvested sustainably, the estimated annual volume of market available bamboo would be 4 million tons of culms and 550,000 tons of shoots (Nguyen et al., 2010). The main bamboo species grown in Houaphanh are Mai Xang (*Bambusa sp*), Mai Khoune (*Bambusa distegia*) and Mai Hea (*Schizostachyum funghomii*).

Houaphanh is divided into eight administrative districts (Xamneua, Xiengkho, Viengthong, Viengxay, Huameuang, Xamtay, Sopbao and Et). PI has been working with the Houaphanh Provincial Government on bamboo value chain development in two of these districts (Sopbao and Viengxay) since 2007.² In addition to this baseline survey and the bamboo resource mapping exercise, activities completed include a policy review (Delaney, 2009), several visits by Chinese bamboo experts, and identifying villages for a bamboo trading pilot in consultation with provincial and district officials. Other organisations involved in assisting the bamboo sector in Houaphanh include the Research and Technological Exchange Group (GRET) and the Netherlands Development Organisation (SNV).

Sampling, Organization and Conduct of the Baseline Survey

The baseline survey was administered in 45 sample villages selected by PI and IRL in Sopbao and Viengxay districts (see Figure 1: Location of Baseline Survey Villages). The baseline survey had a dual structure, with 27 villages selected using a probability proportionate to size (PPS) sampling. The remaining 18 villages (all of which are in Viengxay district) were added purposively and are pilot villages in which PI intends to conduct activities to promote the bamboo industry in the future. The 27 villages form a representative sample of rural households in Viengxay and Sopbao districts, while the 18 pilot villages will be used for monitoring impact of PI activities in the future.³ In most villages, 8 households were then selected randomly from the administrative lists of households in the village. However, 3 villages with less than 30 households were combined with nearby villages before the household sample was drawn.

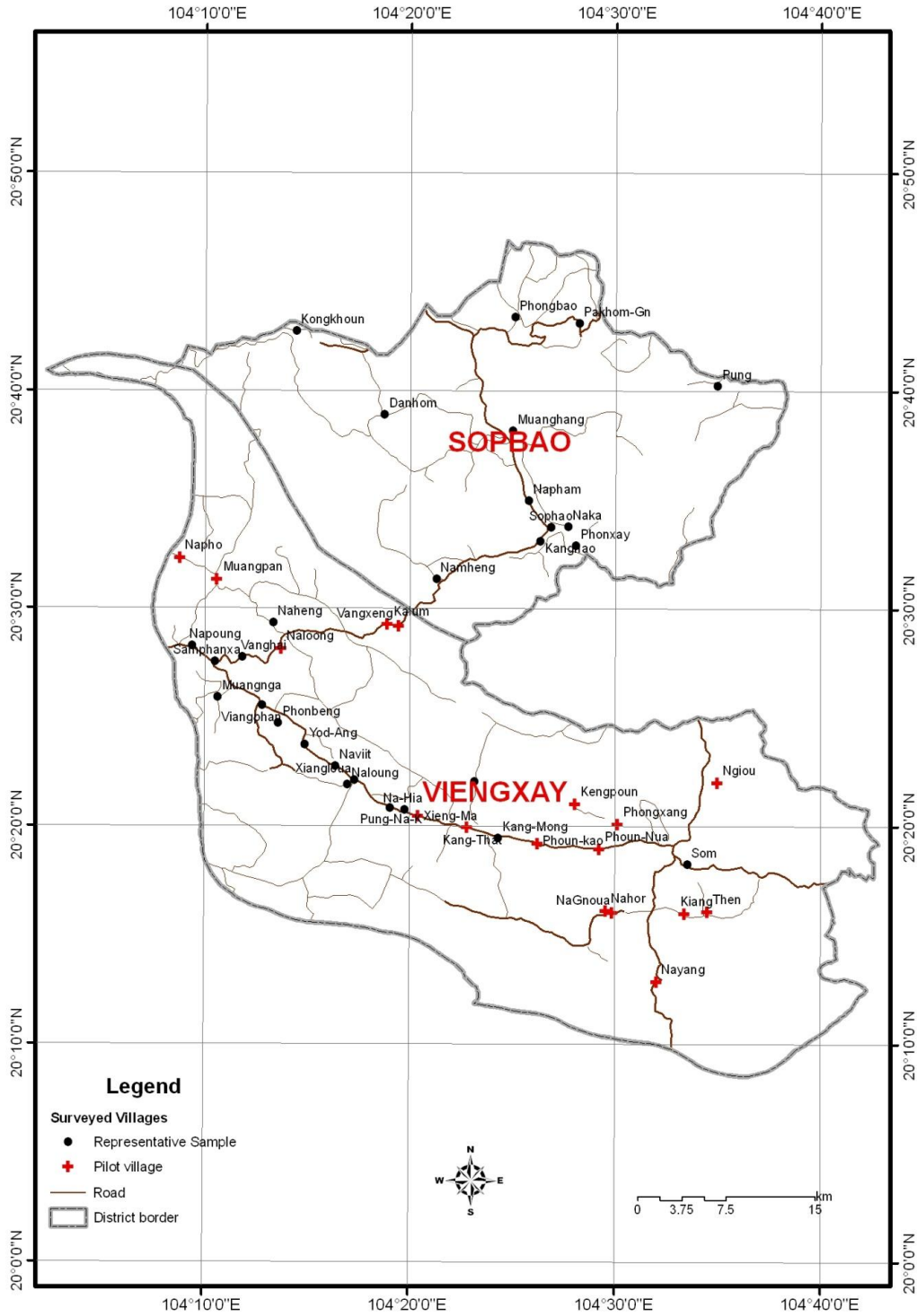
The baseline survey consisted of three parts: a household questionnaire (administered to 336 households), a village questionnaire (administered to the 45 groups of village leaders) and a price

² Funding from the International Finance Corporation, Swiss Agency for Development and Cooperation (SDC) and Oxfam Hong Kong is gratefully acknowledged.

³ As of September 2010, PI has finalized agreements with the Provincial and district authorities and started to implement culm buying activities in four of the pilot villages. These pilot activities started after the baseline survey was completed and are gradually being extended to other pilot villages.

questionnaire (administered in Sopbao and Viengxay town markets). The household questionnaire took an average (median) of 75 minutes to complete, while the village questionnaire took an average of 86 minutes to complete. In addition, Geographic Positioning System (GPS) coordinates were collected for all households, plus village meeting houses and other facilities located in the survey villages, and the district markets.

Figure 1: Location of Baseline Survey Villages



The baseline survey was administered in two phases. In the first, and major, phase in February 2010, 304 households in 27 representative sample and 14 pilot villages were interviewed by two survey teams from IRL.⁴ In the second phase, in late June 2010, an additional 32 households in 4 additional pilot villages were surveyed by an IRL-PI team.⁵ All four of these additional pilot villages were in Viengxay district, and identical questionnaires and recall periods used as for the main phase.

Unless stated to the contrary, the statistics presented in the remaining of this report are based on the representative sample of 208 households in 27 villages.

Household Characteristics and Livelihoods

Table 1 shows the demographic characteristics of the representative sample of household interviewed. Average household size was 5.8 people. The average age of household heads, 97 % of whom were male, was just over 43 years old. 87% of household heads were literate and 70% of them had completed primary schooling. The dependency ratio (the ratio of non-workers to total household size) averaged 0.5, with a minimum of 0 and a maximum of 0.75. Around two-thirds (67 %) of the households were of *Tai* ethnicity, and a fifth (20.2%) were Lao. Other smaller ethnic groups included the Hmong (4.8%) and Phoutai (also 4.8%).

Table 1: Demographic Characteristics of Households

Variable	Mean	Median	Minimum	Maximum
Household size (number of people)	5.8	5	1	21
Number of workers	2.9	2	1	11
Age of Head (years)	43.1	42	18	78
Dependency ratio	0.5	0.5	0	0.75
Sex of Head	Female	Male		
%	2.9	97.1		
Ethnicity of head	Tai	Lao	Hmong	Phoutai
%	67.3	20.2	4.8	4.8

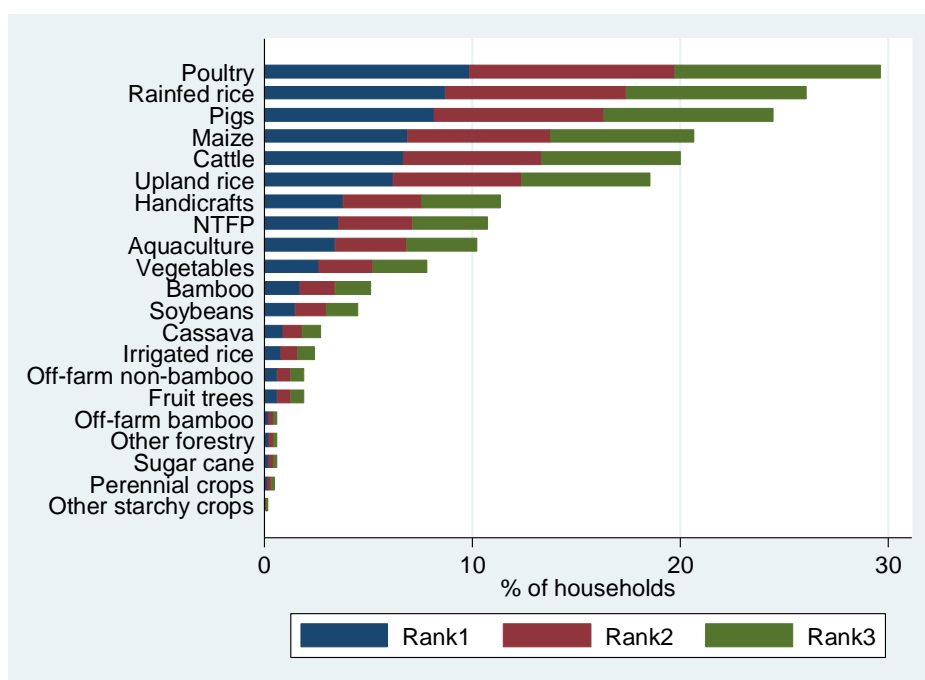
Note: Based on representative sample of households only

⁴ Each of the two survey teams in the first phase consisted of four people: a team leader, four interviewers and a driver. PI made two supervision visits to the survey teams during the survey implementation period, which lasted from 3 to 20 February 2010.

⁵ The survey team for the second phase consisted of four people: a team leader from IRL, two PI staff and one district government officer. The survey period was from 24 to 29 June 2010.

Further information on the importance of the various activities from which households earn their livelihoods is presented in Figure 2: Ranking of Economic Importance of Activities and Crops. The source of the information in this diagram was a series of questions that asked households to list and then rank the main crops and agricultural activities in order of their importance to household income. The most important activity for household income was poultry raising followed by rainfed (flatland) rice production and pig rearing. Maize, cattle and upland rice production were the next most important activities. Handicrafts, Non-Timber Forest Products (NTFP) and aquaculture were each mentioned by around 200 households. As the eleventh most important activity, bamboo cultivation and collection comes fairly low down the list although it is likely that some bamboo is also used in handicrafts, the seventh most important activity.

Figure 2: Ranking of Economic Importance of Activities and Crops



Note: Based on representative sample of households only.

An alternative way of ranking different crops (though not livestock) is to compute their returns per hectare and per family labour day. This is done in

Table 2 shows the gross margins for the most commonly grown crops in the baseline survey.⁶ The crop with the highest return per hectare of land is glutinous rice grown in flatlands, with mean and median gross margins of Kip 5.4 and 4.9 million per hectare. Soybeans, maize and ordinary rice also

⁶ Gross margins are a simple tool used by agricultural economists to describe the returns to different crops, and are calculated using the formula: Gross Margin = Revenue – Variable Production Costs, where revenue includes the value of both sales and own production and costs are the costs associated with the use of all variable factors of production excluding family labour. Gross margins treat fixed assets (such as farm buildings or machinery) as ‘sunk costs’ and therefore avoid the complicated issues that often arise about the pricing and depreciation these assets.

offer good returns to land, with median gross margins of Kip 3.5, 2.4 and Kip 2.3 million per hectare respectively. However, the returns to upland glutinous rice production (Kip 1.4 million/hectare) are similar to those from bamboo grown on household land (Kip 1.3 million/hectare), while those from cassava (another upland crop) are only slightly higher. The crop with the highest return per family labour day is glutinous rice (Kip 74,000 per day) followed by bamboo (Kip 43,000 per day) harvested from household land. This is due to the relatively low labour requirements that bamboo requires once it is established. All other crops have gross margins per family labour day that are close to or substantially below the casual agricultural wage rate of Kip 30,000 per day.

Table 2: Gross Margins (Kip 000s) per Hectare and Family Labour Day, 2008

Crop	N	Per hectare		N	Per family labour day	
		Mean	median		mean	median
Flatland glutinous rice	163	5,449	4,911	163	99	74
Maize/corn	127	3,839	2,375	127	34	23
Upland glutinous rice	74	2,152	1,412	74	31	22
Bamboo (culms and shoots combined)	51	2,637	1,333	51	80	43
Chinese cabbage	31	2,492	1,000	31	8	7
Ordinary rice	27	3,159	2,320	27	33	24
Soybean	25	5,615	3,475	25	27	26
Cassava	21	2,535	1,600	20	31	18

Some three-fifths (60.5%) of households stated that they grew enough rice to feed all their members for 12 months a year, with almost one-fifth (18.8%) growing enough rice for nine to 12 months a year. Just five households (2.4%) did not grow enough rice to feed themselves for at least 6 months a year. Over four-fifths (84.1%) of households reported being able to add to their cash savings in 2009, with the median amount saved by these households being Kip 1 million.

Education and Employment

Approximately nine-tenths (90.7 %) of adult males over 18 years old and seven-tenths (72.5%) of adult females in the representative sample were literate, while seven-tenths (69.6%) and one fifth (21.8%) had completed primary and lower secondary education respectively. Net enrolment rates among children were 53.0% for primary school and 40.1% for secondary school.⁷ Boys were slightly more likely to be enrolled in primary school than girls (52.8 % versus 52.1% respectively).

Table 3 shows the distribution of main employment of adult household members (these figures exclude the few adults over 18 years old who were full-time students). The vast majority (90%) of people were primarily employed in agriculture, aquaculture or forestry. Just over one-tenth (10.1%) of households had regular salaried or waged employment.

⁷ These net enrolment rates were calculated using an age range of 6 to 11 years old for primary school and 12 to 18 years old for secondary school.

Table 3: Main Employment of Adults, 2009

Main occupation	%
Agriculture, aquaculture and forestry	90.0
Construction, mining and manufacturing	3.3
Education and training	2.2
Food/leather/wood processing and handicrafts	1.4
Technical and professionals staff	1.0
Others	2.1
Total	100.0

Housing and Sanitation

Just under two-thirds (64.9%) of the representative sample lived in permanent one-story houses with wooden walls, with semi-permanent houses with wooden walls being the next most popular type of house. Three-fifths (60.5%) of houses had tiled roofs, followed by metal sheets (24.5%) and grass (15.5%) roofs. Wood (42.8%) and concrete (26.4%) were the most popular types of flooring. However, just over a fifth (22%) of households had walls or floors made from bamboo, while 15.5% of households had roofs made of grass. The vast majority of (91.8%) of households use electricity (from either the mains or small hydro-generators) as their main source of lighting. Around three-quarters (74.0%) of households rely on public standpipes for their drinking/cooking water, while 18.8% have piped water. Some 14% of households did not have toilets while another 17.3% had 'dry toilets' (latrines).

Asset Ownership

Table 3 shows the most commonly owned assets among the 208 households in the representative sample. Some four-fifths (80%) of household owned motorcycles, followed by 70% with televisions, and 63% with satellite dishes.⁸ Three-fifths (60%) of households owned mobile phones while around a half owned video CD players and electric fans. The mostly commonly owned agricultural asset was small rice mills (51%) followed by buffaloes (48%) and two-wheel tractors (47%). Around a third of households owned tractor ploughs (38%), cows (38%), and bicycles (34%). Notice, however, the mean and maximum number of assets owned varies by type of asset with households being likely to own more than one buffalo or cow, which are a store of wealth in Houaphanh. Multiple ownership of motorbikes, bicycles, mobile phones and electric fans was also common among some households. In contrast, no household owned more than one tractor, threshing machine, rice mill, electric generator, radio or cart.

⁸ As expected, motorbike ownership is higher in Viengxay than Sopbao, and also much higher than in the Lao Expenditure and Consumption Survey conducted in 2007/08. Note that 21% of households in the representative sample reported having purchased a motorbike during the 2009 calendar year.

Table 4: Ownership of Assets

Type of Asset	percent of households owning	mean number owned	maximum number owned
Motorcycle	80%	0.966	3
TV	70%	0.750	3
Satellite disk	63%	0.639	3
Mobile phone	60%	0.986	4
Small rice mill	51%	0.514	1
Video CD player	50%	0.519	2
Buffalos	48%	1.731	16
Two-wheel tractor	47%	0.471	1
Electric fan	45%	0.548	11
Tractor plough	38%	0.389	2
Cows	38%	1.788	30
Bicycle	34%	0.428	3
Sewing machine	27%	0.279	2
Telephone	22%	0.226	2
Fridge	22%	0.236	3
Electric cooker	21%	0.255	3
Generator	21%	0.207	1
Radio	15%	0.154	1
Water heater	7%	0.072	2
Car	4%	0.043	2
Threshing machine	4%	0.038	1
Cart (animal)	3%	0.034	1

A comparison of the assets and durable goods owned by households in Houaphanh and North-West Thanh Hoa (where PI conducted a similar survey in 2009) shows that while similar assets were owned in both areas, the percentage of households owning assets and the number owned varied significantly (Appendix 2). Except for a few assets such as livestock, mobile phones, motorcycles, sewing machines, tractors and other agricultural machinery, Thanh Hoa had higher levels of asset ownership. However, three times as many households owned cows in Houaphanh than in Thanh Hoa, and the maximum number of animals owned is also thrice as high in Houaphanh. Motorcycles and mobile phones were also more widespread in Houaphanh, while telephones and bicycles were more common in Thanh Hoa. While these differences suggest differences in the level of wealth in the survey areas, they also indicate differences in lifestyles, culture, and farming practices.

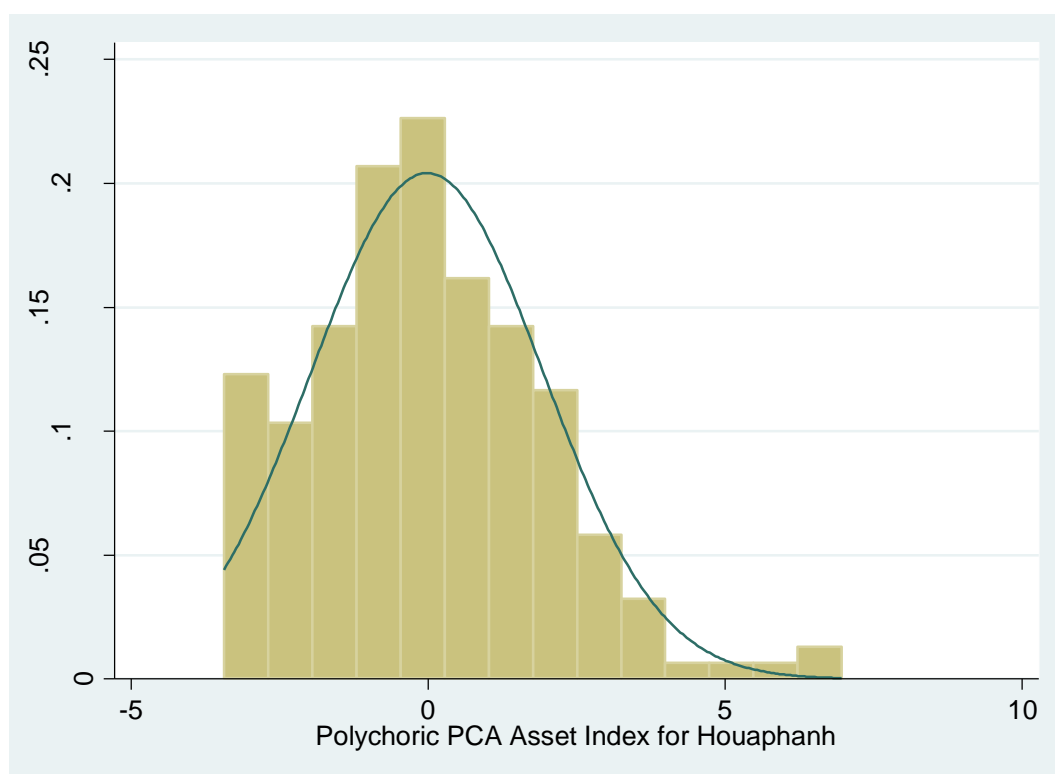
To examine these issues further, we have constructed an asset index using polychoric principal components analysis (PCA), which assigns weights to the different assets that a household owns to produce a single composite asset index.⁹ Twenty four assets were included in the construction of the asset index, based on the levels of assets ownership reported by the sample household.¹⁰ The variables included in the construction of the index were : radio, television, telephone, mobile phone, video CD player, satellite dish, fridge, electric fan, water heater, cooking ring/rice cooker, sewing machine, bicycle, motorcycle, small rice mill, two-wheel, tractor, tractor plough, buffalo, cow, house wall type, house roof type, house floor type, toilet type, water source, and light source. The housing variables were ordered in terms of “best” (1) to “worst” (4-6), based on correlation between construction material and housing type variables and income levels. This comparison generally resulted in the expected ordering, so that a house with walls made of brick was richer than a house with walls made of bamboo, so brick would be coded “1” with bamboo coded “5”. Descriptive statistics for these assets are provided in Appendix 1, and component score coefficients for the first three principal components are given in Appendix 2. The first principal component explains nearly 40% of the total variance in assets with the second component accounting for an additional 9.8% of the variance. The bivariate (Pearson) correlation coefficient between the asset index and household incomes is 0.59

Figure 3 shows a histogram of the distribution of the asset index, which has the expected skew to the left (which indicates that there are many households with an asset index of less than zero but only a few households with asset indices above +5. The asset index has a maximum value of 7.59 and a minimum value of -3.45. Note also that the asset index has, by construction, a mean that is close to zero.

⁹ This type of polychoric principal components analysis (PCA) is preferable to those constructed using regular PCA with dichotomous asset ownership variables because it takes account of the number of each assets which a household own, so that a household who owned, say 30 cows, will have a much higher asset than a household which owned just one cow (Kolenikov and Angeles, 2008). Polychoric PCA also takes account of the ordered nature of some variables (e.g. a two story permanent household should be given a higher weight than a one story permanent house, which in turn should receive a higher weight than a semi-permanent house).

¹⁰ Assets that were owned by less than 4% of the households (in particular non-agricultural machinery) were not included in the asset index. Assets included in the index were chosen included at least two assets from each five remaining categories of assets and durable goods included in the survey.

Figure 3: Histogram of Asset Index, Houaphanh



We utilise the asset index as a succinct way to summarise the asset ownership of a household in the propensity score matching exercise reported in Appendix 3.

Land

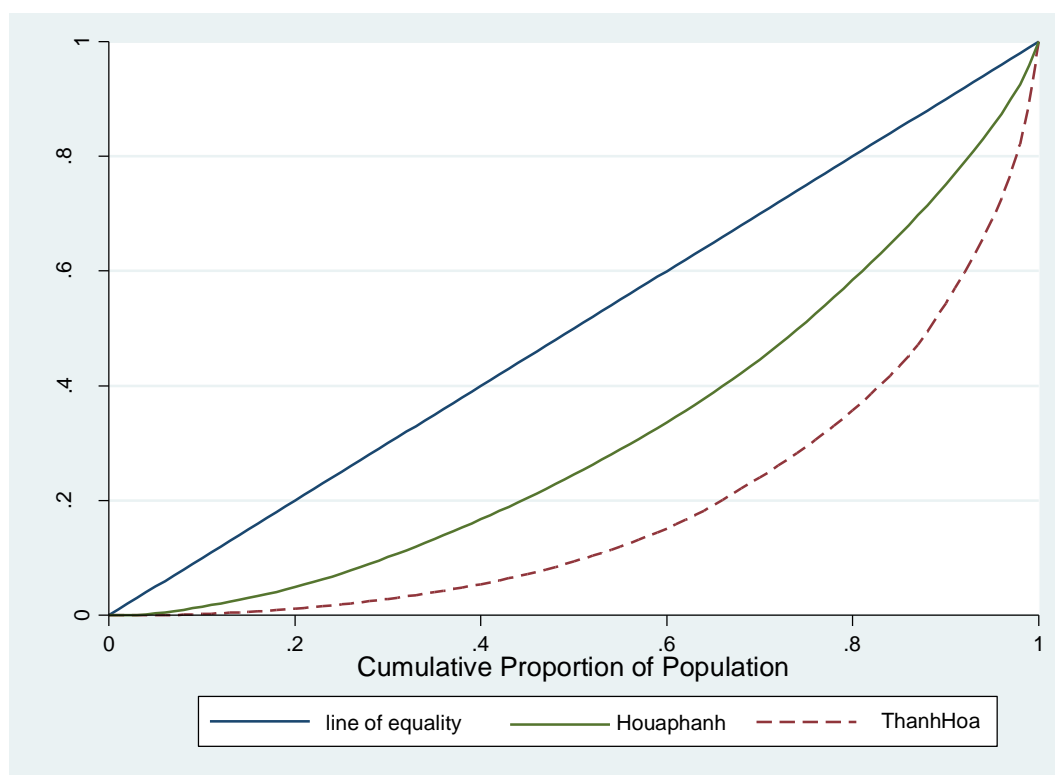
The mean and median amount of land cultivated by households was 1.39 and 1.18 hectares respectively. The median number of plots cultivated by households was two plots, with a minimum of zero plots (for the two non-agricultural households in the sample) and maximum of 7 plots. Just under three-quarters (72.7%) of these plots were permanent agricultural land, with most of the remainder (25.8%) being temporary agricultural land. 13.8% of these plots were irrigated. In addition, almost two-fifths (38.7%) of households had a fishpond. There was only one plot that was rented-out among the 208 representative households.

Of the total 280 ha of land used or managed by households (comprising 538 plots) in the representative sample, 23.3% of land was permanently allocated to the household and 38.4% temporarily allocated to the household by the village head. A further 21.5% of land area is held with title deeds, while 16.0% has been cleared from the forest (without allocation). Very little (7 hectares) of household land is used for forestry, but the majority of this (63.7%) is held with title deeds, with most of the remainder being permanently assigned to the household.

Figure 4 shows Lorenz curves for total land cultivated in Houaphanh and North-west Thanh Hoa. The closer the Lorenz curve is to the line of equality, the more equally land is distributed. As can be seen, land is much more equally distributed in Houaphanh than in Thanh Hoa. The Gini coefficient

for land, which summarises the area under the Lorenz curve, is 0.36 in Houaphanh compared to 0.62 in north-West Thanh Hoa.

Figure 4: Lorenz Curve for Land Cultivated



Note: Based on representative sample of households only

Non-Timber Forest Products

Non-Timber Forest Products (NTFPs) are commonly believed to be an important source of household income in northern Lao (Rigg, 2006). Despite the inclusion of a detailed module on NTFPs, our estimates show that NTFPs accounted for just 2.7% of total household income.¹¹ Around nine out of ten (90.7%) households in the representative sample collected NTFPs, with more than two-thirds (67.6%) collecting plants and tree products and also catching forest animals. The most popular plant NTFPs were mushrooms, Phak nok (Pennywort), Phak Kout (edible fern), Mak Lin Mai and Pak Van (all of which were collected by more than a quarter of households). Rats/mice, Oun (large rodents) and squirrels were the most common animal NTFPs. Women collect just over half (53.7%) of plants, with men collecting one-fifth (20.5%) of plant NTFPs, and women and men collecting most of the remainder (17.2%) together. In contrast, men tend to be responsible for catching animals NTFPs (91.0%) with children catching most (6.2%) of the remainder (mostly rodents).

¹¹ Income from NTFPs is higher in provinces (such as Phongsay, Luangnamtha and Xayabury) in Northern Lao which border China and Thailand and have more abundant household labour.

Bamboo

44 of the 45 villages in the baseline survey (27 out of 28 villages in the representative sample) reported growing bamboo. The vast majority (97.5%) of this bamboo was grown in mixed forests surrounding the village but there was also a little planted bamboo.¹² Total bamboo area in the representative sample villages was 1,873 hectares with another 1,832 hectares of bamboo in the additional pilot villages. The main bamboo varieties grown are Mai Hea (*Schizostachyum funghomii*), Mai Hok (*Dendrocalamus semiscandens*), Mai Luong (*Dendrocalamus barbatus*), Mai Lay (*Gigantochloa albociliata*) and Mai Ja (*Indosasa ingens*), with Mai Luong named as the most important species, followed by Mai Hea and Mai Hok (Table 5). Although grown in a relatively small number of villages (7), Mai Xang is regarded as very important in these villages.

Table 5: Distribution of Bamboo Species by Village, representative sample only

Species of Bamboo	Number of Villages		Order of Importance		
	Growing	Planting	Most	Second	Third
Mai Hea	26	14	3	10	4
Mai Hok	25	14	2	2	8
Mai Luong	22	13	9	2	
Mai Lay	22	13			5
Mai Ja	20	13			
Mai Khome	17	14			2
Mai Khouan	17	14			3
Mai Xang	7		6		

In the representative sample, 94% of all households harvested both culms and shoots with another 2.5% and 2% harvesting only shoots or only culms respectively. However, while the vast majority of households harvested bamboo, only 7.4% and 8.8% of them (15 and 18 households respectively) sold culms and shoots in 2009. The remainder were used for making fencing/wall panels/handicrafts (culms) or consumed within the household (culms and shoots).

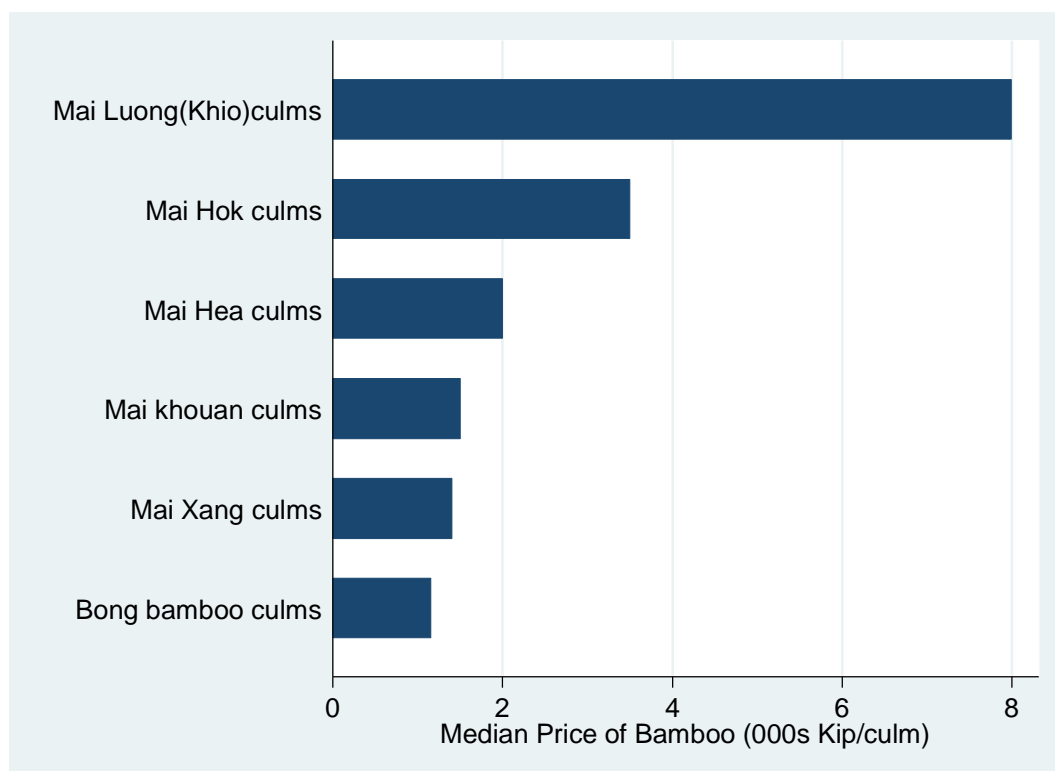
Bamboo accounts for 6.7 % of total household income but just 2% of their cash incomes. While nearly all households in the representative sample harvest culms or shoots, there are only 18 (8.7%) households selling culms, 15 (7.2%) households selling culms and two (1%) households selling both culms and shoots in the representative sample. Women collected more than two-thirds (68.4%) of shoots, followed by women and men (17.5%) and women and children (6.4%). In contrast men were responsible for four-fifths (80.1%) of the 'heavy' work associated with harvesting bamboo culms, followed by men and women (17.2%). Harvesting of culms typically occurs in the agricultural off-season in the first four months of the calendar year, following the end of the main rice harvest in October/November.

¹² In the pilot villages, there was also 120 hectares of pure bamboo forest.

There are 98 bamboo handicraft producers in the representative sample villages (of which 52 are located in B. Kang-Mong in Viengxay). In addition, there are 78 bamboo fencing producers in the representative sample villages (of which 50 are located in B. Vanghai, and the remainder in three other villages in Viengxay). There are 48 more bamboo handicraft producers and one fencing producer in the pilot villages.¹³

The median prices which household report receiving for the culms they sold are shown in Figure 5: Median Price of Bamboo Culms in Sopbao and Viengxay. Mai Luong (Khio), the premium species for processing, received the highest prices of 8,000 Kip per culm followed by Mai Hok and Mai Hea at 3,500 and 2,000 Kip/culm respectively. However, it should be noted that some of the price premium paid for Mai Luong and Mai Hok culms is due to the greater size and strength of these species, which make them more suitable for industrial processing. In contrast, median shoot prices do not vary much by species: shoots of all species were sold at a standard price of 2000 Kip/kg, except for Mai Hea shoots which were sold for 1,500 Kip/Kg. No marked price differential was observed between Sopbao and Viengxay districts, although sales of culms were more common in Viengxay.

Figure 5: Median Price of Bamboo Culms in Sopbao and Viengxay.



In the section on household characteristics and livelihoods, we reported the gross margins for bamboo production (combining sales of culms and shoots) from household land. Since the majority of culms and shoots are harvested from mixed forests surround the village, it is also useful to compute the returns to for village land. These returns, computed as gross margins per family labour

¹³ Note that the representative sample includes two of the pilot villages (B. Na Hia and B. Xleng-Ma), so that there are only 40 additional bamboo handicraft producers in the pilot villages.

day in thousands of Kip, are summarised in Figures 6 and 7. In these plots, the box represents the inter-quartile range (IQR), which is the distance between the 25th and 75th percentile. The horizontal line which dissects it shows the median gross margin. The 'whiskers' above and below the box are defined by the plus or minus 1.5 times the IQR, and the dots above this show outliers. The positive outliers may be households with collection and harvesting methods that are particular profitable, but could also be due to misreported data or unit conversion errors.

Figure 6: Gross Margins for bamboo per family labour day, village land.

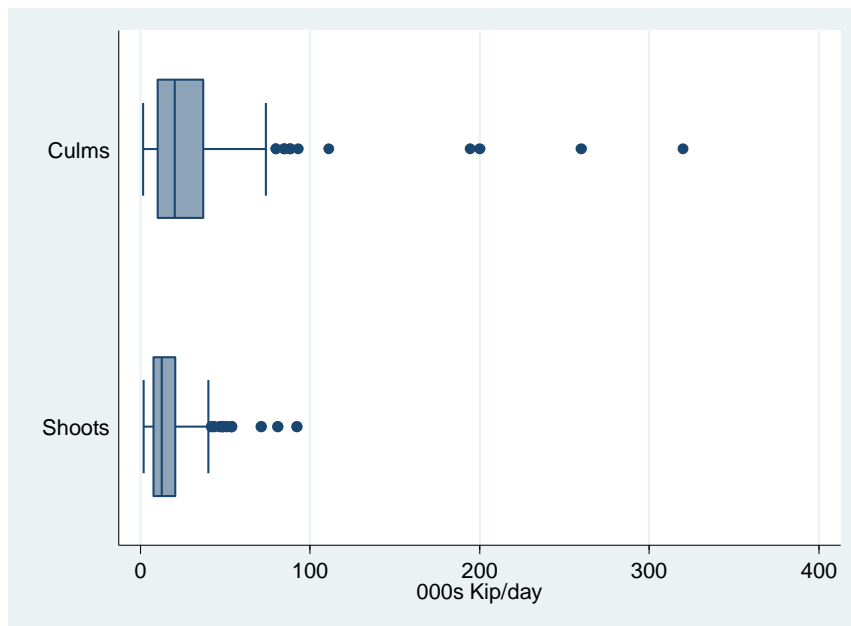
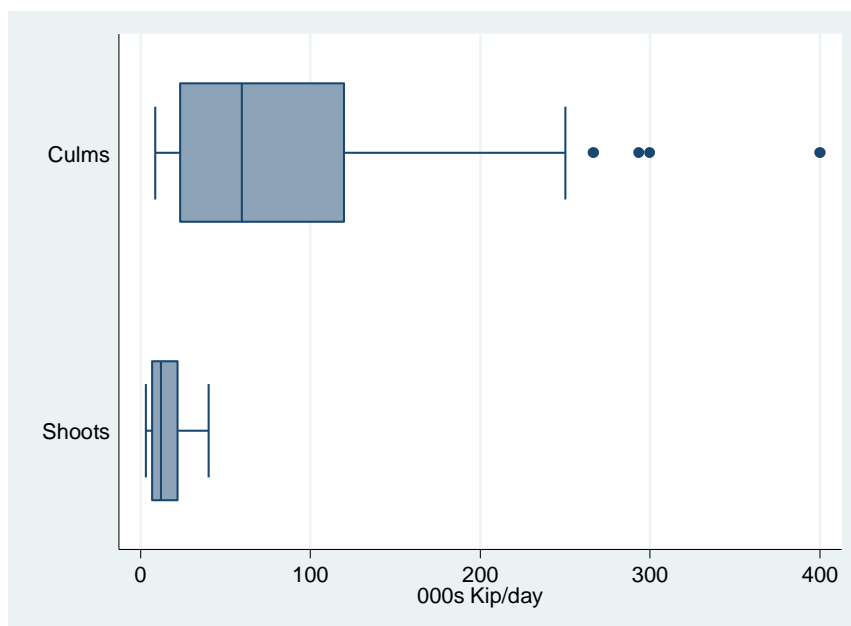


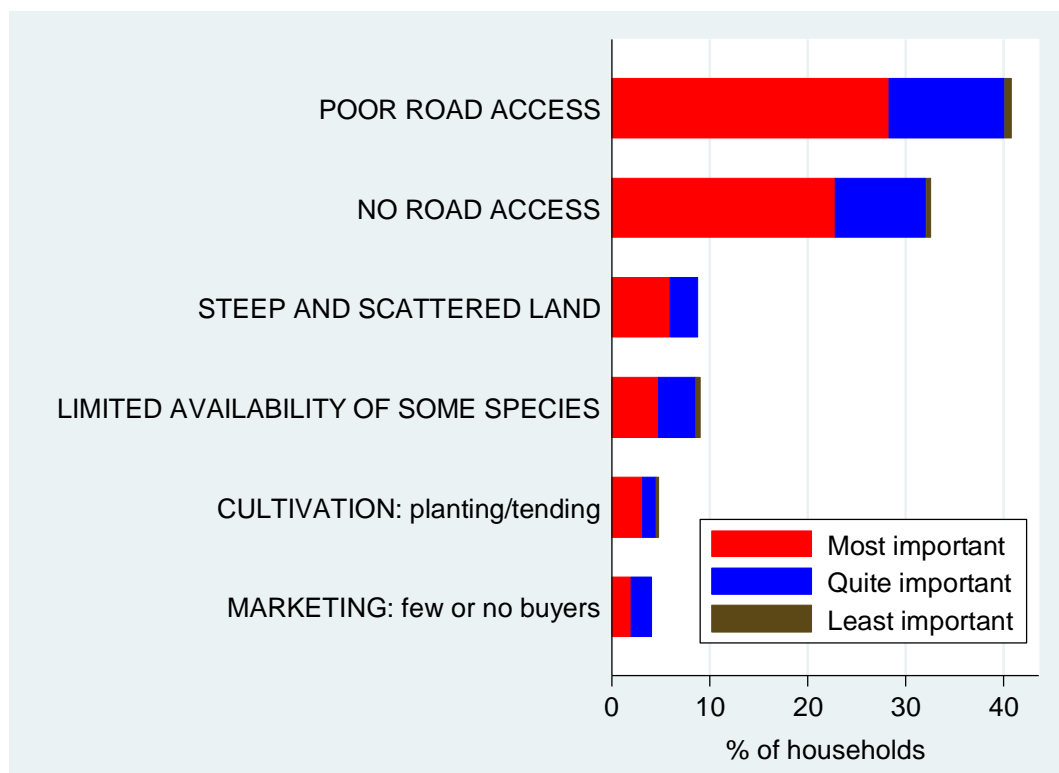
Figure 7: Gross margins for bamboo per family work day, household land.



Return per family work day for harvesting culms from household land are generally higher than when culms are harvested from village land, in part reflecting the price premium that is paid for Mai Luong. The median return for harvesting culms from household land is Kip 63,330 per day compared to Kip 31,400/day for village land. However, there are small number of households harvesting culms from both household and village land who earn more than Kip 90,000/day, or three times the casual agricultural wage, from this activity. In contrast, the returns for harvesting shoots are very similar on both household and village land, with median gross margins close to Kip 13,000/day—which is well below the agricultural wage.

The most important problems which households report with respect to bamboo are mostly concerned with access, due to either poor or nonexistent roads, to bamboo land (Figure 8). This is followed by problems with collecting bamboo when the land on which it grows is steep or scattered, the limited availability of some species (in particular Mai Luong and Mai Hok), cultivation methods, and finally marketing.

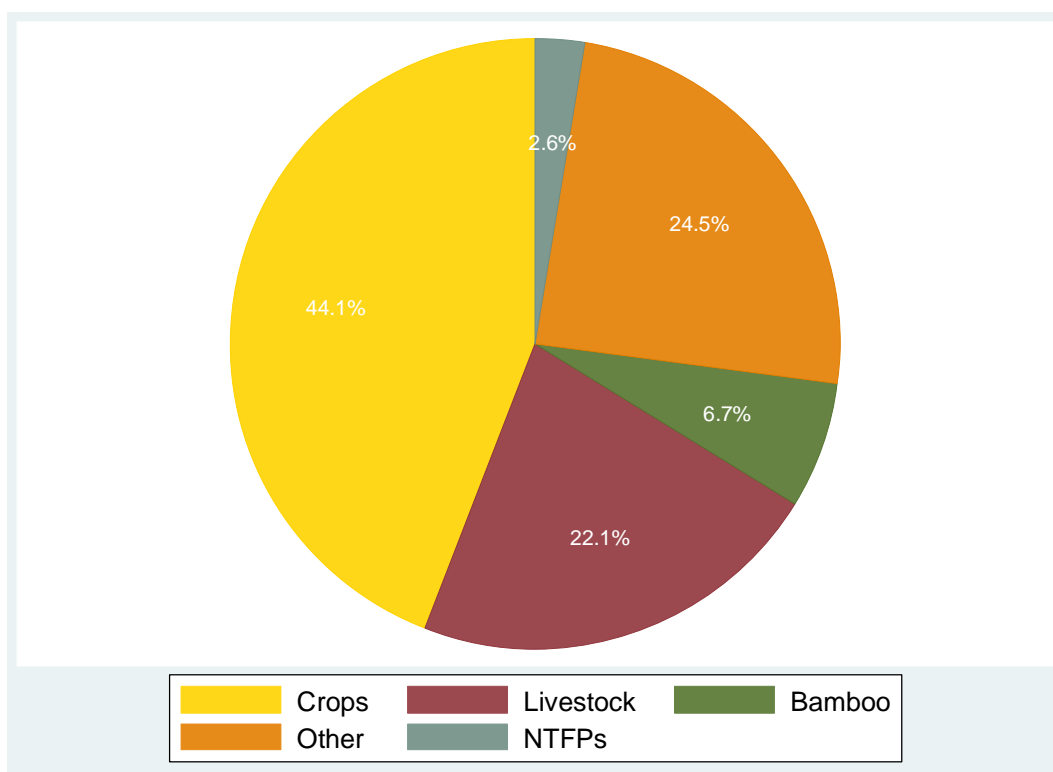
Figure 8: Difficulties with Bamboo Related Activities



Income and Poverty

The baseline survey allows for households' total and cash incomes to be calculated from five sources of income: crops, livestock, bamboo, NTFPs, and other incomes (comprising primary wages, salaries and social transfers). As shown in Figure 9: Sources of Income in 2009, crops make up the largest share of almost a half (44.1%) of total household income, followed by other incomes (24.5%) and livestock (at 22.1%). Just under one-twelfth (6.7%) of household income comes from bamboo, with the remaining portion (2.6%) coming from Non-Timber Forest Products. Note that the share of household income from bamboo in Houaphanh is much lower than in North-west Thanh Hoa (23.1%) where PI conducted a similar survey in 2009.

Figure 9: Sources of Income in 2009



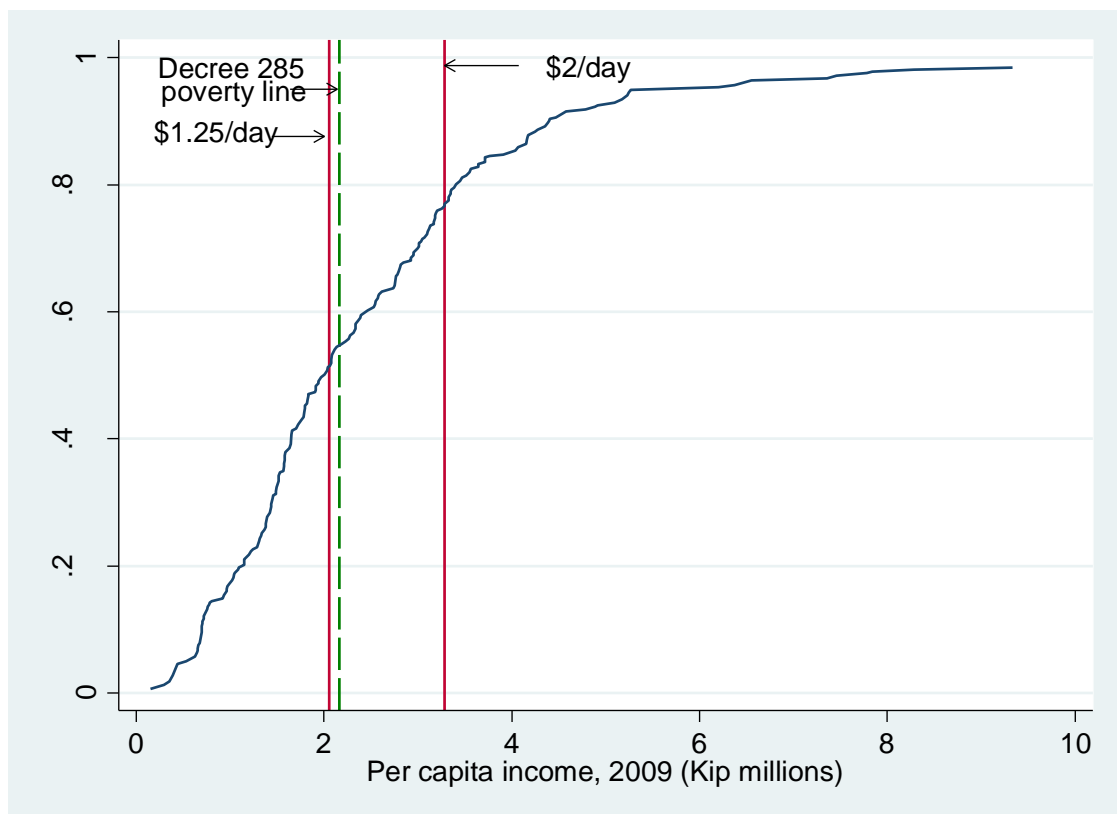
It is important to realise that these averages mask considerable variables in individual household's sources of income. For example, households of Kheumu ethnicity derive a much higher proportion of their total income from bamboo and NTFPs than those of Lao of Tai ethnicity, while Hmong and Tai households derive more than half of their income from crops. In addition, there are three households who derive more than half of their total income from bamboo, and almost 30% who earn more than 10% of their total income from bamboo. The share of income from bamboo (9.3%) and NTFPs (4.7%) was a little higher in the 14 pilot villages than in the representative sample.

Cash incomes (that is net incomes calculated without considering the value of outputs which are produced and consumed within the household) have a different breakdown, Other incomes (which are mostly cash-based) comprise almost two fifths (38%) of total cash income, with crop and livestock making-up 27.4% and 27.7% of total cash respectively. Within these sources, almost half

(47%) of crop cash incomes come from sales of maize, while more than half of livestock cash incomes derive from poultry. Note that 92% of households reporting selling chickens (either meat or eggs) while 57% had sold pork in the last year. This may explain the high rankings given to poultry and pigs in the rankings in Figure 2: Ranking of Economic Importance of Activities and Crops. Cash incomes derived from bamboo and NTFPs comprise just 2% and 5% of total household cash income.

We now examine what the level of poverty was at the time of the baseline survey. For this we use the standard international poverty lines of \$1.25 and \$2 per person per day in 2005 Purchasing Power Parity (PPP) terms, as calculated by the World Bank (Ravallion et al., 2008). When converted into Lao Kip and adjusted for inflation, these give poverty lines of Kip 2.053 and 3.284 million per person per year in 2009 terms. Using these poverty lines together with our estimates of per capita incomes for the representative sample, we estimate that just over half (51.3%) of the rural population in Sopbao and Viengxay were living on incomes of less than \$1.25/day at the time of the baseline survey.¹⁴ The corresponding figures for the poverty gap, a measure of the depth of poverty which shows the average shortfall of the poor's income below the poverty line is 0.208, or about a fifth. If the higher international poverty line of \$2/day is used, 77.5% of the rural population in Sopbao and Viengxay were living on less than \$2/day with a poverty gap of 0.372.

Figure 10: Cumulative Distribution of Per Capita Incomes in Sopbao and Viengxay, 2009

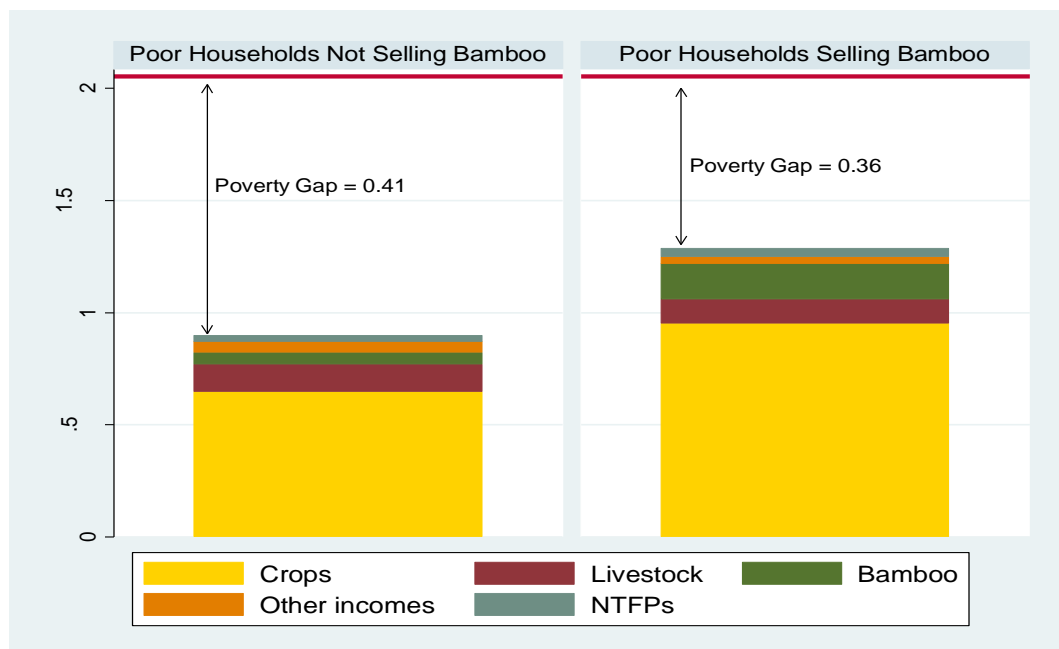


¹⁴ For representative households in Sopbao the poverty headcount ratio using the \$1.25/day poverty line is 57.6% while for Viengxay the corresponding figure is 46.1%.

If instead of the international poverty lines, we use the national poverty line of Kip 180,000 per person per month established by Decree 285 of 13 October 2009, the poverty headcount is 54.5% while the poverty gap is 0.219. These poverty estimates based on the national poverty line lies between the \$1.25/day and \$2/day poverty estimates but much closer to the \$1.25/day ones. The reason for this is shown in Figure 10, where the dashed vertical line represents the Decree 285 poverty line (equivalent to Kip 2.16 million per person per year) and the two solid vertical lines show the two international poverty lines. The point at which the cumulative distribution of per capita incomes cut each of these poverty lines corresponds to the poverty headcount ratio.

In Figure 11 we compare the poverty gap (that is the average income shortfall for households with per capita income below \$1.25/day) according to whether or not they sell bamboo. Median incomes are significantly higher for households who sell bamboo than those who do not sell bamboo. The stacked bars show that this is largely due to crop and bamboo incomes being higher among households who sell bamboo.¹⁵ This results in the poverty gap being lower among poor households who sell bamboo than in households who do not (0.36, or 36% of poverty line income, compared to 0.41).

Figure 11: Poverty Gap by Bamboo Sales Status



Finally, in Appendix 3 we report comparisons of the pilot and non-pilot villages in the baseline survey using both descriptive statistics and propensity score matching. These comparisons find relatively few systematic differences between the representative sample and pilot villages, which suggests we will be able to detect whether PI's buying pilot have a significant impact on incomes and poverty once a resurvey has been conducted. This analysis therefore confirms the value of the survey as a

¹⁵ Note that only total per capita incomes and bamboo incomes are statistically different from one another at the 5% level.

baseline for assessing the impact on incomes and poverty of the bamboo industry in Houaphanh (which was the third objective of the baseline survey).

Summary and Conclusions

This report has presented the key findings from Prosperity Initiative's baseline survey on 'Household Livelihoods and Bamboo-Related Activities in Houaphanh' that was conducted in February and June 2010. Households in the two districts (Sopbao and Viengxay) in which the baseline survey was conducted are heavily dependent on agriculture (in particular glutinous rice, maize and livestock production) and derive two-thirds of their income from crops and livestock. While poverty is high—with more than half of the population living below both the national and international poverty lines—most households grow enough rice to feed themselves for more than nine months a year. Land and other assets appear to be distributed relatively equally in Houaphanh while two-thirds of household report being able to save.

The bamboo sector in Houaphanh is clearly at an early stage of development. While the vast majority of households (94%) surveyed collected bamboo shoots and harvested bamboo culms, most of this bamboo is consumed within the household. Only 8% of households sold bamboo shoots and culms, and the share of income which households derive from bamboo is just 7%. This is much lower than in North-West Thanh Hoa, where PI conducted a similar survey in 2009, and the share of bamboo in household income is 23%. However, there are some households in Houaphanh who earn much more than this from bamboo, particularly those who sell Mai Luong culms, which attract higher prices than other species of bamboo. The importance of collecting bamboo (in particular shoots) from forest areas surrounding the village is also much higher than in neighbouring Thanh Hoa. Finally, the baseline survey shows that the incidence and depth of poverty is lower among the minority of households who currently sell bamboo than among those who do not. So with appropriate policies and interventions, we believe there is considerable potential for bamboo to raise incomes and reduce poverty among the 51% of people in Houaphanh who currently live on less than \$1.25/day.

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Appendix 1: Comparison of Asset Ownership in Houaphanh and Thanh Hoa

Asset	Houaphanh, 2009			Thanh Hoa, 2008		
	<u>Mean ownership</u>	<u>% of households own</u>	<u>Max</u>	<u>Mean ownership</u>	<u>% of households own</u>	<u>Max</u>
Bicycle	0.4279	34.1%	3	0.5756	42.9%	3
Buffalo	1.7308	48.1%	16	0.7561	46.8%	7
Cooking ring/rice cooker	0.2548	21.2%	3	0.4878	47.3%	3
Cooking stove	0.0337	2.9%	2	0.0976	9.3%	2
Cow	1.7885	37.5%	30	0.0146	11.7%	9
Electric fan	0.5481	44.7%	11	1.1561	78.5%	3
Mobile phone	0.9856	59.6%	4	0.4146	30.2%	6
Motorcycle	0.9663	79.8%	3	0.7854	68.3%	3
Pesticide sprayer	0.0192	1.9%	1	0.1415	14.1%	1
Radio	0.1538	15.4%	1	0.0878	8.8%	1
Refrigerator/freezer	0.2356	21.6%	3	0.1122	10.7%	2
Satellite	0.6394	62.5%	3	0.6976	74.6%	2
Sewing machine	0.2788	26.9%	2	-	-	-
Small rice mill	0.5144	51.4%	1	0.0878	9.3%	1
Sofa and armchairs	0.0192	1.9%	1	0.1659	17.1%	1
Stereo	0.0192	1.9%	1	0.0683	7.8%	1
Telephone	0.2260	22.1%	2	0.5317	54.1%	1
Television	0.7500	69.7%	3	0.8293	82.4%	2
Threshing machine	0.0385	3.8%	1	0.1707	17.1%	1
Tractor plough	0.3894	37.5%	2	0.0146	1.5%	1
Two-wheel tractor	0.4712	47.1%	1	0.0098	1.0%	1
Video CD player	0.5192	50.0%	2	0.4976	51.2%	1
Water heater	0.0721	6.7%	2	0.0195	2.0%	1
Water pump	0.0192	1.4%	2	0.2390	23.9%	1

Note: 208 households (Houaphanh), 206 households (Thanh Hoa)

Appendix 2: Coefficients for the Asset Index

Physical Assets polychoric PCA coefficients (first three components)				
	#	1	2	3
Radio	0	-0.0429	-0.0250	-0.0337
	1	0.2320	0.1351	0.1826
TV	0	-0.3249	0.1083	0.1022
	1	0.1059	-0.0353	-0.0333
	2	0.5460	-0.1820	-0.1717
Telephone	3	0.7651	-0.2550	-0.2406
	0	-0.0817	-0.0341	-0.0961
	1	0.2751	0.1148	0.3233
Mobile	2	0.5801	0.2420	0.6817
	0	-0.1749	0.2414	0.0323
	1	0.0330	-0.0456	-0.0061
Video CD Player	2	0.1694	-0.2338	-0.0313
	3	0.3193	-0.4408	-0.0589
	0	-0.1681	0.1538	0.1084
Satellite	1	0.1519	-0.1390	-0.0980
	2	0.4976	-0.4553	-0.3209
	0	-0.2988	0.0561	0.1860
Refrigerator	1	0.1665	-0.0313	-0.1037
	2	0.6921	-0.1299	-0.4308
	3	0.8023	-0.1506	-0.4994
Electric Fan	0	-0.1095	0.0528	0.0097
	1	0.3656	-0.1764	-0.0324
	2	0.6603	-0.3186	-0.0585
Water heater	3	0.7920	-0.3822	-0.0702
	0	-0.1818	0.0699	0.0201
	1	0.1856	-0.0714	-0.0205
Electric cooking ring/rice cooker	2	0.4686	-0.1802	-0.0518
	3	0.6223	-0.2393	-0.0688
	0	-0.0369	0.0188	-0.0005
Sewing machine	1	0.4728	-0.2409	0.0059
	2	0.7055	-0.3594	0.0088
	0	-0.0992	0.0644	-0.0159
	1	0.3166	-0.2057	0.0508
	2	0.5411	-0.3515	0.0868
	3	0.7312	-0.4749	0.1172
	0	-0.0964	0.0198	-0.1511
	1	0.2459	-0.0506	0.3858
	2	0.5446	-0.1121	0.8543

PCA components, cont'd	#	1	2	3	
Bicycle	0	-0.0866	-0.0894	0.0063	
	1	0.1308	0.1351	-0.0095	
	2	0.2664	0.2750	-0.0193	
	3	0.3804	0.3926	-0.0276	
Motorcycle	0	-0.2700	0.1852	-0.5316	
	1	0.0148	-0.0101	0.0291	
	2	0.2710	-0.1858	0.5336	
	3	0.4436	-0.3042	0.8734	
Small rice milling machine	0	-0.1504	-0.3278	0.0483	
	1	0.1406	0.3064	-0.0452	
Two-wheel tractor	0	-0.1323	-0.3619	0.1854	
	1	0.1470	0.4024	-0.2062	
Tractor plough	0	-0.0992	-0.2478	0.2173	
	1	0.1530	0.3823	-0.3351	
	2	0.3999	0.9994	-0.8761	
	3	0.0999	0.2158	0.4088	
Cows	4	0.1182	0.2553	0.4835	
	5	0.1294	0.2795	0.5293	
	6	0.1406	0.3037	0.5751	
	7	0.1516	0.3276	0.6205	
	8	0.2060	0.4451	0.8431	
	Buffalos	0	-0.0420	-0.2365	-0.2897
		1	0.0083	0.0466	0.0571
		2	0.0228	0.1283	0.1572
3		0.0418	0.2354	0.2883	
4		0.0563	0.3172	0.3885	
5		0.0678	0.3819	0.4678	
6		0.0819	0.4610	0.5647	
7		0.0910	0.5123	0.6276	
	8	0.1163	0.6550	0.8023	

PCA components cont'd, household var.	#	1	2	3
Flooring type				
tiles on cement	1	0.504341	-0.33514	-0.42303
concrete	2	0.235407	-0.15643	-0.19745
wood	3	-0.01204	0.007999	0.010096
bamboo	4	-0.19522	0.129725	0.163744
earth	5	-0.36948	0.245521	0.309907
Wall type				
brick	1	0.351086	0.002304	-0.16378
concrete	2	0.223552	0.001467	-0.10429
wood	3	-0.00437	-2.9E-05	0.002038
unbaked brick	4	-0.21211	-0.00139	0.098948
bamboo	5	-0.32084	-0.00211	0.14967
Toilet type				
normal	1	0.113138	-0.00473	-0.02427
dry	2	-0.15967	0.006672	0.034245
other	3	-0.22949	0.009589	0.049219
no toilet	4	-0.34082	0.014241	0.073095
Water source				
piped water	1	0.285085	0.184984	0.143151
public standpipe	2	-0.0338	-0.02193	-0.01697
protected well/borehole	3	-0.29696	-0.19269	-0.14911
river/stream/pond	4	-0.3912	-0.25384	-0.19643

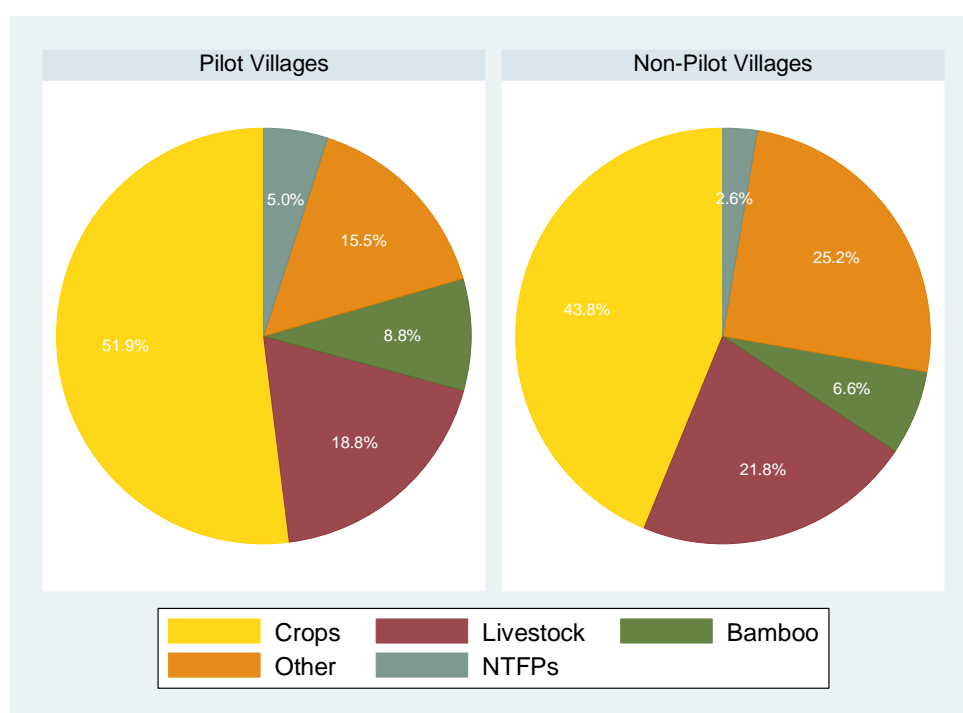
Note: If a household owned more than three of any asset (except buffalos and cows), the total number of assets was recorded as 3 to group any high outliers into the highest ownership grouping. This was expanded to eight ownership levels for cows and buffalos, for which there was a greater variance in the number owned, with more than 8 owned recorded as 8.

Appendix 3: Comparison of Pilot and Non-Pilot Villages in HP Baseline Survey

The final objective of the baseline survey was to provide a baseline against which the future development of the bamboo industry in Houaphanh, and in particular its impact on incomes and poverty, can be assessed. To do this an additional sample of 18 villages, which the Provincial Government and PI identified as likely sites for pilot activities were identified.¹⁶ All of these 18 pilot villages are in Viengxay district, and one of them was also (randomly) included in the representative sample. A total of 136 households were surveyed in the pilot villages, while 200 households were surveyed in the non-pilot villages.

Figure A3.1 shows the share of income which households derive from livestock and bamboo are similar in the pilot and non-pilot villages, but that households earn a higher percentage of their incomes from crops in the pilot villages and from other activities in the non-pilot villages.

Figure A3.1: Sources of Household Income in Pilot and Non-Pilot Villages



Statistical tests show that per capita incomes and other per capita incomes are significantly different from one another (at the 5% level or higher), while bamboo incomes are significantly different at the 10% level. However, crop incomes, livestock and NTFP incomes, when expressed in per capita terms, are not statistically different from one another. It is important to note, however, that although other incomes are much higher in the non-pilot villages, there are just two households in these villages which have other incomes greater than 10 million kip. Note also that although mean

¹⁶ PI started to implement pilot trading activities in four of these villages in September 2010, and will extend these activities to other pilot villages in the coming year.

incomes from crops are higher in the pilot villages, this is offset by both overall incomes and household size being higher in the non-pilot villages.

Table A3.1 presents the number of observations, means and standard deviations for some of the key household and village level variables in the pilot and non-pilot villages. The final column of the table presents a formal t-test (with unequal variances) of whether the mean of the variables in the pilot and non-pilot villages are statistically different from each other. When the p-values are less than 0.10, 0.05 and 0.001, the variable in the pilot and non-pilot villages are different from one another at the ten, five and one per cent levels of statistical significance.

Table A3.1: Descriptive Statistics for Key Variables for Pilot Villages and Non-Pilot Villages, 2009

Variable/Covariate	Pilot Villages			Non-Pilot Villages			t-test
	N	mean	sd	N	mean	sd	p-value
Household size	136	5.559	1.725	200	5.805	2.532	0.290
Dependency ratio	136	0.482	0.176	200	0.490	0.155	0.691
Ethnic minority+	136	0.059	0.236	200	0.210	0.408	0.000
Age of head (years)	136	42.55	11.758	200	42.97	11.67	0.744
Gender of Head+	136	1.007	0.086	200	1.030	0.171	0.111
Highest grade completed by head	136	5.235	2.205	200	5.075	2.862	0.563
Highest grade completed by spouse	131	3.748	2.597	190	4.084	3.138	0.297
Highest grade complete by any adult	136	6.360	2.517	200	6.655	2.961	0.328
Land area (hectares)	136	1.363	1.164	200	1.408	0.961	0.709
Number of land plots	136	3.191	1.268	200	3.060	1.448	0.380
Has income from livestock+	136	0.846	0.363	200	0.915	0.280	0.061
Has wage or other income+	136	0.618	0.488	200	0.725	0.448	0.042
Number of cows or buffaloes	136	2.434	3.386	200	3.360	4.995	0.044
Has non-agricultural machinery+	136	0.029	0.170	200	0.040	0.196	0.599
Village has electricity+	136	0.353	0.480	200	0.640	0.481	0.000
Village has market+	136	0.118	0.323	200	0.160	0.368	0.266
Village has credit-savings group+	136	0.235	0.426	200	0.360	0.481	0.013
Total bamboo area in village (hectares)	136	117.2	111.9	200	68.50	79.4	0.000
Planted bamboo in village+	136	0.412	0.494	200	0.450	0.318	0.000
Mai Luong in village+	136	0.882	0.323	200	0.800	0.401	0.000
Mai Xang in village+	136	0.059	0.236	200	0.240	0.428	0.000
Bamboo handicrafts-fencing+	136	0.471	0.501	200	0.400	0.491	0.202
Visit by culm buyer (in last 3 years)+	136	0.235	0.426	200	0.480	0.501	0.000
Bamboo concession in village+	136	0.118	0.323	200	0.000	0.000	0.000
Classified as poor village+	136	0.235	0.426	200	0.167	0.373	0.008

Note: variables with a "+" are dummy variables.

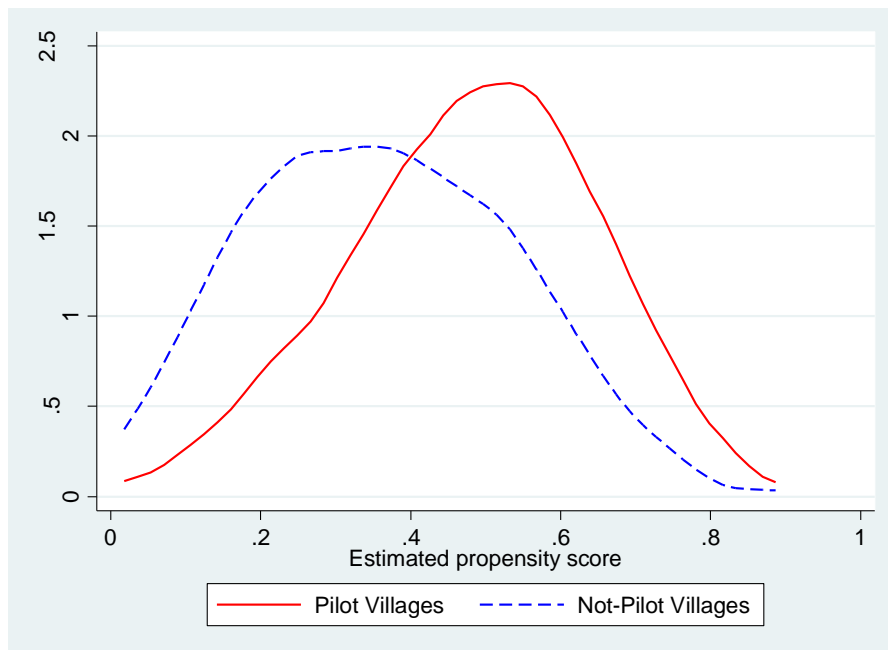
Most of the household level variables are not statistically different between the pilot and non-pilot villages. Exceptions to this are the share of households coming from an upland ethnic minority, plus the number of cows or buffaloes owned per household, both of which are significantly higher in the non-pilot villages. A slightly higher proportion of households in the non-pilot villages also have income from livestock, wages or other income. At the village level, the variables for total bamboo area in the village, whether there is planted bamboo, Mai Luong, and Mai Xang are all significantly higher in the pilot villages. Although there is no difference between whether the pilot and non-pilot villages have been visited by a culm buyer in the last three years, both of the bamboo concessions in the baseline are located in pilot villages. Pilot villages are significantly more likely to have mains electricity or a credit and saving groups. Finally, significantly more pilot villages are officially designated as poor villages according to the Lao Poverty Reduction Fund.

Since there are some variables which are statistically different from each other, it may be problematic to changes in outcome variables from the pilot and non-village villages directly. So propensity score matching is used to construct a statistical comparison group (households in the non-pilot villages which are similar to households in the pilot villages).¹⁷ The propensity score was estimated using a probit model with a range of household and village level covariates (variables) which can reasonably be regarded as predetermined and uncorrelated with whether or not a village is a pilot or non-pilot village.¹⁸ Note that no variables related to bamboo are included among the matching covariates, as these are related to how the pilot villages were selected. Whether or not a village was officially classified as poor also played a role in the selection of the pilot villages, so this variable is also excluded from the matching covariates. The balancing condition was then tested and satisfied. The resulting common support sample contains 326 households, with 8 households from the non-pilot villages and 2 households from the pilot village being excluded in order to meet the balancing condition. Figure A3.2 shows the distribution of the propensity scores in the pilot and non-pilot villages. A good degree of overlap (common support) in the scores of the pilot and non-pilot villages is apparent.

¹⁷ This is a commonly used technique for observational data in the evaluation literature. See Khandaker et al. (2010).

¹⁸ The following covariates were used in the propensity score estimation: household size (log), the share of children in the household, the age and age-squared (centered) of the household head, ethnic minority status, the highest level of education achieved by adult household members (primary, secondary or post-secondary), the area of land cultivated by the household, (the asset index estimated by polychoric PCA) and whether there was a market or saving and credit group in the village.

Figure A3.2: Propensity Scores for the Pilot Villages and Non-Pilot Villages



Once the PI's buying pilot activities in Houaphanh are well-established, it is intended to resurvey the pilot and non-pilot villages, so that a full matched difference-in-difference analysis can be undertaken. It is expected that this resurvey will take place in one or two years' time. The difference-in-difference analysis will allow changes in per capita incomes and poverty across the pilot and non-villages to be compared, with propensity matching used to ensure that households and villages with similar characteristics are being compared. The initial propensity score matching results presented here suggests that only small number of households (10) will be lost due to matching, so there is a high probability of being able to detect whether PI's activities have had a significant impact on incomes and poverty once a resurvey has been conducted.