

A Case Study on the Improvement of Local Pig Production in Sopchia Cluster, Phonexay District, Louangprabang Province in Laos

Souriyasack Chayavong*

Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki 305–8572, Japan

The Livestock Production Extension System, a division of the Laos Extension for Agriculture Project (LEAP), is playing a major role in poverty reduction by promoting sustainable rural development. To improve the quality of life of people in the target region, a field survey was conducted to analyze and characterize the current situation of 78 households in 8 villages in the Sopchia Cluster, Phonexay District, Louangprabang Province, Laos. Most (95%) of these villagers belong to the Khmu ethnic group, who typically are poor and minimally educated. Data were collected through individual interviews by trained personnel using a custom questionnaire. The data revealed that: 1) Although agriculture was a main source of income in the target villages, income remained low owing to limited land area and low productivity; 2) Life expectancy was low in all 8 target villages, most likely because of health problems caused by insufficient food; 3) The 3 major crops produced in the area are upland rice, followed by maize and cassava; much of the grain produced is used to feed pigs; 4) Livestock particularly pigs are not only the main source of income but also the primary protein source. The quality of life of the people in the 8 villages likely could be improved by information sharing and modernization of pig production systems through the Livestock Production Extension System under LEAP.

Key Words: Improving local pig production, Poverty reduction, Khmu people, Sopchia Cluster, Laos.

Introduction

Poverty is high in Laos, particularly among ethnic groups in the rural northern areas. Because of their scant resources and lack of education, these people typically rely on traditional methods of farming, which tend to be inefficient and harmful to the environment. Improved agricultural practices would offer many benefits to rural farmers in Laos. Because pig production is a common and long-standing practice among these communities, a field survey was used to characterize the current status of 78 households among 8 villages in SC, PLB, northern Laos. These data were used to suggest and implement improvements to pig production methods in SC, and by extension, other rural ethnic farming communities in northern Laos.

The Country of Laos

The Lao People's Democratic Republic (Laos) is a small, landlocked country located in the heart of the Indochina peninsula, in Southeast Asia. The country is bordered by China and Myanmar to the north, Vietnam to the east, Cambodia to the south, and Thailand to the west. Laos lies between latitude 14 to 23° N and longitude 100 to 108° E. The total territory of Laos is about 236,800 km². More than 80% of the land comprises mountains and plateaus at elevations of 100 to 2,800 m. Laos experiences a tropical monsoon climate, and annual rainfall ranges from 900 to 3,000 mm. This country has 3 seasons: a hot, dry period from March through May; heavy and frequent rain during June through October; and a cool, dry season from November through February. The temperature during the year ranges from 0 to 40°C.

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* Corresponding author: Department of Livestock and Fisheries, Ministry of Agriculture and Forestry, PO Box 6644, Sithan Nua, Souphanouvong (Luang Prabang) Rd Km 2, Sikhottabong District, Vientiane Capital, Lao PDR.

Tel/Fax: (Office) +856 21 215 242-3, +856 21 215 141, (Mobile) +856 20 2221 3699, E-mail: souriyasack@yahoo.co.uk

Upland Farming

More than half of the national economy of Laos depends on agriculture (Ministry of Agriculture and Forestry 2007), and agricultural production is effectively the sole source of food and income for most rural households. Agriculture in Laos is mostly small-scale and follows traditional production systems. The farming system in Laos is divided into upland and lowland systems (Chapman *et al.* 1998).

As a technique, upland farming involves shifting cultivation and is the only means of food security for Laos' ethnic farmers, especially those in the northern provinces. However, shifting cultivation leads to deforestation and degradation of the environment and unsustainable land use. Therefore, to halt shifting cultivation and assist the sustainable farming systems in upland areas, the Government of Laos recently established new agriculture, forestry, natural resources management, and rural development goals. These goals are based on the concept of long-term and sustainable development and have economic, social, and ecological dimensions (Ministry of Agriculture and Forestry 2010). The 4 current goals for agricultural and forestry development are: enhancement of food security; enhanced production of agricultural and forestry goods; sustainable producing pattern allocation and rural development; and sustainable forest management. In particular, the Government of Laos has been encouraging farmers to adopt well-researched and productive farming methods, such as sustainable land-use systems for agrobiodiversity (Ministry of Agriculture and Forestry 2010). In particular, the Government of Laos has focused on improving livestock production systems and has given the highest priority to practices that promote rural development, reduce poverty, and diminish shifting cultivation.

Pig Production in Laos

In 2009, the pig population in Laos was 2.2 million and accounted for 27% (the largest contribution) of the total livestock production for that year. Commercial intensive pig production systems accounted for approximately 25% of this total, with smallholder farmers contributing the remaining 75%. Pig production is a common activity to support the livelihood of ethnic smallholders in northern Laos; most farm households in this region rear at least a few pigs (Department of Livestock and Fisheries 2010).

To have sufficient household income, upland farmers in Laos traditionally raise 3 or 4 adult pigs for sale each year. Women typically are the key persons in this effort, and, with traditional practices, they spend 2 to 3 hours each day collecting and preparing feed for pigs (Australian Center for International Agricultural Research 2010). The income generated from these animals is used to defray expenses such as school fees, medications, agricultural improvements, and various emergency needs (Phengsavanh and Stur 2006). Typically farmers have sold their pigs directly from the farm to a local trader, who buys several animals in the village, or have themselves brought the animals to the local market for slaughter or movement to larger markets. In the rural and mountainous areas of Laos, approximately 7% to 10% of all pigs produced annually in remote villages are slaughtered locally, during festivals, weddings, and rituals (Department of Livestock and Fisheries 2009). However, market-oriented pig production occurs in villages that are close to roads and markets. Farmers in these villages have more regular cash incomes from selling their pigs than do farmers in the remote areas (Australian Center for International Agricultural Research 2010).

Improving crop and livestock production system is the particular purview of farmers. Numerous techniques and technologies have been introduced to improve pig production throughout the country, especially in the case of local pig production by farmers in northern Laos. Consequently, these farmers have implemented improved feeding techniques and preventive health measures, such that pigs can be reared for selling faster. The shorter time to raise pigs can benefit families and makes it attractive for farmers in the surrounding villages to begin rearing pigs. Many farmers and villagers in northern Laos have extended their local pig-rearing operations to produce piglets for sale and fatten pigs for slaughter. Piglet production is practiced mainly by farmers in the more remote upland areas (often Hmong and Khmu ethnic groups), who sell these piglets to farmers in other villages for fattening. Often villages located in lowland areas concentrate on fattening pigs (Phengsavanh and Stur 2008).

Obstacles to Pig Production in Laos

As a small and developing country, Laos has limited financial resources, inadequate technical skills, and insufficient facilities and infrastructure to develop the

livestock and piggery sector to achieve appropriate quality and safety requirements. Similarly, the private sector's investment in native pig development is weak. In addition, Laos has limited human resources for pig development. The main constraints to local pig production are disease epidemics, high piglet mortality rates, poor growth rates, and high labor demand. Disease outbreaks cause huge losses in pig production by smallholders. In some cases, mortality rates among village pigs are quite high up to 90% for a single outbreak of classical swine fever (CSF). In addition, poor nursing by piglets is prevalent. Farmers in rural, especially in mountainous, areas often lose the majority of piglets born, an outcome that dampens their willingness to continue rearing pigs.

Poor growth rate of animals is another difficulty that curtails villagers' motivation for expanding pig rearing efforts. The poor growth rate in these pigs is related to issues associated with their feeding, which has a high labor cost. Labor is a very limited resource for upland farmers, who produce rice by using a labor-intensive shifting cultivation system. Women, who are the key laborers in pig production, typically spend on average 3 h daily collecting and preparing feed for pigs. Spending excessive amounts of time for pig rearing leads to poor health among the women, their children, and even their families as a whole, therefore they had to collect raw feed materials, firewood from forest, and cook traditionally the feeds before feeding the pigs. Consequently, reducing the labor requirement of all around family activities for pig rearing would improve the growth rate of pigs and health of women, children, and families in upland and mountainous areas of Laos (Phengsavanh and Stur 2008).

Important Points to Improve Native Pig Production

The 3 organizations (Department of Livestock and Fisheries/DLF, National Agriculture and Forestry Research Institute/NAFRI, National Agriculture and Forestry Extension Service/NAFES) of the Ministry of Agriculture and Forestry of Laos have been working closely to tackle the aforementioned problems as: disease epidemics, high piglet mortality, poor growth rate, and high labor demand. Policies, strategies, plans, and regulations regarding pig production are developed by the Department of Livestock and Fisheries (DLF). In addition, the National Agricultural and Forestry Research Institute (NAFRI) has discover-

ed possible ways to improve livestock production. For example, one study acknowledged that pigs in northern Laos that were fed a high-quality commercial diet such that the energy and protein supplied exceeded the animals' requirements gained more than 500 g in body weight daily (Keonouchanh *et al.* 2008). However, the authors cautioned that pigs' intake of nutrient-dense feed should be restricted to avoid excess accumulation of body fat, which is expensive in terms of energy and feeding costs (Keonouchanh *et al.* 2008). Consequently, the authors highlighted the need to provide knowledge (i.e., nutrient strategies) to farmers to ensure optimal performance during pig production (Keonouchanh *et al.* 2008). Another important aspect to address to improve pig production in northern Laos is the restoration of land that has been subjected to shifting cultivation, and the subsequent evaluation and adaptation of forage technologies to the unique situation of rural upland communities (Phengsavanh and Stur 2008). Furthermore, using the CSF vaccine has been beneficial and cost-effective for smallholder pig farmers (Conlan 2006), to the extent that the success of preventive health measures for pig production in northern Laos depends on CSF vaccination (Vitesnik 2006). And, The National Agriculture and Forestry Extension Service (NAFES) of the Lao Ministry of Agriculture and Forestry has combined matters of policy, strategy, planning, regulation, and research addressing livestock development in Laos into the Lao Extension Approach (LEA), the extension system for livestock and crop expansion. To hasten livestock development, especially local pig production, LEA established a program for working with farmers in the mountainous regions of northern Laos, particularly developing a specific model for working with indigenous people in these areas (Millar and Sendala 2009).

The Khmu People

Laos is one of the poorest countries in the world, with poverty more prevalent in rural than urban areas. In 2009, 26% of the country's population was below the poverty line (Ministry of Planning and Investment of Laos 2010). The 6.5 million people who live in Laos represent 3 ethnic groups: Lao Loum (or Lao, 62%); Lao Theung (or Khmu, 25%); and Lao Soung (or Mhong, 13%) (National Statistic Center 2010). Along with the Lao (or Lwa or Lawa), the Khmu (or Khamu) are the oldest inhabitants of the land presently

called Laos (Viravong 1964). In general, the Khmu are poor and lack education; many of them cannot write and read either the Lao or their native (Khmu) language. In particular, many Khmu women cannot communicate effectively in Lao, the country's official language (Stelling and Millar 2009). Historically, the Khmu people have settled on forested slopes and slope basins between 400 and 800 m above sea level. Settlements were established where the biomass was large enough to provide sufficient food for the small number of inhabitants. The Khmu's traditional agricultural production system comprises sloping land agriculture, hunting, and gathering of forest products. Traditional crops include upland rice and maize, and the animals raised include pigs, poultry, cattle, and buffaloes (Green Discovery Laos 2005).

Justification for Improving Local Pig Production in Sopchia Cluster

Pigs play an important role in the household economy of Laos, and pig production is a typical activity of smallholders throughout the country especially in the northern mountainous region and is an important component of these people's livelihoods. In rural areas, women traditionally have performed the majority of pig-rearing chores; they spend much time and labor each day collecting and preparing feed for their pigs. In Sopchia, pigs are sold when a need for cash arises, such as for school fees, medical expenses, or agricultural improvements.

Although various attempts to improve pig production in northern Laos have long been practiced, these efforts were not fruitful or sustainable. In 2006, these endeavors gained new momentum with the implementation of the Capacity Building for Smallholder Livestock System Project (CBSLSP). This project focused on building the capacity of 4 District Agriculture and Forestry Office staffs members, who support farmers through the 'learning-by-doing' method and match mentors with trainees. Project activities were: (1) training farmers in livestock production techniques and technologies; (2) supporting educational teams who worked with farmers in target villages; (3) establishing livestock farmers' groups; and (4) organizing the exchange of work methods and knowledge.

Implementation of CBSLSP successfully led to increases in livestock production and the capabilities of educational staff members. Improvements in livestock production particularly pig production led to increases

in the family incomes of farmers in the target villages. In parallel with these benefits to farmers, the target staff members have been certified to carry out the same responsibilities as part of new projects. In recognition of this success, the Asian Development Bank has approved a new, continually operating project (2009–2014) called the Northern Region Sustainable Livelihood through Livestock Development Project (NRSLLDP) or Livestock Development Project (LDP) for the 5 northern provinces of Laos (Asian Development Bank 2008). In 2009, the Agro-Ecosystem Analysis and Enhancing Marketing in Phonexay (Product Selection) component of The Agricultural Biological Initiative (TABI) selected native pig as the first of 3 priority products for the improvement of, and increase in, volume and quality. Increasing native pig production in northern Laos will supplement the demand for pork (more than 15 t daily) in Louangprabang, 70% of which currently comes from Thailand (Connell 2009). In June 2010, The Agricultural Biological Initiative (TABI) founded the Improving Native Pig Production Systems and Marketing Context (INPPM) subproject, the focus of which is to increase both the quantity and quality of production of native pigs. Activities under INPPM include: (1) building the capacity of educational staff members; (2) supporting personnel working with farmers in target villages; (3) establishing livestock farmers' groups; (4) facilitating the exchange of knowledge and working methods; and (5) identifying marketing opportunities and strategies for local pig production. To increase the volume and quality of local pig production, INPPM will promote the biodiversity of pig breeds and feeds (Non-timber forest products, legumes) and the use of natural medicine and traditional herbs to encourage both self-sufficiency and enhanced productivity of native pigs (The Agricultural Biological Initiative 2010).

Study Objectives

The purpose of the study was to identify ways to improve the livelihood of the Khmu people by using improvement of local pig production as the entry step. The success of this effort will not only increase family incomes and food security but also improve the health of Khmu women and provide a model of rural development and environmental conservation in the mountainous regions of Laos.

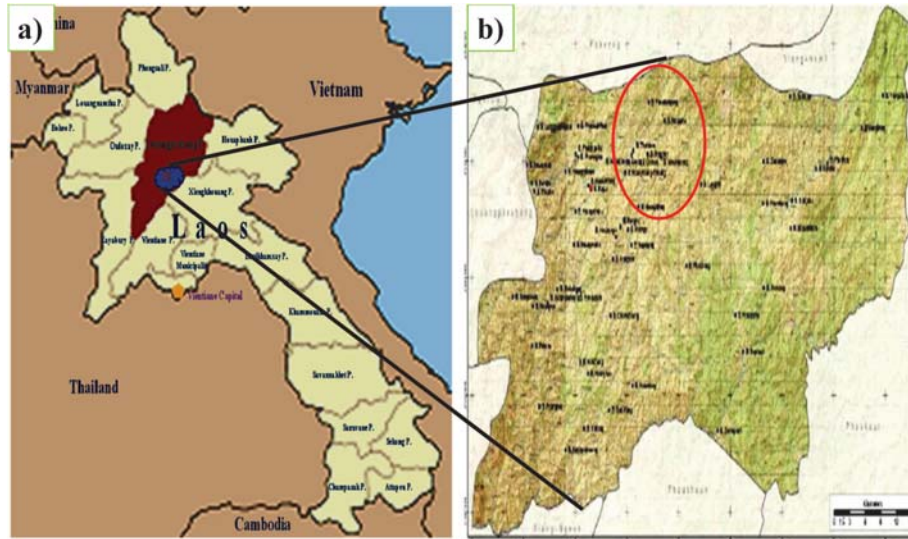


Fig. 1. a) Map of Laos (Source: The Agricultural Biodiversity Initiative, 2009). b) map of Sopchia Cluster, Phonexay District (Source: Wikimedia, 2010).

Methods and Materials

Study Area

The target study area was the Sopchia Cluster, Phonexay District, Louangprabang Province, Laos (Figure 1).

Louangprabang Province

Louangprabang is 1 of 8 mountainous provinces in northern Laos, comprising approximately 16,875 km² and 440,000 inhabitants in 2009 (Planning and Cooperation Department of Louangprabang 2010). This province lies on latitude 19.88.56 N and longitude 102.13.47 E. Originally, the land was inhabited by people of Mon khmer/Khmu and Lwa/Lao descent (Viravong 1964). The region lies at 172 to 2200 m ASL. Louangprabang experiences 2 seasons annually; the cool season (19 to 22°C) occurs from November through January, and the warm season (24 to 27°C) is from February through October; and annual rainfall ranges from 5 to 298 mm (Provincial Agriculture and Forestry Office of Louangprabang 2009). Louangprabang and Phonexay are 2 of the 12 administrative districts of Louangprabang Province (National Statistic Center 2010).

Phonexay District

Phonexay is one of the 6 poorest districts in Louangprabang and one of the 47 poorest districts in Laos (National Statistic Center 2010). Phonexay comprises 10 administrative clusters, including Sopchia.

This district is located in the center of the northern high-mountainous region of Laos, about 100 km north-east of Louangprabang. Phonexay comprises 63 villages, with 5055 households. The total population of Phonexay is 29,419, of which 14,823 are women; 60.18% of the total population is Khmu, 30.33% is Mongh, and 9.49% is Lao. More than 80% of the total population is subject to poor infrastructure and conditions: these people earn less than \$1USD per day and lack sufficient food, safe drinking water, clothing, housing, and other basic needs. The people of Phonexay typically are small-scale householders who practice upland-mountainous agriculture. Natural resources are the predominant focus of their livelihood, with a lesser contribution from traditional farming and livestock-rearing efforts (Phonexay District Agriculture and Forestry Office 2007).

Sopchia Cluster

Sopchia is 1 of the 10 clusters of Phonexay District, Louangprabang Province, Laos. Sopchia comprises 8 villages, namely: 1. Donexay, 2. Sopchia, 3. Houysinoua, 4. Houamuang, 5. Phakhok, 6. Houaychia, 7. Houaydong and 8. Tadthong. The cluster is located in the high-mountainous area of central Northern Laos, approximately 15 km southeast of Phonexay Municipality and 115 km northeast of Louangprabang City. The climate in Sopchia is cold (4°C) in nighttime from September through February and hot (39°C) in daytime from March through August (Phonexay District Agri-

culture and Forestry Office 2007). Sopchia was founded more than 50 y ago. In the past, each village in the cluster was a small number of households. However, the population of the villages has increased during recent years because of social development and increased availability of government services. In 2010, Sopchia comprised 616 households, with a total population of 3718 people, most of whom are Khmu and have poor living conditions, and small numbers of Laoloum (5%) live and trade in the center of this area. Each village has 1 headman and 2 deputy headmen as the local authorities. For appropriate facilitation, social organizations such as groups for women, youth, and the elderly exist at the village level (Phonexay District Agriculture and Forestry Office 2010). The livelihoods of the Khmu people in Sopchia are dependent on natural products and upland farming. Rice from slash-and-burn cultivation with low productivity is the main food crop for families; maize, cassava, bananas, and other plants are cultivated for feeding livestock and as cash crops. Livestock (buffaloes, cattle, goats, pigs, and poultry) provide the main family income. Pig production is the most important in terms of income, whereas poultry is the main protein source for families.

Pig Production in Sopchia Cluster

Whereas there are three moderate-scale Laoloum farmers who follow semi-intensive pig production techniques, almost all pig farmers in Sopchia are Khmu and rear pigs according to small-scale, traditional, low-productivity methods. For example, with traditional low-productivity rearing, pigs require nearly 2 years to reach the sale weight of 60–70 kg (Phengsavanh *et al.* 2008). In addition, numerous pigs in Sopchia die from epidemic diseases such as CSF (Conlan *et al.* 2008). Furthermore, the constraints of rearing native pigs in villages in northern Laos include lack of breeding and rearing management, using poor-quality feeds, and other issues (Keonouchanh 2010). In June 2010, The Agricultural Biological Initiative began to support native pig production and marketing systems through the Provincial Livestock and Fishery Section (PLFS) of Louangprabang Province and the Phonexay District Agriculture and Forestry Office.

Data Collection and Analysis

As part of the current study, a field survey was conducted to assess and characterize the current status of 78 households in the 8 villages of Sopchia Cluster, Phonexay District, Louangprabang Province, Laos.

The study population of 78 households (approximately 12% of the total number) was selected randomly, and the data were collected through individual, face-to-face interviews conducted by trained teams using a custom questionnaire. Data on socioeconomic factors were collected in early January 2011; interview was performed in 2 parts (training and implementation) and a total of 4 steps.

As the first part and step of data collection, I facilitated training sessions for the interview teams. These sessions involved the 2 teams that had been selected from the Phonexay District Agriculture and Forestry Office to conduct the survey. During these sessions, I instructed the teams in various techniques for communicating and working with the farmers and villagers and introduced the use of the questionnaire. To obtain useful data, the communication techniques focused on maximizing participation and methods for working with farmers and villagers in northern Laos, particularly those of the Khmu ethnic group.

The implementation part of the data collection was divided into 3 steps: meeting with village authorities, focus-group discussion, and individual interviews. All 3 steps were done by trained staff members and were conducted in each village. Meeting with village authorities was the requisite courtesy at the beginning of the study. The study team met with each village headman and his committee. The purpose of this meeting was to gather general information regarding village history, social and economic development, and the importance of local pig production to the community. Focus-group discussions occurred in each village, during which the village authorities organized a meeting of the farmers among the random sample. The main topics discussed included the importance of local pig production to the local livelihood, current production practices and constraints, and families' economic issues. In the final step, trained personnel interviewed each head of a household within the random sample set by using a custom questionnaire. These interviews took place in the farmers' homes, to collect additional information about families' agricultural practices, constraints, and household incomes.

The questionnaire was divided into 5 sections. Section A addressed general household information, including the number of family members and their names, religion, sex, age, familial relationship, health status, and educational status. Section B focused on agricultural production, including the area under culti-

vation with various crops and plants, the annual production and unit price, and the amount of labor used for production. Section C dealt with livestock production status, including animal species, the number of animals per species, feed types and sources, labor used for raising animals, and price of traded animals. Section D inquired about family income and expenditure, including sources of income and types of expenditure. In addition, the questionnaire solicited information regarding problems with livestock and cultivation; family expectations and plans for improving livelihoods; and family economic and environmental use indicators. Secondary data and information were gathered as needed to support the various items. All data were analyzed by using Microsoft Office Excel 2007.

Results and Discussion

Age Distribution

Overall, the structure of age distribution decreased sharply from young to elderly people, particularly in the 20- to 30-y bracket (Figure 2). Additional information revealed that 14.45% of young people between 20 and 30 years old, who would normally provide the bulk of the labor, had migrated from the cluster for the purposes of employment (8.75%) and education (5.70

%). However, because of the extremely low educational levels of these young migrants, they lack appropriate and sufficient knowledge and training and are restricted to working as physical laborers in factories and construction areas in towns and cities. Alarming, the study revealed that the ratio of workers of optimal age (people between 20 and 59 years old) to workers of suboptimal age (younger people and the elderly) was about 1 : 1.36. Additionally, the optimal age people worked for the young people from the villages aged 20 to 30 accounted for only 5.7% of students in the towns and cities. The data enable the division of the sample population into 4 groups on the basis of physical characteristics: young, 0–19 y; main-labor age, 20–59 y; aged people, 60–79 y, and elderly, 80–99 y. The youngest group accounted for 54.1% of the total population, the main-labor group accounted for 42.4%, and aged people 3.5%; no one in any of the 8 villages met the criterion of ‘elderly’ (Table 1). The age distribution shows that there has small labor force in each village; therefore it limits the number of pigs that villagers can raise by traditional methods, which are labor intensive. Ways to increase pig production are to increase the labor force

Villagers’ Educational Level

In general, the educational level of respondent

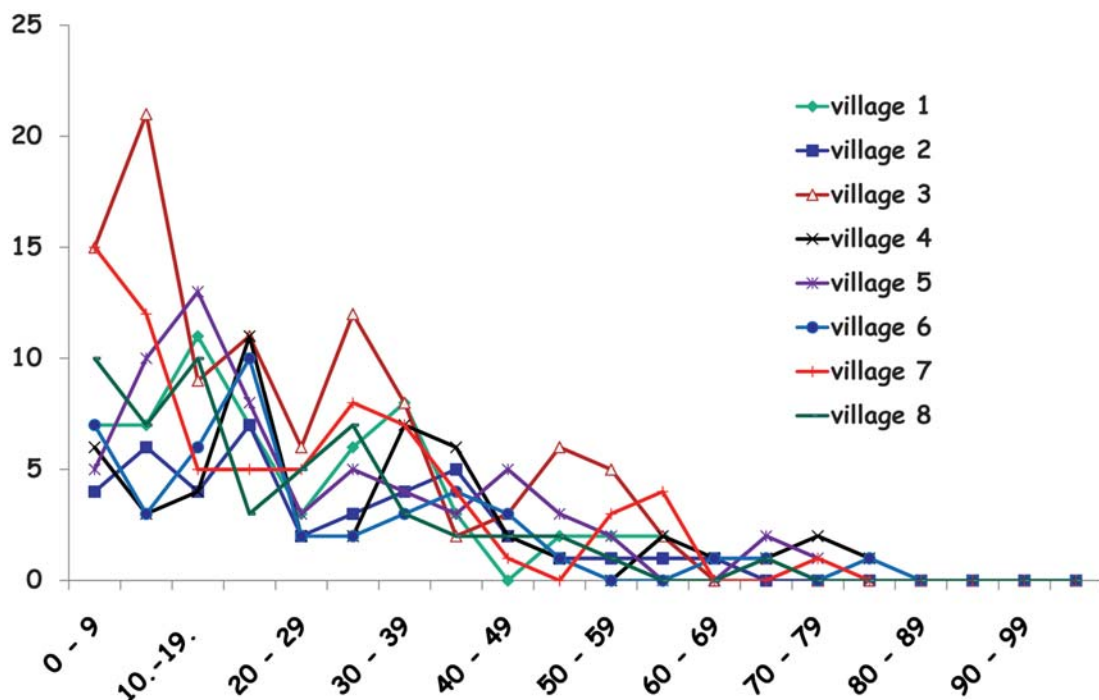


Fig. 2. Age Distribution of Respondents in the Sopchia Cluster Villages.

Table 1. Age (y) distribution of villagers

Village	0-9		10-19		20-29		30-39		40-49		50-59		60-69		70-79	
	m	f	m	f	m	F	m	f	M	f	m	f	M	F	M	f
1	7	7	11	7	3	6	8	3	0	2	2	2	1	0	0	1
2	4	6	4	7	2	3	4	5	2	1	1	1	1	0	0	0
3	15	21	9	11	6	12	8	2	3	6	5	2	0	1	0	0
4	6	3	4	11	2	2	7	6	2	1	0	2	1	1	2	1
5	5	10	13	8	3	5	4	3	5	3	2	0	0	2	1	0
6	7	3	6	10	2	2	3	4	3	1	0	0	1	1	0	1
7	15	12	5	5	5	8	7	4	1	0	3	4	0	0	1	0
8	10	7	10	3	5	7	3	2	2	2	1	0	0	1	0	0
Total	69	69	62	62	28	45	44	29	18	16	14	11	4	6	4	3

m, male; f, female

No villager was older than 79 y.

villagers was quite low; most of them had received very little formal schooling. The total percentage of villagers with some school education was 64.25%, including: primary school 51.03%, secondary school 10.95% and high school 2.27%. Additionally, 16.12% of all villagers were illiterate, preschool children accounted for 19.63% (Table 2). Among the 5 groups, in the 8 villages, village 2 had the highest proportions of villagers with high school (4%) and secondary school (13%) education, as well as the greatest population of preschoolers (61%), but village 3 had the highest population with primary education (58%). Illiteracy was greatest (30.00%; males, 6.67%; females, 23.33%) in village 1 and second greatest (28.30%; male, 9.43%; female, 18.87%) in village 8. A few school teachers and healthcare workers were local villagers, but most were outsiders, who worked periodically. Similarly, most of the young adults who went to study in the towns and cities did not return to work or live in Sopchia, because they could find better working and living conditions elsewhere. For these and other reasons, capacity building must begin with the current residents, who (because of age, education, or other constraints) have tended not to migrate from Sopchia. The low educational level and illiterate is main barrier to pig production, therefore they do not know how to improve the pig feed quality or disease control, etc. To tackle with this problem is to provide them education. Then, the pig production will help to increase family income which can support their children's education.

Family Size and Male to Female Ratio

This analysis involved a total of 484 people from 78 surveyed households (Table 3). Village 6 had the fewest households (7) among the 8 villages, but village 2 contained the fewest people (41). Overall, the 8 villages had an average family size of 6.3 persons per household; on a per-village basis, the largest average family size was 9.2 persons per household (village 3) and the smallest was 4.6 (village 2). There were slightly more males than females overall, yielding a male to female ratio of 50.6:49.4 for the 8 villages as a whole. Males predominated slightly in villages 1, 5, 7, and 8; females were more numerous in villages 2, 3, and 4; and the male to female ratio was 1 : 1 in village 6 (Table 3).

Although males and females were present in approximately equal numbers, sub-optimal laborers (children and elders) predominated (Table 3). This large number of sub-optimal laborers likely led to overwork of very young people to provide the labor necessary in traditional agriculture. Moreover, the illiteracy and poor education of this group prevented changes in their status, and they were not aware of modern or appropriate techniques and technologies to improve their agricultural production and systems. Accordingly, the results of the use of traditional practices were poor productivity, with subsequent low incomes and increased poverty.

Agricultural Land Use

The survey results revealed that average land use for agriculture was 1.33 ha per household (0.214 ha per

Table 2. Highest Educational Levels of Adult Villagers (% of village population)

Village	High School	Secondary School	Primary School	Illiterate		Children
				Men	Women	
1	2.00	7.00	28.00	6.67	23.33	33.00
2	4.00	13.00	12.00	4.88	4.88	61.24
3	1.00	5.00	58.00	2.97	5.94	27.09
4	1.00	5.00	37.00	1.96	9.80	45.24
5	0.00	5.00	35.00	6.25	10.94	42.81
6	2.00	9.00	20.00	2.27	13.64	53.09
7	1.00	5.00	33.00	2.86	8.57	49.57
8	0.00	4.00	24.00	9.43	18.87	43.70
Average	2.27	10.95	51.03	4.55	11.57	19.63

Table 3. Ratio of Men to Women and Average Family Size (no. of persons)

Village	No. of household	Population	Men : Women	Average family size
1	10	60	55 : 45	6.0
2	9	41	44 : 56	4.6
3	11	101	46 : 54	9.2
4	10	51	47 : 53	5.1
5	11	64	52 : 48	5.8
6	7	44	50 : 50	6.3
7	11	70	54 : 46	6.4
8	9	53	58 : 42	6.8
Total	78	484	Mean 50.6 : 49.4	6.3

person), which was allocated among 6 cultivable crops (Table 4). The 7 villages that were populated only by Khmu people used their land for growing upland rice, to gain food security. In contrast, the remaining village (no. 2), which included some Laoloum residents, primarily used their land for growing pig-feedable cultivars such as maize and cassava (Table 4), additionally for growing sweet potato, taro, banana, stylo and other vegetable as the commodity and pig feedable cultivars. As the average of agricultural land use is quite small area, therefore it is not possible to increase number of buffalo or cattle. While the amount of the land can support to increase pig raising, therefore it needs small piece of the agricultural land to grow stylo to increase the pig feed protein.

Agricultural Production

The findings of the study survey confirmed that

Sopchia residents used a traditional mountainous agricultural system. The horticultural sector included upland rice, cassava, maize, lowland rice, sugarcane, and sesame; the livestock sector comprised buffaloes, cattle, goats, pigs, and poultry. Both types of agriculture are very important to the livelihoods of the villagers, because of upland rice was the main food crop that they depended on. In contrast, livestock were the main source of income, providing most the families' discretionary income. Further exploration revealed that these efforts and allocations yielded insufficient food for the families more than 30% of the time, on average. For example, average production of upland and lowland rice was 1.31 t per household and 0.21 t per person in Sopchia; this compares with 0.45 t per person in Laos overall and 0.35 t per person for Laotians who live in poorest districts (Ministry of

Table 4. Agricultural Land Use (in ha)

Village	Upland Rice	Upland maize	Cassava	Sugarcane	Sesame	Lowland rice
1	4.7	2.2	0.7	1.3	2.5	0.9
2	1	1.6	2.5	2.7	1.5	0.5
3	19.6	2.2	0.7	1	0.2	0
4	11.3	0.4	0.1	0	1.4	1.2
5	6.5	0.7	1	0.3	0.4	0.7
6	6.9	0.7	1.4	0	1.5	1.3
7	7.3	0.6	0.6	0	0	2.6
8	5.8	1.3	0.9	0	1.5	0.3
Total	63.1	9.7	7.9	5.3	9.0	7.5

Table 5. Agricultural Production in 2010 (t)

Village	Upland Rice	Upland Maize	Cassava	Sugarcane	Sesame	Lowland rice
1	7.11	2.60	4.00	1.55	0.60	2.20
2	2.50	2.70	7.70	9.12	0.28	1.80
3	15.60	3.45	4.80	0.46	0.10	0.00
4	14.32	0.80	0.40	0.00	0.51	0.00
5	10.46	1.13	2.40	0.46	0.15	0.75
6	13.95	0.90	2.90	0.00	0.75	2.77
7	11.80	0.70	1.30	0.00	0.00	5.08
8	13.05	0.87	2.10	0.00	0.25	1.00
Total	88.79	13.15	25.60	11.59	2.63	13.60

Agriculture and Forestry 2010). The remaining agricultural production was earmarked for animal feed, home consumption, and sale (Table 5). The pig production can be promoted to fill up the insufficient food. Therefore, there is cassava, maize, agricultural by-products, rice bran and natural vegetables, which should be used to feed pigs and buy to fill up the lacking foods.

Family Income

According to the gathered data, household income was the most important indicator of family wealth. Family income covered all family expenditures, including food and remained crop foods that imbalanced, traditional contexts, agricultural needs, health care, and school fees. A closer look at the data revealed that family income was derived from 4 different sources: livestock, cultivated crops, Non-timber forest products,

and businesses. Livestock accounted for the greatest proportion of overall income (36.51% to 44.76%) in 4 of the 8 villages (Table 6).

Further research attempting to reveal possible means for improving the livelihood of the Khmu people in Sopchia showed that the main income from businesses resulted from hard manual labor by men, such as working in construction, digging land, and transporting loads on the shoulders, all of which were beyond the physical capabilities of women. The income from NTFP reflected the collection of natural products. Although this activity represents a potential alternative income source, the local environment of Sopchia has been damaged for a long time by shifting cultivation, deforestation, and other insults and, without long-term efforts to rejuvenate the land, yields are likely to be low and to diminish over time. Because crop produc-

Table 6. Annual family income (%) from various sources

Village	Livestock	Crops	Non Timber Forest Products	Business
1	44.76	20.00	6.86	28.38
2	26.31	34.46	0.24	38.99
3	75.38	8.42	8.32	7.88
4	18.42	22.68	15.47	43.42
5	39.01	8.67	42.33	10.00
6	23.41	46.89	12.53	17.18
7	55.03	11.17	12.57	21.23
8	36.51	30.93	11.43	21.13
Average	39.85	22.90	13.72	23.53

Table 7. Percentages of Income from Various Types of Livestock and Animal Ownership (%)

Village	Income from Various Types of Livestock				Household Animal Ownership			
	Buffalo	Cattle	Goats	Pigs	Buffalo	Cattle	Goats	Pigs
1	34.57	29.63	17.28	18.52	50.00	60.00	40.00	60.00
2	28.33	3.33	15.00	53.33	44.44	11.11	33.33	66.67
3	33.91	29.57	0.00	36.52	45.45	54.55	0.00	100.00
4	21.48	28.89	19.26	30.37	50.00	70.00	50.00	80.00
5	1.72	8.62	29.31	60.34	9.09	18.18	18.18	81.82
6	3.51	19.30	10.53	66.67	14.29	42.86	14.29	57.14
7	22.86	28.57	0.00	48.57	45.45	54.55	0.00	63.64
8	21.05	26.32	42.11	10.53	11.11	22.22	22.22	66.67
Mean	22.86	23.21	14.29	39.64	34.62	42.31	21.79	73.08

tion represents a family's food security, it could not be promoted as a main commercial activity to improve livelihoods by increasing off-farm sales. However, crop cultivation would be an excellent supporting activity, if the selected crops, like maize and cassava, had value-added purposes as animal feeds, especially for pig production. As shown previously, livestock were the biggest source of income, and livestock production might be a way to improve livelihoods in Sopchia.

To this end, an analysis of the interview data revealed that the 4 species-specific income averages were quite different: raising goats accounted for only about 14.29% of livestock-associated income overall; raising pigs accounted for 39.64%; buffalo 22.86%; cattle 23.21%; and goats 14.29%. However, by village, income from pig production was the most im-

portant in villages 2, 3, 4, 5, 6, and 7 compared with buffalo for village 1 and goats for village 8.

Income from Livestock Production

The survey data showed that pigs accounted for the biggest share of income among the 4 animal species and in 6 of the 8 villages (Table 7). Nevertheless, all livestock production was practiced according to traditional technologies; therefore the rearing period was quite prolonged, and profit was low. Approximately 73% of all households in Sopchia reared pigs traditionally (Table 7), keeping them in pens and feeding them maize and cassava that they had planted, along with rice bran, garden byproducts, and wild vegetables. In addition, some villagers planted stylo to use as a concentrate feed for their pigs. However, pig health care and management were lacking in improvement

because of the use of poor facilities and human resources and outdated methods of dissemination of techniques and technologies. In comparison, pastoral rearing of buffaloes, cattle, and goats was accomplished by men only, who lacked sufficient land to grow and store feed for these ruminants. In terms of practicality, the steep mountainous location of Sopchia is inappropriate for increased production of cattle and buffalo. However, the Department of Livestock and Fisheries's zoning strategies and policies toward 2020 for livestock production promotion in Laos acknowledge that mountainous areas, especially northern Laos, are suitable for promotion of pig production. In addition, the success of the CBSLSP of the Department of Livestock and Fisheries during 2006 to 2008 has been confirmed by the fact that 5 of the 8 villages in Sopchia showed substantial improvements in local pig production. Therefore, in 2010, the Department of Livestock and Fisheries and The Agricultural Biological Initiative renewed their commitment and supply of resources toward improving native pig production in all 8 villages of Sopchia Cluster, with the original target group of 55 farming households. In 2011, the project is expected to expand to 7 more villages, to benefit Hmong farmers and villages (The Agricultural Biological Initiative 2010).

Conclusions

The native pigs reared by farmers in Sopchia Cluster contribute greatly to the farmers' food and livelihood security. However, the traditional pig-rearing methods that these farmers use currently fail to routinely provide sufficient subsistence for the farmers and their families and lack sustainability for livelihoods and for society. Moreover, these traditional methods of pig production are problematic in that they are very labor intensive and therefore damaging to the health and welfare of farm families. The Government of Laos has promoted various strategies regarding pig production. In particular, improving and sustaining pig production in Sopchia requires the implementation of both technical-technological aspects and working strategies. It will be important to continue using native pig breeds and raising them on a small scale, to reduce the risk of loss and to recover the cost of investment. In the current study, data were collected by survey from village householders in Sopchia to discern how to improve local pig production. In turn, improved pig production will decrease poverty and conserve local genetic re-

sources in the context of the knowledge, experience, traditional practices, and opportunities of these ethnic farmers.

The leading obstacle to improving livelihood in Sopchia Cluster is poverty. Contributing factors include: a main labor force that is smaller than the population of preschool children and elders; small area (1.33 ha) and highly sloping land for agricultural production; low to insufficient agricultural production for families' consumption; poor education and a high illiteracy rate; and low income. To emerge from poverty, these farmers and their families must adjust, adapt, and enrich their livelihoods and environmental conditions. To this end, most of these farmers are already familiar with rearing pigs; modifying the methods used to raise these animals can ease farmers' reliance on labor-intensive and ecologically unsustainable upland farming. Increased pig production likely can be accomplished by using the same amount of agricultural land as previously while reducing labor and increasing income. The following recommended steps and criteria for implementation can help achieve these goals.

Recommendations

Improving local pig production in Sopchia Cluster is one facet of social development in Laos, the goal of which is to reduce poverty, increase family income and food security, and maintain the health of rural people, especially women. This development carefully considers the needs of all stakeholders: local authority, farmers, traders, and agricultural teams'. In particular, these staff members will be responsible for executing the various developmental components, such as transferring technical and technologic information; demonstrating the transferred techniques and technologies; establishing marketing responsibility; and facilitating collaboration among all people and organizations concerned (Figure 3). However, the specific means for achieving this goal is to develop the pig sector (Figure 4).

To achieve these goals, appropriate long-, mid-, and short-term plans need to be developed that address implementation, monitoring, evaluation, and adjustment for reimplementation. The focus of the long-term plan is sustainability. Therefore, the long-term plan should set the desired 10-y end point, such as whether local pig production will be a commercial or semi-commercial enterprise, will replace at least 70% of the shifting cultivation, and so on. The mid-range



Fig. 3. Working Strategies for Improvement of Local Pig Production System

plan should consider those activities that should desirably be performed 3 to 5 years after the initiation of pig production improvement efforts. Short-term plans should involve activities that should be performed monthly or annually.

The first, most important step toward improving local pig production is to ensure that the target farmers have a clear understanding of both their need to participate in achieving the stated goals and the influence of their participation in realizing those goals. There are 5 components of attaining the designated goals, namely: (1) training effective facilitators, (2) supporting designated staff as they work with farmers in target villages, (3) establishing livestock farmers' groups, (4) addressing marketing aspects of local pig production, and (5) organizing the exchange of knowledge, skills, and methods.

Effective facilitators. Facilitators will help to perform activities according to the needs of the target group. Ideally facilitators will not direct the activities of the local staff, farmers, and authorities but will guide their actions and deliberations so that they realize what is needed. Therefore, facilitators must be able to build staff capacity; directly participate with farmers, villagers, staff, and authorities (especially with ethnic people); identify clearly the status of the target area; and work behind all stakeholders.

Supporting designated staff as they work with farmers in target villages. The working strategy is the standard by which facilitators guide agricultural teams to implement component steps with appropriate flexibility regarding time and methods. However, successful implementation of the working strategy requires maximal coordination and accountability: the

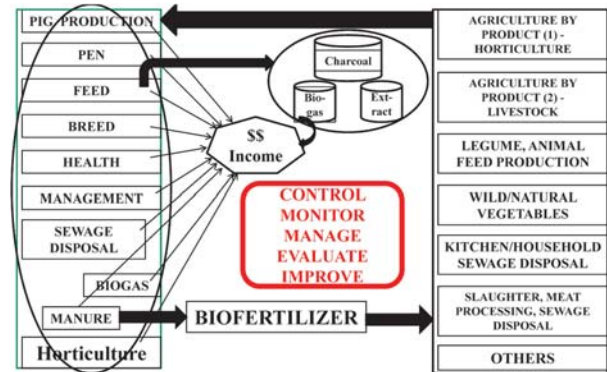


Fig. 4. Pig Production Improvement System

entire project will fail if just 1 of the 3 features is omitted or ineffective. All techniques, technologies, and so on will arise from the strategy. Staff members' introduction of techniques or technologies and the ability of the farmers and villagers to implement them must be balanced effectively to achieve success (Figure 3).

Establishing farmers' groups for improving local pig production. To be effective, a farmers' group should comprise only 5 to 7 members at the start. The scope of the farmers' group is to identify its structure, functions, self-identified rules and regulations, leadership, membership, and other necessities. The results of that target farmers can be the right model farmers who are ready to teach other farmers and have more income which can maintain their living conditions and support to their children's education.

Addressing marketing. Using marketing tools and information to support improvement of local pig production is imperative. Currently, farmers in Sopchia lack the ability and know-how to address marketing issues themselves. Therefore, as stakeholders, traders should expand their role to share helpful information from markets and consumers with farmers and their groups. Such information identifies markets and consumer requirements and includes optimal weight and age of pigs and the effects of place, time, and season on pig sales. This information then is used to plan the local pig production plans.

Organizing the exchange of knowledge, skills, and methods. To accomplish this exchange, staff should meet monthly and farmers' groups weekly. The exchange forum is an open workshop-type meeting, in which everyone can share her or his concepts, ideas, comments, questions, answers, and other concerns.

However, the duration of workshop-meeting should be limited, and discussion should focus on the improvement of local pig production. All aspects of the improvement effort are open for discussion in the workshop-meeting, including: feed and feeding, breeds and breeding, pig health issues and vaccination, management aspects, collaboration, and leading and leadership. The workshop-meeting ideally will identify numerous potentially useful solutions to the various concerns addressed. Every agreement in the workshop-meeting is a regulation that must be implemented.

An important perspective to this improvement effort is that education is the preeminent subject to impose. This perspective is necessary to sustain development in Sopchia. Ultimately the education of young girls must become compulsory. The educational system should be able to produce children that in future will have higher levels of education; this is the opposite to the current situation. Another important point of education is to enable illiterate and poorly educated villagers to read materials and record information to support their agricultural production.

Improving local pig production is just one part of livelihood improvement. Therefore, it should be promoted in light of, and adjusted for, the effects on other aspects of livelihood improvement, such as improved production of other animal species, different cultivation activities, efforts in the health care sector, and forestry conservation projects. In further study the role of extension agents in knowledge dissemination should be clarified, consequently to enable the farmers to improve their pig production and marketing efficiency.

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