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CAMBODIAN ECONOMIC  
ASSOCIATION

# CAMBODIAN ECONOMIC REVIEW

**Issue 4**  
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# CAMBODIAN ECONOMIC REVIEW

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## FORWARD

The Cambodian Economic Association (CEA) commits to promoting the sharing of information and analysis by economists, professionals in related fields, and economic students pursuing their studies. The fourth issue of the Cambodian Economic Review has been materialized through voluntary efforts dedicated by selected members of and contributors to the young economic association. It contains five articles as follows:

1. the extent to which the large-scale agricultural investment benefits the poor;
2. the role of rice mills within the rice marketing system;
3. the contribution of the household silk weaving industry to the rural economy;
4. the pro-poorness of the national plan and its implementation through resource allocation; and
5. the feasibility of growing jatropha for electricity production.

Despite their expected limitations, I believe that these papers will be of benefits to academicians, university students and practitioners in Cambodia. They discuss a set of very interesting issues that are highly relevant to the contemporary challenges facing Cambodia.

I would like to thank all the authors for their serious efforts and dedication to sharing knowledge for the betterment in Cambodia. I am grateful to the editorial committee and Oxfam America, Oxfam Hong Kong, Oxfam Great Briton, and Novib for providing the necessary financial support to enable CEA to carry out a number of activities including publishing this Cambodian Economic Review.

It is challenging for us to strive to achieve our goal in publishing a quality journal. We look forward to receiving more participation from our prospective contributors and members as well as constructive criticism.

Chan Sophal  
President of CEA

# **Does Large-Scale Agricultural Investment Benefit The Poor?**

A Case Study of Rubber Plantation  
in Mondulkiri Province<sup>1</sup>

by

Ngo Sothath

## **Abstract**

Cambodia has promoted investment in agriculture sector since 2005 through granting economic land concessions to private companies (Sub-decree on ELCs, No. 146 ANK/BK, Dec. 2005), aimed to increase economic activities and provide employment to the people, especially the poor. This case study, based on interview with local authorities, company representatives, workers, and villagers, then examines the extent to which the poor benefit from large-scale investment projects, in particular, the rubber plantation in Pech Chreada district, Mondulkiri province. Though, it is inconclusive to say whether or not the investment in rubber plantation in Pech Chreada district is pro-poor since it yielded both positive and negative impacts, a good model of co-existence has been implemented by Daklak Rubber Company and it appears to be the best approach for a long term win-win situation for both local people and the company.

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<sup>1</sup> This case study is part of a full study on “does large-scale agricultural investment benefit the poor?” executed by the Cambodian Economic Association in partnerships with Oxfam America, Oxfam GB, Oxfam Hong Kong and Oxfam Novib.

# Does Large-Scale Agricultural Investment Benefit the Poor?

Ngo, Sothath<sup>2</sup>

## I. Introduction

In 2008, the world experienced food crisis, the situation in which the world was in shortage of food supply due to increased food demand and competition of land for non-food crop production such as bio-fuel crops. The crisis drove the food price high. Like many other countries, Cambodia in 2008 experienced soaring prices of agricultural/food commodities, pushing year-on-year inflation to above 20% during March–August, although it gradually declined to 13.5% in December 2008.<sup>3</sup>

High international food prices provide incentives and a good opportunity to boost agricultural production in many developing countries where land and labor are still underutilized. In Cambodia, there is potential to increase agricultural productivity. Theoretically, this will be in favour of poverty reduction, rural development and supporting sustainable rural livelihoods, which are the primary objectives of development plans in Cambodia as well as other low-income countries. Whether such opportunities will be realised depends on the agrarian structure because only the landed households are likely to benefit from land utilisation. The nationally representative survey (CDRI, 2008) conducted in June 2008 found that only 35% of the rural households have the potential to produce agricultural surplus for sale. About 20% of the households are landless and 45% are small land owners, owning less one hectare.

Meanwhile, the Royal Government of Cambodia has promoted the investment in agriculture sector through its policy to grant large-scale economic land concessions to private companies (Sub-decree on ELCs, No. 146 ANK/BK, Dec 2005). In this sub-degree, the rationale of economic land concession is “to increase economic activities and provide employment in rural areas within a framework of intensification and diversification of livelihood opportunities to people, especially the poor”. Thus, in this article, we study the impacts of large-scale agricultural investment projects on the poor by using the case study of the rubber plantation in Pech Chreada district, Monduliri province.

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<sup>2</sup> Mr. Ngo Sothath is a researcher at the Cambodian Economic Association. The article represents the view of individual author only, but not necessary of the CEA. His contact email address is [sothath@gmail.com](mailto:sothath@gmail.com)

<sup>3</sup> According to the Bulletins of Consumer Price Index published by the National Institute of Statistics.

## II. Overview of Investment Locations and Projects

Pech Chreada district has a population of 10,302 living in 2,222 households. It is located in Mondulakiri province, which had a population of about 61,000 only. According to the 2008 population census, Mondulakiri has the lowest population density (only 8 per square km) of any province in Cambodia. Pech Chreada district has four communes: Krang The, Pu Chry, Srae Ampum, and Bu Sra. The study selected two out of the four communes for scrutiny. With a population of 3,704 living in 800 households, Bousra was one of the most populated communes in Pech Chreada district. It comprises seven villages.<sup>4</sup> Krang Teh commune had 382 families and a total population of 1,567 (821 females). The commune comprises four villages: Kran Teh, Tramkach, Purapeith, and La-eth.

Private companies started to come to Mondulakiri and seek investment opportunities in 2006. Others followed in late 2007 and 2008. According to the Governor of the district, eight ELCs had been granted in Pech Chreada district. All of the concessions were requested for the purpose of establishing rubber plantations. Many of them were located in Bu Sra and Krang Teh communes and had a size of 3,000–5,000 hectares each (Table 2.1). All of these investment projects have been reportedly active, with the exception of Sarmala Company. By 2008, SOCFIN-KCD cleared 223 hectares and planted rubber trees on 137 hectares. Khaou Chouly Development (KCD) Ltd. cleared the land and planted rubber trees from 2006 in Krang Teh commune. In 2008, a company called Dak Lak cleared 48 hectares and planted on 45 hectares. Kovi Phama cleared 60 hectares and was able to plant rubber on 25 hectares. Varanasi and DTC have been clearing the land and also planting rubber trees. Sethei Kola Company started land-clearing activities in 2009 while Sarmala has not been active yet.

**Table 2.1. Overview of investment companies in Pech Chreada district, Mondulakiri**

No	Companies	Land Areas of ELCs reported (ha)	Location	Type of Investment
1	Khaou Chouly Development (KCD)	3,000	Krang Teh	Rubber plantation
2	SOCFIN – KCD (Belgium-Cambodia)	10,000 <sup>5</sup>	Bu Sra	Rubber plantation
3	DAK LAK (Vietnam)	4,000	Bu Sra	Rubber plantation
4	DTC	4,000	Pu-Chry	Rubber plantation
5	Sethei Kola	4,000	Bu Sra	Rubber plantation
6	Kovi Phama	4,500	Bu Sra	Rubber plantation
7	Sarmala	N/A	Bu Sra	Rubber plantation
8	Varanasi	N/A	N/A	Rubber plantation

*Source: Interview with the Governor of Pech Chreada District, commune chiefs, representatives of SOCFIN-KCD Company, Provincial Office of Agronomy*

<sup>4</sup> Phum Muoy, Phum Pi, Phum Bei, Phum Buon, Phum Pram, Phum Prammuoy, and Phum Prampi.

<sup>5</sup> While 2,705 ha is reported by the district and commune authorities, the representative of SOCFIN reported the concession size is 10,000 ha large.

Two companies were the most active in the district and deserve to be mentioned in some detail. Dak Lak Rubber Company is a Vietnamese company specializing in rubber plantations, rubber latex processing, and the manufacturing of rubber-related furniture. Vietnam is the world's sixth largest rubber producer, with rubber trees on 450,000 hectares, ranking below Thailand, Indonesia, and Malaysia (*Vietnam Investment Review*, 19 April 2007).<sup>6</sup> Dak Lak Rubber Company is a state-owned company with 16 branches in Vietnam. Due to the lack of suitable land in its home country, the company expanded its investment into the neighbouring countries of Laos and Cambodia. In Cambodia, the company arrived in November 2006 and was granted an economic land concession in June 2008 on 4,162 hectares of land.

SOCFIN-KCD is a joint venture between SOCFIN Belgium and Khaou Chouly Development (KCD) Cambodia. KCD was granted an economic land concession by the Royal Government of Cambodia; SOCFIN has technical expertise and experience in running rubber plantations. SOCFIN holds 70%, while KCD holds 30% of the shares. The company planned to install the rubber processing plant in 2011 or 2012 and will export its rubber to Japan and other countries. The concession covers 10,000 ha, and 70% of this concession is estimated to be cultivable land for rubber trees.

### **III. Impacts on the Communities**

The study observes that investment companies provided some material benefits to community and local authorities. The companies offered office equipment such as generators, computers and printers to the district and commune authorities. Moreover, the companies have contributed to community development in terms of road rehabilitation and school buildings. For example, DCT Company improved a road in Pu Chry commune, and Khaou Chouly Development and Viko Phama constructed two school buildings for the Bu Sra commune. Dak Lak Company also donated a school building for the Koh Nhek district. However, some people complained that the presence of investment companies also destroyed their roads, which were constructed by commune funds and their contributions. To further understand the impacts of the investment projects through the acquisition of economic land concessions from the government, the study in particular focuses on the impacts in three dimensions: employment, livelihood transformation, and land transactions. Again, this case study was carried out in Bu Sra and Krang Teh communes in Pech Chreada district.

#### **3.1. Employment**

The positive impact is the job creation that has been available to local people and Cambodian migrants from other provinces. The investment has transformed the way in which people live their lives traditionally. Local people now participate in economic activities through employment provided by the rubber plantation, which is much needed as they have no work to do in some months of the year.

SOCFIN-KCD started its rubber plantation in 2008. It planted rubber trees on 1,500–2,000 ha per year, employing about 2,000 workers between May and August and about 800 workers during the other months. According to the company, local

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<sup>6</sup> Rubber firms bounce over the border, *Vietnam Investment Review*, 19 April 2007  
<http://www.vir.com.vn/Client/VIR/index.asp?url=content.asp&doc=12893#>, accessed 8 July 2009



labourers share about 20–25% of the total employment, and 60% of these local workers are female. Other workers are migrants from lowland provinces such as Kampong Cham, Kampong Thom, and others. SOCFIN estimates that when fully planted, the rubber plantation could employ at least 1,500 workers.

On a daily basis, unskilled workers, or those that do not possess particular skills in rubber planting, earn an average of US\$5 per day. There is no difference between the payment for male and female workers. Local workers are employed to do labouring jobs such as weeding and applying fertilizers. They can choose to work 10–15 days or less per month for eight hours a day. They leave home at 7:00am, return for lunch at 11:00am, and work again from 1:00 until 5:00pm.

On an output basis, skilled workers earn about US\$6.50–8.00 per person day. These workers possess skills in rubber planting; all of them are migrant workers and have experience working in the rubber industry, for example, in Kampong Cham. They are hired to do jobs such as transplanting and also work in the nursery. For nursery work, they are paid US\$0.0325 (130 riels) per rubber seedling. In a day, a skilled worker might finish a nursery of 200–250 rubber seedlings. Though they have to be away from home, migrant workers expressed their satisfaction with their earnings. They spend about US\$1.25 on food per day.

While the company may find importing labour workers more efficient, some local villagers are not willing to work or the company does not intend to employ them due to land conflicts. In other cases, villagers are not accustomed to full-time employment and they find it difficult to adapt to it. They prefer their traditional way of living. Then, some local villagers work in the plantation for a week, after which they quit for a while. With such habits, the company finds it difficult to manage their plantation work. Thus, KCD in Krantes commune in particular does not hire local villagers as daily workers, but prefers to employ them as full-time workers with a salary of US\$75 plus 20 kg of milled rice per person per month.

### **3.2. Livelihood transformation**

Villagers in Bousra and Krantes are mainly indigenous people. Some are new settlers who have migrated from lowland provinces. Before the arrival of the investment projects villagers were dependent on a range of sources, including: rice cultivation on both lowlands and highlands, cash crop farming (such as maize, potatoes, bean, cashew, mangoes, bananas, jackfruits, sugarcane, papayas and so on), collecting forest by-products (such as resins, beehives/honey, vines, and leaves), raising animals such as cattle, pigs, chicken and ducks, fishing, hunting, collecting gold and sales of groceries. With the presence of large-scale investments since 2006, these sources of livelihoods have been affected.

While villagers can still practise rice cultivation on lowlands near the village, both rice cultivation and cash crop farming on the highlands are affected by the ELCs. Community people across Bousra commune, with the exception of some new settlers and villagers of Phoup Buon village, have lost their farmlands to the concession. Villagers confirm that at least two hectares of farmland were lost per household. Many have lost all their land; some still own a smaller area of farmland, while the farmland of others are being threatened by the inactive [parts of] economic land

concessions. Coping with subsistence, villagers in Purapeith village, in particular, sought other cultivable areas in the lowlands, which is about 1.5 or 2 hours walk away from their homes. People have found that the land is cultivable for wet-season rice, but they have only small plots and the land is unfertile and the yields are low. This has threatened villagers' food security. "We never had food shortage from our farming in the past, now the loss of farmland threatens our food security," said Mr. Nhem Thay, a villager in Purapeith.

Loss of forestland threatens the livelihoods of local people. With more economic land concessions granted to investment companies, local people in Bousra and Krantes commune have continued to lose the forestland that has been a source of their livelihoods. The forest provided foods, medicines, and cash incomes through non-timber forest products. Although people can still collect forest products, they have to go to other, more distant places and into Namlear Sanctuary, but earn less money and in more difficult situations. In the past, a family could earn US\$10–15 in income from the collection of forest products in a week. For example, the collection of a quantity of resins could take a week's time and yield cash income of about US\$12.50 (50,000 riels). However, these indigenous people habitually do not earn to get rich, they do not go into the forest every week; they only go there when there is a need to.

Raising cattle has become more difficult due to the loss of grassland. The grassland is now granted to a private company as economic land concessions. As the land is now developed for a rubber plantation, the company prohibits access of cattle and imposes a policy of fines for any cattle entering the plantation area. People then had to sell off their cattle or send them out to relatives in other villages, and kept as few as possible. In Purapeith village of Krantes commune, in particular, in the past about half of the village households left home to seek gold minerals at a mountain near the village after farming work in the wet season; the rest enjoyed collecting forest products. But now, people no longer have access to gold-bearing minerals since the mountain was licensed to a private company to exploit the gold-bearing minerals.

Villagers involved in running businesses appear better off as their sales increase. Many of these business villagers are migrants from lowland provinces. They earn their living from the sale of groceries, repairing electronic goods or motorbikes and so on. Cash incomes earned by local villagers and migrant workers from work in the plantation and from sales of land and animals have increased demand for food and other consumption goods and have led to more economic activities in general.

### **3.3. Land transactions**

Traditionally, farming activities practiced by indigenous people in Mondulkiri are characterized by shifting cultivation, which means people do not farm on the same land every year – they farm on one piece of land, then shift to another piece and repeat the cycle every few years. With land abundance due to low population density in Mondulkiri, villagers could continue the shifting cultivation extensively. Many of the households utilized 5 to 10 hectares in total. Indeed, they did not have certificates of land ownership formally issued by the government or the local authority. The villagers recognized each other's land based on tradition and mutual respect.

In general, each household has lost at least two hectares of their traditional farmland to ELCs, but those who settled in the area in five years or less are not affected by the ELCs. This is because these new settlers mostly depend for their living on small businesses such as grocery sales or repairing electronic goods or motorbikes, or they might purchase some land by the roads and close to the villages, which are outside the economic land concession. In order to understand the implications of land transaction determined by the presence of ELCs in the local communities, the study observed the ways in which land possessions have shifted in the following cases.

### ***KCD in Krang Teh***

According to group interviews with villagers in Purapeith, the presence of KCD had resulted in land transactions across the villages in Krang Teh commune, with the exception of La-eth village. They reported that the company actually bought their land, but they were cheated by intermediaries, comprised of company staff, members of the local authority and some villagers. KCD agreed to buy the people's land at US\$200–250 per hectare. Following negotiation and agreement on the sale price, facilitated by intermediaries, villagers in Purapeith were asked to thumbprint the sale agreement. Following this, they were paid only US\$25 per household and in the agreement it was a condition that people had to repay 10 times the sale price if they violated the agreement. However, 24 households who strongly resisted accepting the payment were later offered land in exchange.

### ***SOCFIN-KCD (in Bu Sra)***

In Bu Sra, all villagers have been affected by the investment projects of the SOCFIN-KCD and Dak Lak Rubber Company. The exception is Phoup Buon village. SOCFIN-KCD started developing the land earlier than Dak Lak Rubber Company and is more controversial with villagers. When SOCFIN-KCD developed the land, people reacted as the company cleared their farmlands (sometimes with crop trees on them). It was a big shock for the land-owners when the company cleared their land without giving any prior notice, but a SOCFIN-KCD representative presented the map and explained that except for the spiritual forests, no community land was identified on the granted concession. The controversy between the community people and company staff led villagers to burn the company's tractors in December 2008. Following the violent conflict, a Land Conflict Resolution Committee was set up and headed by the provincial deputy governor, while district and commune authorities are members of the committee.

While the people said villagers across Bu Sra commune have been affected by SOCFIN-KCD Company, the commune authority cannot tell how many households have actually lost their land to the concession. CLEC, an NGO active in the local community, reported that 362 households in Bu Sra were initially affected in 2008, and that the number may have increased when the company continued to further develop the land. In contrast, SOCFIN-KCD confirmed that 172 affected households were on the list endorsed by the government. The company agreed to compensate the affected households, giving them the following options:

1. **Cash payment:** the company agreed to pay US\$200–250 per hectare based on the actual type of land and US\$2.50 per fruit tree such as cashew, mango,

jackfruit, etc. However, a fruit tree is paid only if it has yielded by the time of the land clearing.

2. Land exchange: the company reserves land in another place for exchange with villagers' land that was lost to the concession.
3. Land exchange and development: the company exchanges the land for local villagers, then plants rubber trees on the land. All planting costs are recorded as loans while local villagers are obliged to repay these loans from the 9<sup>th</sup> to the 20<sup>th</sup> years.<sup>7</sup> The villagers can choose to sell their latex as they wish when they get it.

Although options are available, people have no better choice than to accept the cash payment. The people said the location of land for the exchange is a great distance from the village and the soil is not fertile for cultivation, while the farmlands that were taken by the company are near the villages. While the company reported that people only chose the first option (cash payment), the people explained that when they opted for third option, the company prolonged the solution process and thus they simply chose the cash payment option.

#### ***Dak Lak Rubber Company (in Bu Sra)***

On the 4,162 hectares of its granted concession in Bu Sra, a representative of Dak Lak Rubber Company said that 40–50% of the concession is the local people's land. Mr. Vann Soeun said that local people were initially worried that the company would grab their farmland, but this is what Dak Lak experienced with community people in Vietnam. Mr. Vann Soeun explained that Dak Lak does not want the land, but is there to earn a profit from its investment and business and also shares benefits with the local people.

Dak Lak negotiates with land-owners before developing the land. Villagers and Dak Lak agreed to share 50% of the land. The entire 50% of individual villagers' lands are placed in one location close to the village, which allows local people to easily access and look after their plantation. Also, it is convenient for them to raise the cattle and guard them from accessing the company's plantation. Further, it is easy for the company when there is a need to build infrastructure such as roads in the future.

On the villager's 50% share, the company develops the land and plants rubber trees. The company then trains villagers on how to take care of their rubber trees. The incurred costs are accumulated and recorded as a loan that people are obliged to repay later. As the company borrowed from Agri Bank in Vietnam, villagers will pay the same interest rate. The loan has a grace period of 10 years. People can harvest the rubber latex in year 7 and sell it to the company, while the company guarantees to buy the latex at 80% of the international market price. The people will repay the loan from year 10 to year 20.

Although villagers may want to sell their lands to Dak Lak, the company does not have a policy to buy them. In the meantime, if villagers have no land for crop farming,

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<sup>7</sup> By the time of field research, the company said the interest rate was not yet known, but the company liked the model in Kampong Cham, where the interest was charged at 9% per year in Cambodian riels.

the company allows them to cultivate crops in the spaces between the young rubber trees. Local villagers express their satisfaction with the model offered by Dak Lak Company and suggested other companies follow this model. This method of implementing ELCs makes use of coexistence, and appears to be the best model, a win-win situation, in Cambodia.

#### **IV. Conclusion**

There have been increasing numbers of investments in Pech Chreada district of Mondulhiri, particularly in Bu Sra commune, to make use of the abundance of land for rubber plantations. However, the presence of these investments represents both positive and negative impacts to the communities. An investment project makes employment available to Cambodians and local people in particular, allowing them to participate in economic activities through their labour. However, the investment has negatively impacted the livelihood of the local community. Local villagers find that their food security has been threatened and their income has declined due to loss of farmland, forestland, and grassland, which were previously sources of food crops, cash crop farming, the collection of forest products and areas for cattle raising.

With a mixed picture of positive and negative impacts resulting from investment projects, it cannot conclusively be said that these large-scale agricultural investments have yielded or will yield net benefits to the poor. Villagers have more cash from selling their land and labour leading some to increase their levels of consumption at present, but local villagers lost conventionally owned land, which means they have lost an asset that created household wealth, and the loss of common property resources means the loss of their traditional incomes.

However, there are ways in which the investment projects could have reduced the negative impacts on local communities.

- The granted concession should not overlap with local people's land. Therefore, not only should proper studies be conducted, but also effective (either participatory or independent) follow-up mechanisms should help reinforce the company's and the government agencies' implementation and accountability.
- Land reserves for exchange should have been cultivable land located closest to the people's community.
- Although compensation options are made available and people should have the freedom to choose, the government or NGOs should have explained the pros and cons of each option. Local people have limited education, hence they may choose option that is worthwhile for them now, but which may be worse in the long run and cost government effort to help them.

A good model of co-existence has been implemented by Dak Lak company. Local people were consulted and agreed to a solution before development activities took place. Local villagers gave away half their land in exchange for the rubber plantation provided by the company on the other half of the land. They were willing to give up the land since they never used all the land for farming. It permits efficient use of the land. The villagers' half of the land is close to their home and will provide them with a secure income when the plantation yields outputs. While people lack capital, the

company provides soft loans with a reasonable grace period and gradual repayments. Moreover, people can earn more income from labour work in the rubber plantation. Meanwhile, the company can still access rubber latex for its production demands.

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# **Rice Mills within Rice Marketing System in Cambodia**

By

Meas Wat Ho

## **Abstract**

This study examines the role of rice mills within the rice marketing system in Cambodia. Sample rice millers are seen to play multiple roles as paddy buyers, moneylenders to rice growers, farmers, paddy processors, and wholesalers of milled rice. Mills are found to be more family-oriented enterprises, and are classified as small, medium, and large-sized mills. Large-sized mills are seen to have a higher overall efficiency than the small and medium-sized mills even though some medium-sized mills have a high efficiency. The medium and large-sized mills are seen to have potential to be more export-oriented even though the study shows that the majority of sample mills are still domestically-oriented. This study suggests that the promotion and investment in medium and large-sized mills will help Cambodia to become a rice exporting country in the future, while the promotion of the small-sized mills will boost community development in the rural areas.



## Rice Mills within Rice Marketing System in Cambodia

Meas, Wat Ho<sup>8</sup>

### I. Introduction

Many scholars<sup>9</sup> have viewed rice mills as one type of agro-processing firms. In most Asian countries, farmers sell rice to traders in the form of paddy — unhusked rice. It is then processed into polished rice at rice mills for further marketing. According to Kawagoe (1998), the function of Japanese rice mills is not limited to processing, but also includes storage and shipment. Therefore, the rice mills are seen as playing a key role in the rice marketing system in Japan.

Under a free market economy, however, strong competition occurs within the rice marketing system among the various actors. Hayami (1999) found that large commercial rice mills in the Philippines competed strongly with each other for hauling and processing for as much paddy, and selling as much milled rice, as possible: these mills thus bear the function of both collecting and processing paddy, and then distributing the milled rice to the retailers. During the process, they often develop long-term trade relationships with paddy collectors and retailers.

Other researches<sup>10</sup> have also shown that agro-processing firms can play an important role in generating employment and income in rural areas. Cambodian researchers, Oum and Sok (2004), assert that “agro-processing firms could contribute to diversifying the economy by shifting more rural employment to manufacturing.”

Examining the role of rice mills within the entire rice marketing system in Cambodia will help to better understand the nature and characteristics of Cambodian rice millers as rural entrepreneurs. The objectives are to examine the practice of their business management, paddy collection, productivity, and marketing.

The paper is organized as follows: Section two discusses the significant role of Cambodia’s rice mills in the industrial sector. Section three provides the scope and methodologies used to conduct the field survey. Section four discusses the characteristics, roles, management, financial condition, productivity, and marketing practices of the rice millers. Finally, section five concludes that the promotion and investment in medium and large-sized mills will help Cambodia to become a rice exporting country in the future, while the promotion of the small-sized mills will boost community development in the rural areas.

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<sup>9</sup> Timmer (1973), Minot, and Goletti (2000), Burger, Kameo, and Sandee (2001), Gandhi, Kumar, and Marsh (2001), Goel, and Bhaskaran (2007).

<sup>10</sup> Kawagoe (1994) p. 176, Gandhi et al. (2001) p. 331-332, Burger et al. (2001) p. 291-292.

## II. Significance of Cambodia's Rice Milling Industry

Agriculture is still a dominant sector out of the three primary sectors in Cambodia, the other two being the industrial sector and the service sector. Agricultural industry mainly comprises crops, livestock, fishery, forestry, and rubber, crop production, especially paddy production, being major in the sector. During the ten year period between 1990 and 1999, paddy production achieved more than the level of food self-sufficiency for the country. The productivity of paddies rose from 1.3 tonnes per hectare in the early 1980s to 2 tonnes per hectare in 1999, even though it is still among the lowest productivity per hectare in Asia (Sok and Sarthia, 2002). As with cassava, corn and other crops, the growth in paddy production has also required an increase in the activity of agro-processing firms, processing rice as a finished or unfinished product. Since Cambodia's economy still depends upon agricultural products, agro-processing firms can play a crucial role in processing crops as well as generating jobs and income in rural Cambodia. They also have the potential to diversify Cambodia's economy into a manufacturing based economy by shifting more rural employment to manufacturing<sup>11</sup>.

According to a 2003 study by the Ministry of Industry, Mines and Energy<sup>12</sup>, agro-processing firms played a dominant role among small industrial establishments in 2001. They accounted for about 74 per cent of all small industrial establishments. In terms of employment, agro-processing firms employed about 75 per cent.

## III. Methodology

A survey was conducted in Battambang province, which is located in the north-western part of Cambodia<sup>13</sup>. This province is known as the "Rice Bowl of Cambodia".

Battambang province has a very high level of rice production and had a total cultivated land area of approximately 224, 268 hectares in 2004. The average rice yield that year was 2.2 tons per hectare, with the total output standing at 446,359 tons<sup>14</sup>. Production rose to 536,830.8 tons in 2006. The number of commercial rice mills in this province had reached 323 in 2006.

A qualitative research method was employed in gathering relevant data with secondary data was collected from - related Ministries' departments and from a number of Economic Surveys conducted by various economic institutes in Cambodia like the Cambodia Resource Development Institute, and the Economic Institute of Cambodia. The primary data was based on field surveys of rice mills which involved face-to-face interviews by the author with rice millers using structured questionnaires, and field observation. 44 rice mills in Battambang were randomly selected. Interviews held at the milling premises each lasted between one and two hours. The surveys were

<sup>11</sup> Oum and Sok (2004), p. 101.

<sup>12</sup> Private Sector Assessment for the Kingdom of Cambodia, p. 34.

<sup>13</sup> Battambang is also close to an economic zone in the northwestern region bordering Thailand (about 100 km from the Poipet border-crossing, approximately 3 hours by road) and about 300 km or 6 hours by road from the capital city of Phnom Penh.

<sup>14</sup> The 2004 figure for rice production in other major provinces is listed as: Banteay Mean Chey (323,163 tons), Siem Reap (256,795 tons), Kampong Thom (169,012 tons), Pursat (135,678 tons) cited from "Agricultural Statistics 2003-2004", Ministry of Agriculture, Forestry and Fisheries, Phnom Penh, 2003, p. 6.

conducted in March 2007. Field observation was conducted to provide additional context for the findings.

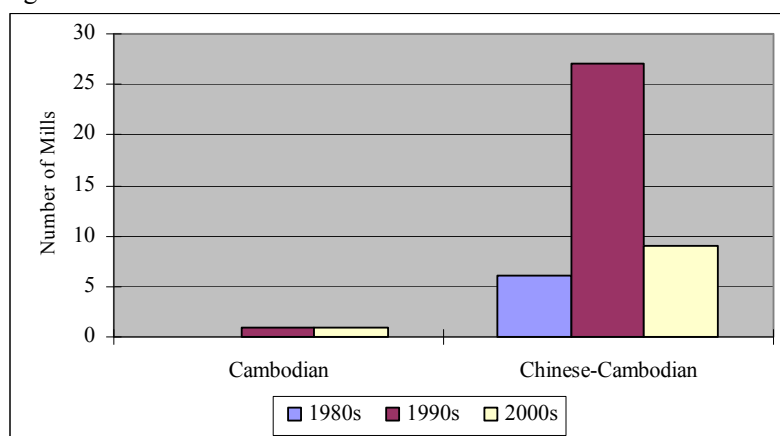
## IV. Findings and Discussions

### 4.1. Characteristics of Rice Millers

Rice millers assume five significant roles in the rice marketing system: rice millers (paddy processors), paddy buyers, moneylenders to rice growers, rice growers or farmers themselves, and finally, wholesalers of milled rice. About 34 per cent of the sample millers also grow crops.

42 sample rice mills are owned by second and third generation Chinese-Cambodian<sup>15</sup>, and two mills are owned by pure Cambodians, of which one was established in the 1990s, and the other in the 2000s (Figure 1). These Chinese-Cambodian rice millers, however, do not have any known relatives living in China nor economic ties with people living in China. 90 per cent of the sample mills are headed by men and 10 per cent by women. Their economic activities are conducted for their own personal living, solely within Cambodia, without any trading or business connection outside Cambodia.

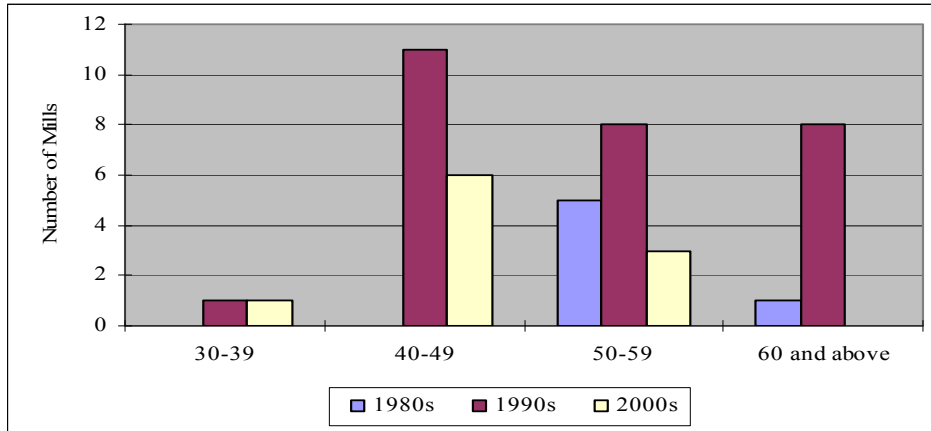
Figure 1. Races and Establishment Year



Source: Field Survey, March 2007

<sup>15</sup> Some Cambodians claim themselves as Chinese-Cambodian because they consider themselves to have a Chinese blood through a mixture of Cambodian and Chinese parents or grandparents, or some of them were born of pure Chinese parents.

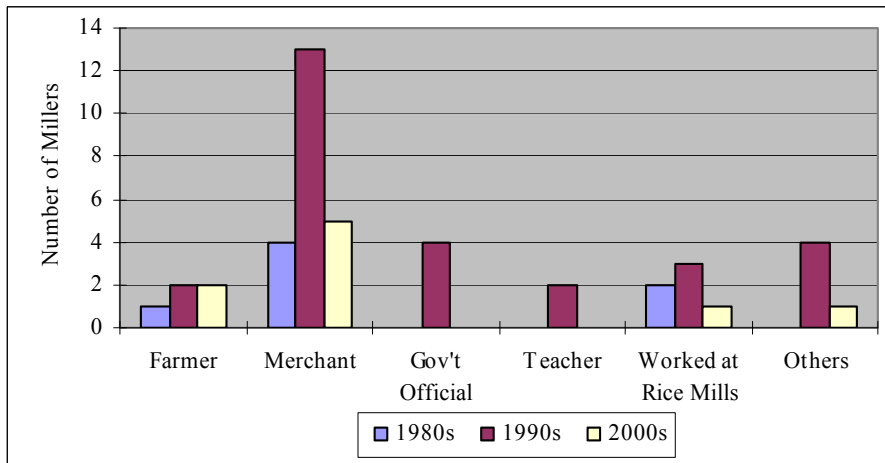
Figure 2. Ages of Rice Millers and Establishment Years



Source: Field Survey, March 2007

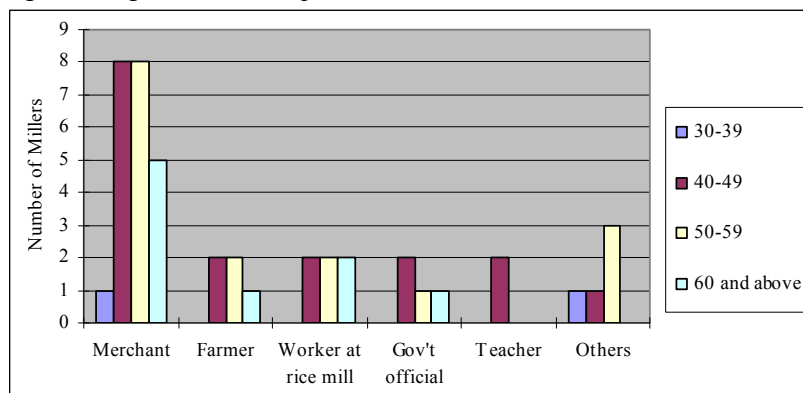
Figure 2 shows that 33 sample millers are middle age (in their 40s and 50s). Many rice millers in their 40s established their mills in the 1990s and 2000s, while many rice millers in their 50s established their mills in the 1980s. This means that the millers in their 50s have experienced both a planned economic system and a free market economy during their years of business operation, while those in their 40s have experienced only a free market economy during their years of business operation, since their establishments started when the government changed to a new economic system in the early 1990s.

Figure 3. Past Experiences and Establishment Years



Source: Field Survey, March 2007.

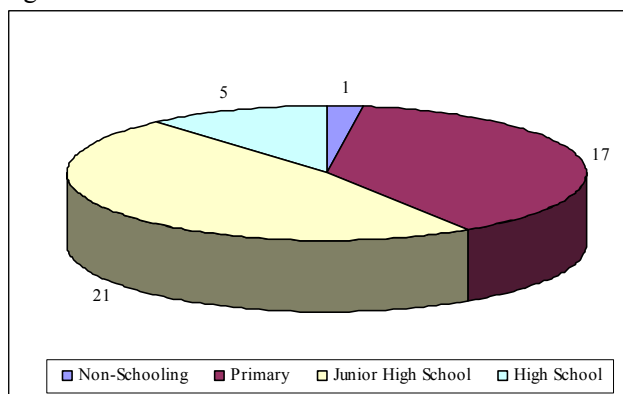
Figure 4. Ages and Past Experiences



Source: Field Survey, March 2007.

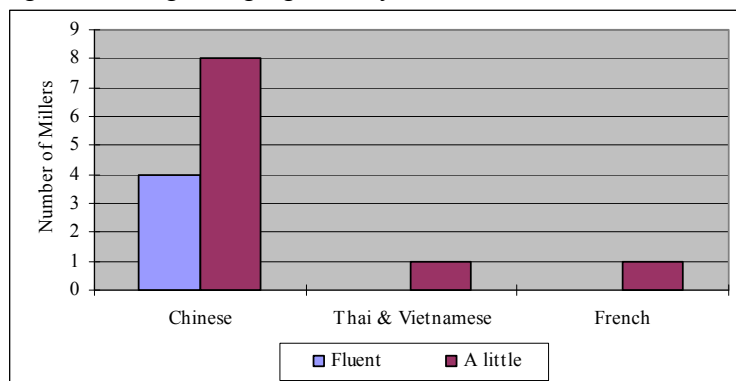
Figure 3 shows 22 sample millers were merchants before they became rice millers, 4 of whom established rice mills in the 1980s, five of whom started in the 2000s, and 13 of whom set up in the 1990s. Those who established their current rice mills in the 1990s come from different age groups even though the majority are in their 40s and 50s (Figure 4). Five of the sample millers were farmers before entering the rice milling business, of whom one established his mill in the 1980s; two set up in the 1990s and two in the 2000s. Six rice millers formerly worked as employees in other rice mills, one of whom established his current mill in the 2000s, two in the 1980s, and the other three in the 1990s. The past work experience of the millers as farmers, merchants, and workers at the rice mills appear to be significant because their experience and their age allowed them to enter the rice milling business at all stages during the establishment years (Figure 3 & 4). Moreover, their past occupations are now connected to their current businesses. The fact that the majority of them were formerly merchants allowed them to establish business networks before entering their current milling business. A number of the interviewees noted that it has been helpful for them to find a market through established business networks, including ability to access rice growers for paddy supply and rice sellers for selling milled rice. Their past experience has also helped them to expand the size of their current business, gaining influence in the market.

Figure 5. Rice Millers' Education



Source: Field Survey, March 2007.

Figure 6. Foreign Language Ability



Source: Field Survey, March 2007.

Figure 5 shows that four sample millers had studied at local Chinese schools; one went to a Chinese primary school, another to Chinese junior high school, and two attended both Khmer and Chinese schools. These four millers have a good command of the Chinese language in terms of reading, writing, and speaking. Five graduated from high school while 17 completed primary school educations, and 21 finished junior high school. Figure 6 shows that another eight millers can speak and understand Chinese a little even without going to Chinese school, because they learned from their parents through communication at home. Two other millers have a little knowledge of other languages: one can read and understand a little French and another can communicate in Thai and Vietnamese. The sample millers can manage and handle their business to some extent with their current knowledge and experience.

The relatively low level of general education and the lack of formal business education, however, show their limitations in terms of making any long-term plans or predication for the future of the business. Most millers are primarily concerned only with their current situation and day to day matters; they can never imagine how their business will be in the long run. It can be said that this is one of the weaknesses of many rice millers in Cambodia. Knowing languages other than Khmer would definitely be an advantage for the millers. This advantage could help them to expand their market beyond their immediate locality in the context of a free market economy because it could be easy for them to build up connections with foreign traders from China, Thailand, Vietnam, France, and so on who are interested in buying Cambodian rice.

#### 4.2. Management of Rice Mills

In this study, rice mills are classified as small, medium and large mills, based on processing of white rice per hour and storage capacity. Small mills are considered to have a production rate of white rice of up to 0.5 ton per hour, and have a storage capacity of less than 100 tons. Medium mills produce more than 0.5 tons but less than 1.5 tons of white rice per hour and have a storage capacity of between 100 tons and 1,000 tons. Large mills process 1.5 tons of white rice per hour or more, and have a storage capacity of more than 1,000 tons.

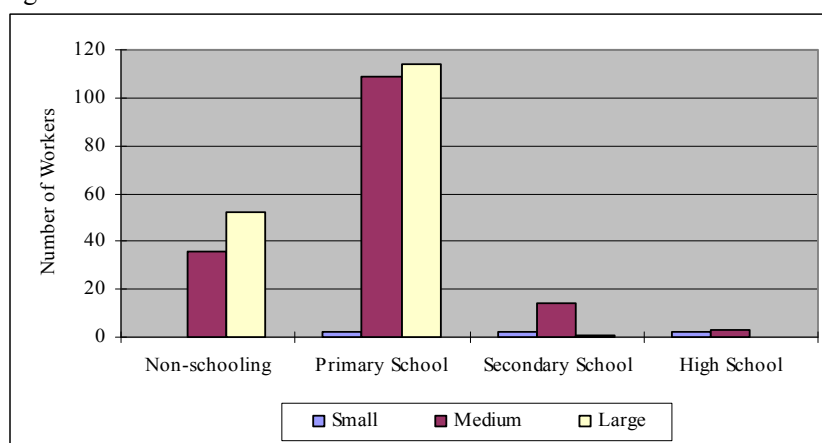
According to this classification, three sample rice mills are considered small, 26 rice mills medium, and 15 large milling enterprises. It is worth noting that small rice mills

hire an average of 3 workers, medium-sized mills employ an average of 6 workers, and large-sized mills have an average of 11 employees.

In the case of small rice mills, the workers are normally family relatives. Basically, they do not receive any regular payment from the owners of the rice mills because they live together in the same household. Medium and large mills employ unskilled workers, machine operators, and supervisors. Unskilled workers are normally hired for a few months during the busy season. Often, unskilled workers are introduced by friends or relatives, or sometimes the millers choose directly from people they know in the village or district where the mills are located. Their duties normally include loading and unloading paddy/rice on and off the trucks, packing milled rice into bags, and transporting paddy/milled rice to warehouses. The machine operator is responsible for checking the condition of machinery and overseeing the milling process on a daily basis. He also repairs machines when there is a problem.

Some mills employ supervisors in order to help them with the overall management. These supervisors are usually close relatives of the millers. The average salary for an unskilled worker is around USD 40 per month while it is about USD 80 and USD 100 for a machine operator and supervisor, respectively. The majority of these workers from all mill sizes have only completed primary education while many others have never gone to school at all (Figure 7). The owners of rice mills oversee the management of the daily operations: buying paddy, keeping records of the stored paddy/milled rice, checking the quality of paddy/milled rice, and handling financial matters. Some of their family members are involved in the tasks especially financial affairs that they cannot trust others to do. The rice millers manage everything within the mills alongside with some of their workers. Family members or close relatives are also seen to play an important role in the business management of the rice mills alongside the millers.

Figure 7. Workers' Education



Source: Field Survey, March 2007.

Many researchers<sup>16</sup> have shown the significant role of rice mills in income and employment generation in rural areas. This study, in contrast, shows that the rice millers are selective in seeking educated or skilled workers or those with whom they

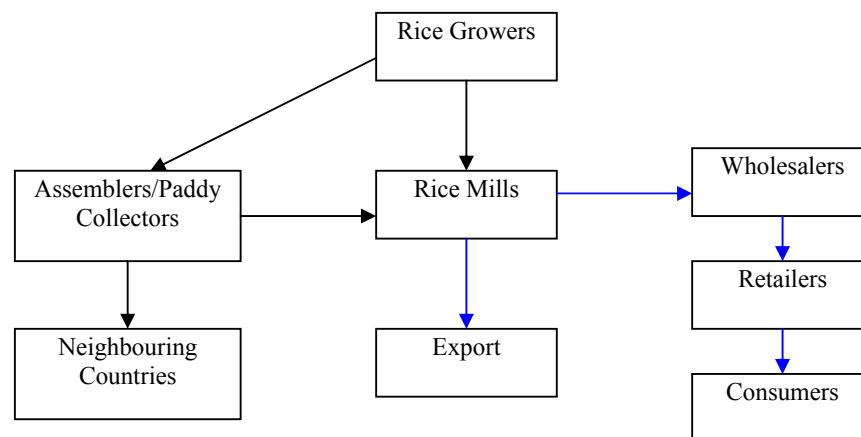
<sup>16</sup> Kawagoe (1994), Oum and Sok (2004)

have a personal or familial relationship, thus limiting employment opportunities for rural workers on a large-scale basis.

### 4.3. Collection of Paddy

Rice marketing channels here can be divided into two stages as shown in Figure 8. The first stage is the flow of unprocessed rice from rice growers to rice millers and from rice growers to collectors and collectors informally export to neighboring countries or sell to rice millers. The second is the flow of milled rice from rice miller to consumers. In the first route, the rice travels from either rice growers to rice miller via collector or middlemen, or directly from growers to miller. Some paddy is exported unofficially to neighboring countries like Thailand and Vietnam by private traders. In the second channel, rice moved from millers to consumers via wholesalers and retailers, some rice millers export their milled rice overseas through local agents.

Figure 8. Elements of Paddy-Rice Distribution Channels in Cambodia



Note:

→ Paddy Flow  
 → Milled Rice Flow

Source: Field Survey, March 2007.

The sample rice mills buy paddy according to their starting capital, working capital, and their storage capacity. These variables affect the current amount of paddy stored by the sample mills. The relationship between the current storage amount and the starting capital, working capital and storage capacity can be expressed in the following formula:

$$CS = \alpha + (\beta SC) + (\beta WC) + (\beta SCA)$$

Where

CS = Current Storage Amount of Paddy  
 SC = Starting Capital of the Sample Mills  
 WC = Working Capital of the Sample Mills  
 SCA = Storage Capacity of the Sample Mills  
 $\alpha$  = the Intercept  
 $\beta$  = the Coefficient for SC, WC, and SCA



Table 1 shows the regression results of the relationship between current storage level, starting capital, working capital and storage capacity, in the sample mills. This table shows the statistical significance of working capital and storage capacity and the influence of these two variables on the buying behavior of the rice mills. The table demonstrates that the amount of the current storage of paddy increases when the rice mills have a high amount of working capital and high storage capacity. The reason for this is because working capital gives the rice millers the ability to procure the amount of paddy they wish according to the size of their storehouses. This result does not show the statistical significance of the starting capital, but its positive coefficient suggests that a high amount of starting capital is a great help in increasing the amount of current storage of paddy.

Table 1. Determinants of Current Storage

	Coefficients ( $\beta$ )	P-value
Intercept ( $\alpha$ )	-54.234	0.406
SC	0.000	0.935
WC	0.003	0.000
SCa	0.181	0.000
R square = 0.96		

Source: Field Survey, March 2007.

Competition is seen to be very strong among the sample rice millers, each miller wants to procure as much paddy as possible according their resources. This causes many rice millers to seek ways of obtaining ample paddy supply with their working capital. This case study reveals two means by which rice millers (among the medium and large mills) gather the amount of paddy they need, apart from simply buying directly from rice growers and collectors at their milling premises. Generally, rice growers and collectors come to sell their paddy directly to the sample rice millers at the milling premises, and negotiation about prices is made between the buyers and sellers. The paddy is bought after they reach an agreement.

Firstly, 9 medium-sized mills and 5 large-sized mills loan money to rice growers who lack finance with the expectation that the growers will pay them paddy in exchange for the loan after the harvest season. Secondly, rice millers hire people whom they know well as their paddy collectors. Paddy collectors are defined as “dependent collectors”. They depend financially upon the miller to whom they are connected. These paddy collectors receive capital from the millers in line with paddy prices, set by the millers. They then buy from the growers at a price lower than the set price, the difference making up their commission. The collected paddy needs to be transported to rice millers within a day or two. Two large-sized mills and one medium-sized mill hire such paddy collectors. The mills, especially those among the medium and large mills, which have a strong competitive advantage, are those who have strong working capital and high storage capacity. Personal money is still seen to be the major source of finance for both start-up and working capital for the sample mills (Table 2 and 3). Table 3, however, suggests that personal money alone does not enable the sample mills to buy adequate paddy to run their business at a profit. Therefore, they need to

seek loans from other sources, mainly banks and local money lenders<sup>17</sup>, in order to purchase more paddy.

Table 2. Sources of Start-Up Capital

Sources	No. of Mills	Percentage
Own money	31	70%
Local money lenders	2	5%
Own money & relatives	2	5%
Own money & Local money lender	6	14%
Own money & banks	1	2%
None	2	5%
<b>Total</b>	<b>44</b>	<b>100%</b>

Source: Field Survey, March 2007.

Table 3. Sources of Working Capital

Sources	No. of Mills	Percentage
Own money	16	36%
Banks	8	18%
Local money lenders	1	2%
Own money & relatives	3	7%
Own money & Local money lender	5	11%
Own money & banks	4	9%
Own money & government	1	2%
Own money, banks, and local lenders	2	5%
None	4	9%
<b>Total</b>	<b>44</b>	<b>100%</b>

Source: Field Survey, March 2007.

<sup>17</sup> Some rich people have money to lend to borrowers at an interest rate higher than the bank's rate, but do not require such complicated procedures as the bank. The duration of a loan is also more flexible than the bank's.

#### 4.4. Productivity of Rice Mills

The production rate per hour in the sample mills appears to be related to several factors: the ‘tbal angkoh’ or ‘rice polishing stone’, worker capacity, the amount of starting capital, and the amount of working capital. The ‘tbal angkoh’ polishes milled rice at the end of the milling process, and is the most important part of the milling process. Thus, the quantity and quality of the milled rice is dependent upon the quality of tbal angkoh that used by each mill in the production process<sup>18</sup>. The relationship between all four factors and production per hour can be shown in the following formula:

$$P/hr = \alpha + (\beta TA) + (\beta W) + (\beta SC) + (\beta WC)$$

Where

- P/hr = Production per hour
- TA = Tbal Angkoh
- W = The number of workers
- SC = Starting Capital of the Sample Mills
- WC = Working Capital of the Sample Mills
- $\alpha$  = the Intercept
- $\beta$  = the Coefficient for TA, W, SC and WC

Table 4 shows the regression results of the relationship between production per hour and other variables. Variables ‘tbal angkoh’, worker capacity, and starting capital are significant. Essentially the mills with a large number of ‘tbal angkoh’ and workers, and a high amount of starting capital have result in higher rates of productivity. However, this finding does not show the significance of the working capital.

Table 4. Relationship between Production per Hour and other Variables

	Coefficients ( $\beta$ )	P-value
Intercept ( $\alpha$ )	0.366	0.000
TA	0.130	0.000
W	0.049	0.000
SC	0.000	0.017
WC	0.000	0.618

R square = 0.81

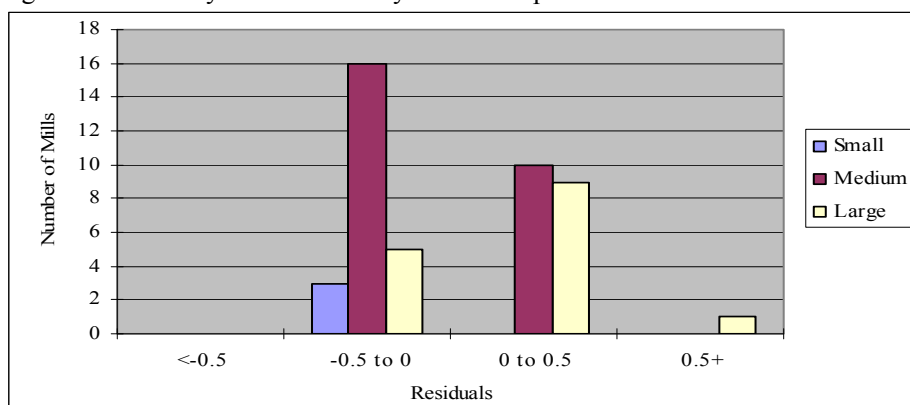
Source: Field Survey, March 2007.

Since the residual represents the efficiency of the sample mills, the mills with more than 0 residual have a higher efficiency while the mills with less than 0 residual have a lower efficiency. Figure 9 shows that small and medium-sized mills are less efficient while large-sized mills have an overall higher level of efficiency. The production level of small and medium-sized mills remains low because of their limited resources (tbal angkoh, workers, starting capital, and working capital). Figure 9, however, exhibits that majority of the total sample mills have a lower efficiency level even though the majority of larger-sized mills demonstrate a high level of

<sup>18</sup> Rozemuller (1998), p. 18, describes that if tbal angkoh is too old or not well maintained, the quality of milling decreases dramatically resulting in more broken rice. The number of tbal angkoh can vary from one tbal to more according to the size of the mill.

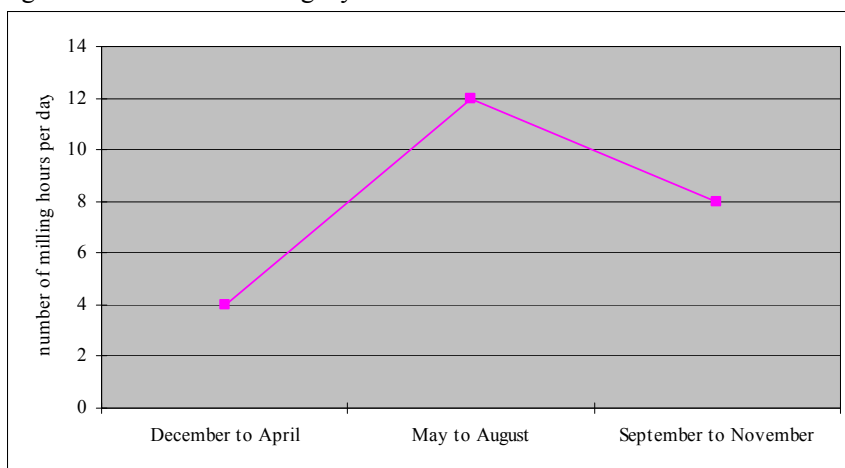
efficiency. This may be the result of using poor technology (e.g. second hand machines or second hand tbal angkoh)<sup>19</sup>, as well as the lack of skill among workers of the sample mills.

Figure 9. Efficiency and Inefficiency of the Sample Mills



Source: Field Survey, March 2007.

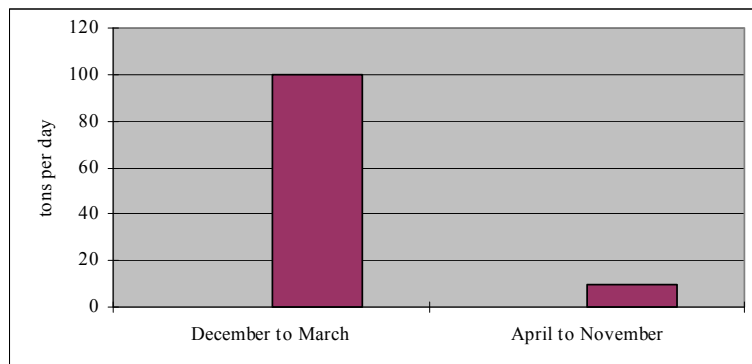
Figure 10. One Year Milling Cycle



Source: Field Survey, March 2007.

<sup>19</sup> Rozemuller (1998), p. 39, explained that the quality of rice mills give a low efficiency rate in general in Cambodia because the poor machinery used by the rice mills.

Figure 11. Purchasing of Paddy by the Sample Mills



Source: Field Survey, March 2007

Between May and August is the busiest time of the year for millers, especially for the medium and large-sized mills. They often mill up to 12 hours per day during this period (Figure 10). Increased numbers of market orders of white rice explains why the sample mills are busier during this period. The demand for white rice begins to increase once the harvest season<sup>20</sup> is over. Figure 10 also shows that the second busiest period is from September to November whereas December to April is the low season for milling. Figure 11, however, shows that the sample millers are nonetheless very busy buying paddy between December and March. During April most farmers and millers take a break because it is the month of the Khmer New Year. Even though the official number of holidays is only about four days, they tend to treat this month as a general opportunity for family gatherings or reunions.

#### 4.5. Marketing of Rice Mills

Table 5 states that the market for white rice from small-sized mills is mainly local within Battambang province, whereas the largest market for the medium and large-sized mills is in Phnom Penh and little is exported. Only three to four per cent of the milled rice was exported to Malaysia and Thailand in 2006 by three of the medium-sized mills and one large-sized mill, respectively. The four exporting rice mills, however, are among those in the sample that have large storage capacity. They entered the export market after being contacted by agents who has an interest in buying their milled rice for export to Thailand and Malaysia.

Table 5. Market of Milled Rice

Mills	BB	OP	PP	Overseas	Total
Small	100%	0	0	0	100%
Medium	43%	9%	45%	3%	100%
Large	6%	19%	71%	4%	100%

Note: OP : Other Provinces, BB : Battambang Province, PP : Phnom Penh

Source: Field Survey, March 2007.

Thus, it can be said that the sample rice mills are more domestic-oriented rather than export-oriented even though the medium and large-sized mills are more export-

<sup>20</sup> The harvest season begins late November and ends late February.

oriented. Many owners of the medium and large-sized mills expressed that the main reasons why their mills can not be export-oriented are the lack of confidence in assurance of stable white rice supply for exporters after making a contract and the quality of rice needs to be improved in order to compete well in the international markets. As the millers operate in a very competitive market, procuring adequate paddy supply and seeds in a timely manner can be challenging and requires a large amount of working capital which may not always be readily available.

## **V. Conclusion**

Rice milling enterprises have grown significantly since the government adopted “the open door policy” by encouraging privatization in the early 1990s. Even though many researchers have shown the significant role that rice mills play in income and employment generation, the rice mills in this case study seek educated or skilled workers, and are content to be family-oriented enterprises.

This case study showed how a rice miller can function as assembler, moneylender to rice growers, farmer, paddy processor, and wholesaler of milled rice. In order to procure enough paddy, working capital plays an important role and competition among the millers is strong. Many rice mills depend on banks and local money lenders as a source of additional finance. The competitive advantage lies with strong working capital and high storage capacity, thus the large-sized mills are the most competitive. Yet, this depends on the availability and access to credit with a reasonable interest rate. Accessibility to banks for additional finance will help rice millers acquire adequate paddy supply to increase production output. In turn, the acquisition of enough paddy supply will give the rice millers greater confidence in entering into contracts for rice exportation.

The large-sized mills generally have a higher overall level of efficiency than the small and medium-sized mills even though some medium-sized mills have a high efficiency. Poor technology and employment of unskilled workers by many rice mills contributes to their lower level of efficiency regardless of the size. Government assistance to rice mills for obtaining new machinery and technology and providing technical assistance and training for millers and workers to improve their business management skills would also help increase the efficiency of the rice mills.

Finally, even some millers export rice, the majority of their business is also primarily domestic. However, some medium and large-sized mills have the potential to become more export-oriented in the future. Improvement of productivity, efficiency and quality of the rice mills by obtaining adequate working capital, using advanced technology and skilled workers will give the rice mills the confidence and opportunities they need to be equipped to participate in rice export markets. The promotion and investing in medium and large-sized mills also will help Cambodia to become a rice exporting country while promoting small-sized mills will boost community development in rural areas.

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# **The Role Of The Household Silk Weaving Industry In Promoting Rural Economic Growth In Cambodia:**

**A Case in Bati District, Takeo Province**

By

Ek Chanboreth

## **Abstract**

This article assesses the contribution of the household silk weaving industry to the rural economy of Cambodia. The primary objective is to gain a better insight into employment and income generations derived from this household industry. Silk weaving provides high opportunities for self-employment and substantial income to rural people, especially women. Rural households are actually more actively engaged in silk weaving than farming as they can weave year-round whereas farming is typically seasonal. Income earned from silk weaving constitutes the largest share of total household income, and it is comparatively higher than income from agriculture. The major factors associated with the variation of income generated from silk weaving are the number of looms, weavers, working hours and the benefits gained from formal technical skill trainings. Despite significant contribution to rural income, the household silk-weaving industry is facing challenges related to growth as the result of limited access to capital, credit, marketing service supports, and technical training.

**Key words** – rural industry, rural economy, non-farm employment, rural income generation, silk weaving, women, Cambodia

# **The Role of the Household Silk Weaving Industry in Promoting Rural Economic Growth in Bati District, Takeo Province**

Ek, Chanboreth<sup>21</sup>

## **I. Introduction**

Rural households in Cambodia are primarily engaged in agriculture, largely dominated by paddy production, but off-farm and non-farm activities also contribute significantly to employment and income generation of rural households. Off-farm sources of employment often involve rice milling, fish processing, silk weaving, pottery, brick making and marble handicraft. Among these activities, silk weaving has been identified as one of the major cottage industries providing high self-employment opportunities and substantial income for rural people, particularly women. This historical profession is included in the Cambodia National Export Strategy 2007-2010 as the major rural industry with a strong potential for export-oriented growth.

Cambodia's silk weaving is characterized as a cottage or household industry. It is primarily operated by individual households that sometimes hire outside labour. Notably, women are overwhelmingly represented in this industry and skills are transferred from mothers to daughters. Cambodian workers undertake three specific tasks in silk production: yarn preparation, dyeing and weaving. It is estimated that about 21,000 people are involved in the silk sector including weavers, middlemen, retailers and breeders (PASS, 2005). The overwhelming majority are weavers, dominated by women.

Generally, silk weaving makes a large contribution to the development of rural households. Economically, the industry contributes significantly to employment and income generation, especially for women, the elderly and children. Socially, silk weaving allows rural women to generate income and while simultaneously keeping up with their household responsibilities thus allowing these women to maintain rural lifestyles and enjoy an intimate knowledge of social life in weaving areas. The drain of young women from silk weaving areas to work in garment factories in the capital of Phnom Penh has been curbed. Women's self-confidence has grown with their newly-developed entrepreneurial and community-building skills (International Trade Centre, 2006).

More broadly, Cambodia's long history of a strong silk-weaving tradition, silk production undoubtedly contributes to the preservation of the national cultural heritage and tourism attraction. At present, silk products have a high potential for export growth, particularly through cultural tourism. According to the International Trade Centre (2006), silk products are exported indirectly through tourists and expatriates. About 40 percent of silk fabrics are consumed by tourists and expatriate Cambodians, and the rest are used within the country.

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However, this household industry has been facing major impediments in relation to generating capital, building worker skills through technical training, improving and acquiring production tools and equipment and marketing service supports. All of these factors contribute substantially to high production costs, relative to other exporters, limited capacity of silk production and lack of consistent quality standards for silk products, limiting the value-added of silk-weaving for participating households and discouraging new entrants into the market. These constraints mainly manifest as decreased income and employment opportunities for rural people.

The primary objective of this paper is to assess to what extent the household silk weaving industry might be able to better contribute to the rural economic growth and poverty alleviation in Cambodia. The layout of the paper is as follows. Section 2 describes briefly the general practice of silk weaving of rural households in Cambodia. Section 3 provides a quantitative analysis on the economic benefits of silk-weaving to rural economies in terms of employment and income gained. This is followed by Section 4 that examines the factors influencing the variation of income earned from silk weaving. Section 5 identifies the major faced by the household silk weaving industry and Section 6 summarizes the key findings and offers policy recommendations for improving growth in the industry.

The paper is an exploratory research which is mainly based on primary data from a field survey with eighty silk weaving households in Bati District of Takeo Province. In the survey, a stratified random sampling was used to select eighty households from Pey Village in Tnaot Commune and Khnar Rong Village in Pea Ream Commune. Furthermore, two focus group discussions were organized to obtain additional qualitative information on the economic benefits and challenges of the silk weaving industry. The interviews with key informants from local district and communes, non-governmental organizations (NGOs) and micro-financial institutions were also conducted to gain their perception on the benefits and constraints of this household industry and suggestions for future policy implications to improve growth within the industry as a means of rural economic development.

In this paper, silk weaving activity is characterised as a household industry and so-called *the household's silk weaving industry (HHSWI)*, herein refers to an industry organized and operated by members of the households at home or within their villages for the manufacturing of silk products by using locally produced or imported raw materials.

In consideration to the limitation and difficulties of the study, it is important to realize that this study only focuses on economic aspects in terms of employment and income. Also, the study does not pay attention to various types of silk fabrics. In the research, only *Hol*<sup>22</sup> product has been examined because most of the local weavers selected for this study primarily work with this type of silk fabric. Consequently, there is some limitation in the variation of income earning from the production of different types of silk fabrics. Moreover, it is difficult to collect data on such items as sources of income, production units and costs of inputs. Almost all respondents do not keep

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<sup>22</sup> *Hol* is a Cambodian traditional fabric worn during celebrations by women of a certain age, and it is sold as *Kben* (4x1 meter).

records, and some of them were not willing to provide accurate data, limiting the degree of accuracy for the figures.

## II. General Practice of Silk Weaving

After the collapse of the Khmer Rouge regime, silk weaving began to recover in 1980, and silk yarn has been imported from neighbouring countries. Many middlemen and wholesalers from families who were formerly active in the silk business started to reinvest in the sector, and trade exchanges between Vietnam, Phnom Penh City and silk weaving villages have gradually been strengthened (Khmer Silk Village, 2006).

Cambodia can produce around 6 to 7 tons of yarn per annum. The production can supply about 2 percent of the total domestic demand. An additional 400 tons of silk yarn imported from Vietnam is thus required to meet the demand for 20,000 weavers, of which a large number are situated in Vietnam-bordered provinces. Half of the weavers are located in Takeo Province distributed across Bati, Prey Kabbas and Samraong Districts. Most of the households in these areas have been practicing silk weaving for generations, while some of them have only started during the last few years.

In the study area, Bati District, one of the oldest silk weaving areas consists of about 40 percent of all silk weavers in Takeo Province. The majority of the weavers are located in Tnaot and Pea Ream Communes. Some villages in the two study communes have been practicing silk weaving for decades. Others started when silk weaving began to be practiced for commercial purpose and generate additional off-farm income in the 1990's. Today, Takeo weavers are famous for *Hol* production which is in large demand from Cambodians and expatriates (Khmer Silk Villages, 2006). These weavers are still using traditional tools and equipment with indigenous skills transferred throughout generations.

### 2.1. Duration and Reasons for Engagement in HHSWI

From the households sampled, about two thirds (70 percent) have been engaged in silk weaving for over 20 years, while a quarter have been involved from 10 to 19 years and the remaining five percent have been practicing for less than 10 years. The average engagement period of the households in HHSWI is around 22 years.

Table 2.1. Duration of Engagement in HHSWI

Period (years)	Frequency	%
5-9	4	5.0
10-19	20	25.0
20-27	56	70.0
Total	80	100.0
Average		22 years

Source: Field Survey, 2007.

It should be noted that the engagement period of the sampled households for this study is only considered from 1980. The households engaged in HHSWIHHSWI in the period of 20-27 years might have been involved for many generations, but they stopped during the Khmer Rouge before returning to this industry after the collapse of the regime in 1979.

The main purpose of all sampled households engaged in HHSWIHHSWI is income generation. Over two thirds (72.5 percent) also mention that they are involved in silk weaving to preserve their indigenous skills and intergenerational occupation. In addition, about half of them (52.5 percent) mention that they engage in silk-weaving due to personal interest.

Table 2.2. Reasons for Engagement in HHSWIHHSWI

Reasons	(Multiple Responses)	
	Frequency	%
1. Income generation	80	100.0
2. Preserving indigenous skills and/or intergenerational occupations	58	72.5
3. Personal interest	42	52.5

Source: Field Survey, 2007.

Takeo Province is famous for *Hol* production. About 85 percent of weavers produce this kind of silk fabric because of their traditional knowledge, while the remaining of 15 percent make bulk fabrics sold per meter alongside other types. From the field survey, all of the sampled households only produce *Hol*.

## 2.2. Utilization of Raw Materials, Tools and Equipment

The most important raw materials used in the silk weaving industry are yarn and dye. In Cambodia, these materials are mostly imported. To recap, Cambodia can produce approximately 7 tons of yarn per year, while the domestic demand is up to 400 tons, requiring yarn imports usually through informal channels from Vietnam. Dye used by Cambodian weavers are mostly imported from Thailand and some from Germany, as well as produced locally.

The majority of handlooms (58.7 percent) are produced by households themselves. Almost one-third of the looms (31.7 percent) are bought in cash from local carpenters. A small number of them (6.7 percent) have an access to loans from local micro financial institutions for buying looms, and a few of them (2.9 percent) acquire looms lent by middlemen or supported by local NGOs, such as World Vision Cambodia.

Table 2.3. Sources and Duration of Handlooms

Handlooms	Frequency	%
<i>Source of handlooms</i>	<i>104</i>	<i>100.0</i>
• Self made	61	58.7
• Local carpenter using cash	33	31.7
• Borrowed money	7	6.7
• Lent by middlemen	2	1.9
• Provided by government	0	0.0

• Provided by development agency	1	1.0
<i>Duration of handlooms (years)</i>	<i>104</i>	<i>100.0</i>
• 5 and below	34	32.7
• 6-10	16	15.4
• 11-15	22	21.2
• 16 and above	32	30.7
Average		11 years

Source: Field Survey, 2007.

For the duration of the looms, one third of them (32.7 percent) are in the age group of 5 years and below as they are new-made, while another one third (30.7 percent) are very old looms ranged in the age of 16 years and above. The rest of them are ranged in the age group of 11-15 years (21.2 percent) and that of 6-10 years (15.4 percent).

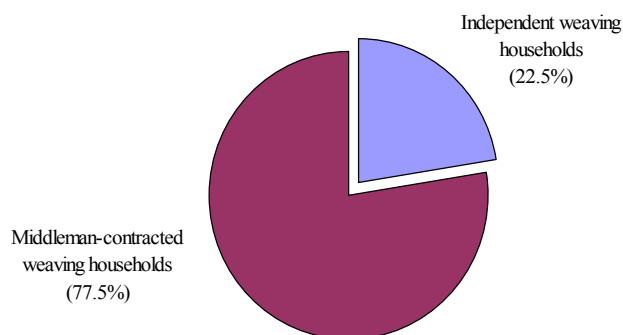
### 2.3. Characteristics of Silk Weaving Households

The majority of the weavers in Takeo commonly contract middlemen who lend them raw materials like yarn and dye on credit. The weavers, in turn, have to sell their finished products back to the same middlemen. It is estimated that the silk weaving industry in Takeo consists of over 80 middlemen. The small-scale middlemen can deal with from 10 to 30 weavers, while the large-scale ones can deal with up to 500 weavers.

There are two types of silk weaving households found in the research. The first is a *middleman-contracted household* which buys raw materials such as yarn and dye from middlemen on credit. In turn, they have to sell their finished products to the same middlemen. The second type is characterized as an *independent weaving household* which buys yarn and dye in cash from a local market, a local weaving group or middlemen. The independent weaving households have access to cheaper yarn because they pay immediately, while the middle-men contracted households are usually charged interest that is often included in the price of the yarn and dyes. The loan is only repaid when the finished products are sold.

The findings from the field survey show that the majority of the sampled households (77.5 percent) are middleman-contracted, while around a quarter of them (22.5 percent) are independent.

Figure 2.1. Characteristics of Silk Weaving Households



Source: Field Survey, 2007.

## 2.4. Sources of Capital Used in HHSWI

The initial investment for silk weaving is estimated at around 1.2 million riels (about US\$400). This includes costs for weaving tools and equipment, such as a handloom, warping frame and spinning tool as well as raw materials such as silk, yarn and dye. Considering this is what most rural families earn in a year, this investment is still a major constraint for new households who want to enter the industry, particularly for poor ones.

These barriers remain even though it is not required to purchase all inputs at once. Some weaving tools and equipment are not used permanently in the production process and can be lent and borrowed from one household to another, except the loom. The households that started weaving during 1980s mostly produced weaving tools and equipment by themselves, while others hired local carpenters to make them based on traditional styles and indigenous skills. Yet, the majority of the old and new weaving households face major constraints to acquiring working capital and have to rely on middlemen for buying raw materials on credit.

Table 2.4 shows that the source of the fixed capital used in HHSWI for almost all the sampled households (96.2 percent) is gained from their own capital. Only two households (2.5 percent) have access to a loan from local micro financial institutions (MFIs) to start their HHSWI, and one case (1.3 percent) is supported by the World Vision Cambodia both based in Bati District.

Table 2.4. Sources of Capital Used in HHSWI

Source of capital	Fixed Capital		Working Capital	
	Frequency	%	Frequency	%
Self provision	77	96.2	11	13.8
Middlemen	0	0.0	65	81.3
Government	0	0.0	0	0.0
Development agencies	1	1.3	0	0.0
Micro financial institutions	2	2.5	3	3.8
Others	0	0.0	1	1.3
Total	80	100.0	80	100.0

Source: Field Survey, 2007.

Though the majority of the households start the HHSWI with their own capital, they depend largely on middlemen for working capital. As shown in Table 2.4, most of the sampled households (81.3 percent) relied on middlemen for the variable costs of buying yarn and dye. A small number of them (13.8 percent) could support themselves. A few households (3.8 percent) had access to loans from micro financial institutions.

## 2.5. Marketing of Silk Products

Cambodian silk weavers normally rely on middlemen for marketing services because the weaving households are individual production units which can produce only a few units a month. While not every weaver noted they were motivated to be an entrepreneur, most of them hold the perception that they are weavers and not traders because they lack marketing skills and investment capital (Seng *et al.*, 2006). Since weavers feel they do not have better options, they are more satisfied to sell their silk fabrics to middlemen and accept the offered prices. Most weavers do not know the market value of their fabrics but rely heavily on information from middlemen and the negotiation as patron-client business. Some of the weavers sell their fabrics to the middlemen but are not paid immediately because they have to wait until the middlemen return from their trade missions from Phnom Penh. In this case, middlemen might later refuse to pay the prices negotiated with the weavers if wholesalers in Phnom Penh offer lower prices than initially expected. In fact, the wholesalers in Phnom Penh markets, where the majority of middlemen market the silk fabrics, are the most powerful bargainers.

From the field survey, the majority of the sampled households (77.5 percent) sell their silk products to the middlemen who lend them yarn and dye for production. This is not surprising given the majority of the weaving households in the study area are middleman-contracted. A small number of them (20 percent) market their silk fabrics to local traders who often go to their villages for buying fabrics from the weavers. Few households marketed their silk fabrics in other ways such as direct marketing to wholesalers in Phnom Penh or to their relatives working in Phnom Penh.

Table 2.5. Marketing of Silk Products

Marketing	Frequency	%
Local market	0	0.0
Phnom Penh markets	1	1.3
Middlemen	62	77.5
Local trader	16	20.0
Others	1	1.3
Total	80	100.0

Source: Field Survey, 2007.

As noted, the households surveyed rarely sell *Hol to* the local market given that the price is not significantly different from those offered by the traders who buy the fabrics directly at home. Moreover, most of them know these traders, which make the prices they offer more reliable than those by retailers in the local market. From the sampled households, not one case of silk fabrics is marketed to the local market.

## III. Economic Benefits

The rural non-farm sector makes a large contribution to rural employment, in particular subgroups of the population like women and children who are unable to participate in the agricultural wage labour market (Lanjouw, 2001; Berdegué et al., 2001). In the Cambodian silk weaving industry, it is estimated that there are more



than 20,000 weavers in the country, of which about 90 percent of them are women (PASS, 2006).

### 3.1. Employment Creation

In the research design, employment in HHSWI was considered only as household members who are engaged in their own silk weaving industry. Those who are hired temporarily for assisting in the weaving preparation stages, such as tying weft thread were not counted as employed in the industry.

From the sampled households, almost half of them (48.8 percent) have one weaver, and around one third of them (33.8 percent) consist of two weavers. Only a small number of the sampled households (12.5 percent) have three weavers, followed by a few of them (5 percent) consisting of four weavers. The average number of weavers per household is 1.7.

Table 3.1. Number of Weavers per Household

Number of Weavers	Frequency	%
1	39	48.8
2	27	33.8
3	10	12.5
4	4	5.0
Total	80	100.0
Average		1.7 weavers

Source: Field Survey, 2007.

Cambodian silk weaving has been recognized as a home-based activity, mostly practiced by women. Until now, women are mostly employed in the silk weaving industry. The findings from the survey show that the vast majority of weavers from the sampled households (87 percent) are female, while a small number of them (13 percent) are male.

Table 3.2. Sex of Weavers

Sex	Frequency	%
Male	18	12.9
Female	121	87.1
Total	139	100.0

Source: Field Survey, 2007.

The majority of the weavers (38.1 percent) are between 20 and 29 years old, followed by almost a quarter (23 percent) between 30 and 39 years of age. The average age of the weavers was 32 years. Two reasons explain why the weavers are young. First, HHSWI provides employment opportunities to the young Cambodian population with the potential for skill development. Second, the need for good eyesight disqualifies people who begin to lose their vision as they mature (Seng *et al.*, 2006).

Table 3.3. Age of Weavers

Age (years)	Frequency	%
10-19	15	10.8
20-29	53	38.1
30-39	32	23.0
40-49	18	12.9
50 and above	21	15.1
Total	139	100.0
Average		32 years

Source: Field Survey, 2007.

HHSWI provides year-round employment because the demand for *Hol* is not seasonal although it usually declines slightly during rainy season from August to October due to fewer social ceremonies. Some households keep their handlooms inactive during on-farm season, particularly the households with only one weaver, while others are still active although their working hours in HHSWI are reduced due to their engagement in paddy production from July to September for planting and from January to February for harvesting.

During the survey, interviewers attempted to collect information on the working hours of the weavers during on-farm and off-farm seasons from the respondents to observe the different patterns of employment in HHSWI. However, it was difficult to collect such figures because the weavers could not recall their working hours in HHSWI during on-farm season. Instead, they estimated their average daily working hours during off-farm season.

From the sampled households, almost two thirds of the weavers (60.4 percent) work from 5 to 8 hours a day, followed by a quarter of them (25.2 percent) working less than 5 hours and some of them (14.4 percent) working more than 8 hours. On average, the weavers work 6.2 hours per day.

Table 3.4. Working Hours of Weavers in HHSWI per Day

Working Hours per Day (Hours)	Frequency	%
< 5	35	25.2
5 - 8	84	60.4
> 8	20	14.4
Total	139	100.0
Average		6.2 hours

Source: Field Survey, 2007.

### 3.2. Income Earning

The importance of the rural economy in generating income for rural households cannot be overstated. Numerous studies indicate that rural industries or non-farm enterprises provide a substantial contribution to income of rural households because

in many rural areas, agriculture alone cannot provide sufficient livelihood opportunities for rural people, and the incomes of households participating in rural industries are significantly higher than those who do not participate (Lanjouw, 2001; Deininger *et al.*, 2007; Berdegú, *et al.*, 2001; Ann and Catherine, 2001; Janvry and Sadoulet, 2001; Daniels and Mead, 1998). As mentioned earlier, silk weaving in Cambodia is an important non-farm rural activity accounting for a significant share of rural household income and has been identified as a rural household industry with high export potential in the National Export Strategy.

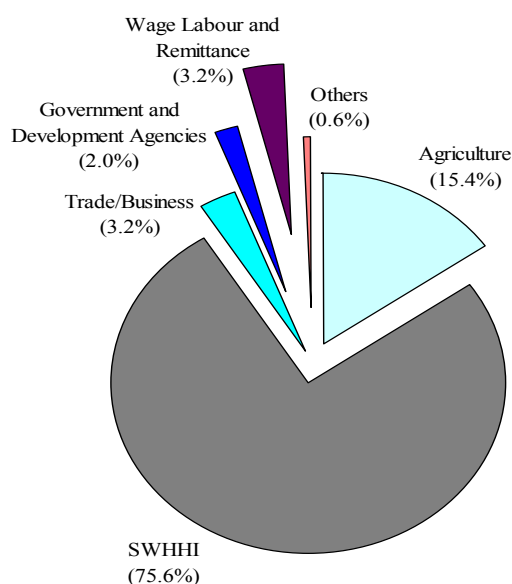
### ***Composition of Household Income***

Income is among the more difficult variables to calculate from household surveys; hence, most researchers used expenditure as a proxy. However, expenditure data generally cannot be used for analysis or comparison of incomes from different sources (Chan and Sarthi, 2002). In this study, efforts were thus made to generate data on income by asking respondents to recall their income from all possible sources during the past twelve months (August 2006 to July 2007). Income from each source is defined as follows:

- i) Income from “agriculture” is the gross value of paddy production converted based on production yields and market prices provided by the respondents, and income from selling livestock, commonly pig, raised by the households.
- ii) Income from “HHSWI” is the gross income calculated based on the number of production units produced per year and average annual selling prices.
- iii) Income from “trade/business” is the net income from other self-employment in non-farm activities excluding the HHSWI such as groceries, small trade activities and services operated by the households.
- iv) Income from “salary” refers to cash income obtained from serving as a government official, such as a district officer, member of a commune council, village headman or teacher in public school, and as development agency staff.
- v) Income from “wage labour and remittance” refers to cash income from hiring out labour either inside or outside the village and remittance sent by migrant household members.
- vi) Income from other sources includes cash income from lending money and renting out assets such as animals, farm tools and machinery.

Not surprisingly, income from silk-weaving in the sampled households is more significant than other sources. As illustrated in Figure 3.1, most of the household income (75.6 percent) is from HHSWI, followed by agriculture (15.4 percent) and other sources including trade and business activities and waged labour and remittances with an equal proportion (3.2 percent) for each.

Figure 3.1. Composition of Total Household Income



Source: Field Survey, 2007.

According to the focus group discussions, a majority of the participants mentioned that they are not able to produce surplus paddy production for sale. Most of them produce paddy for household consumption. Some participants have to buy more paddy or milled rice for consumption due to inadequate production. Despite the number of options for rural household income, opportunities for growth are limited. At present, they depend heavily on income earnings from silk weaving to cover various household expenses such as food, health care, and social ceremonies.

Table 3.5 shows that the average annual income earning from HHSWI of the sampled households is almost 7 million Riel, but only 1.5 million Riel is derived from agriculture and about a million riel from other sources; everything else comes from silk-weaving.

Table 3.5. Average Annual Household Income by Source

Sources of Income	Income (riels)	%
Agriculture (paddy and livestock)	1,460,900	15.8
HHSWI	6,881,000	74.6
Trade/business	325,600	3.5
Salary	204,500	2.2
Wage labour/remittance	303,600	3.3
Others	55,800	0.6
Total	9,231,500	100.0

Source: Field Survey, 2007.

Important to note, the income earned from agriculture for the majority of households is not in cash. The households mostly keep paddy from production for household consumption. For the purposes of this study, it has been converted into cash based on

paddy yield and sale price given by the respondents to determine its proportion of household income.

### *Income Earning from HHSWI*

#### *a) Gross Income Earning from HHSWI*

Based on Table 3.6 about half of the sampled households (51.3 percent) earn a gross income from HHSWI ranging from 5 to 10 million Riel. Almost one-third of them (30 percent) generate income ranging from 2 million to 5 million Riel. Some of them (15 percent) receive better income ranging from 10 million to 15 million Riel, while a few of them (3.8 percent) earn an income ranging from 15 million to 20 million Riel. On average, the gross income gain of the sampled households from HHSWI is about 6.9 million Riel.

Table 3.6. Annual Gross Income of Households from HHSWI

<b>Net Income (Riel)</b>	<b>Frequency</b>	<b>%</b>
2,000,000-5,000,000	24	30.0
5,000,001-10,000,000	41	51.2
10,000,001-15,000,000	12	15.0
15,000,001-20,000,000	3	3.8
Total	80	100.0
Average		6,881,000 Riel

Source: Field Survey, 2007.

#### *b) Net Income Earning from HHSWI*

HHSWI provides a good net return for rural households. Around half of the gross income is net income if the labour costs of household members are excluded. Table 3.7 shows that net income for about half of the sampled households (51.2 percent) from HHSWI ranges from 3 to 5 million Riel. Net income for nearly one third of them (30 percent) ranges from 1 to 3 million Riel while some of the households (13.8 percent) earn from 5 to 7 million Riel, followed by a few (7.5 percent) who earn from 7 to 9 million Riel. Net income for the minority of households (2.5 percent) ranges from 9 to 11 million Riel. The average net income of the sampled households from HHSWI is around 6.9 million Riel per year.

Table 3.7. Annual Net Income of Households from HHSWI

<b>Net Income (Riel)</b>	<b>Frequency</b>	<b>%</b>
1,000,000-3,000,000	24	30.0
3,000,001-5,000,000	37	46.2
5,000,001-7,000,000	11	13.8
7,000,001-9,000,000	6	7.5
9,000,001-11,000,000	2	2.5
Total	80	100.0
Average		4,175,800 Riel

Source: Field Survey, 2007.

In HHSWI, it is commonly perceived that the more looms the households own, the more income they generate. Based on Table 3.8 households consisting of four weavers had the highest net income from HHSWI (about 6.7 million Riel per year) followed by households with three weavers (6.4 million Riel), households with two weavers (4.3 million Riel) and those with a single weaver (3.2 million Riel).

Table 3.8. Annual Net Income Earning from HHSWI by Number of Weavers and Looms

Number of Weavers	Riel	Number of Looms	Riel
1	3,183,100	1	3,313,300
2	4,331,700	2	5,964,900
3	6,436,700	3	9,517,700
4	6,742,400	-	-

Source: Field Survey, 2007.

Note: - = no loom in the category

With respect to net income by number of looms, the more looms the household owns, the more income they generate. As can be seen in Table 3.8, the net income of households with one loom is about 3.3 million Riel per year, while that of those with two and three looms can reach 6 million and 9.5 million Riel per year, respectively.

#### IV. Factors Associated with Income Earning from HHSWI

Income earning from HHSWI varies from household to household according to the differences in their socio-economic characteristics. Not surprisingly, the number of looms and weavers are major factors affecting the variation of income. Generally, households with more looms can generate more income than those with fewer looms. Furthermore, households with more weavers, in many cases, can earn more income than those with fewer weavers.

The result from the multiple regression analysis explained that there were four independent variables - the number of looms, benefits gained from technical skill trainings, number of working hours and number of weavers – associated with the income earning from HHSWI of the poor households. All of the determinants had a positive impact and contributed 74.4 percent (Adjusted  $R^2 = 0.820$ ) to the income generated from HHSWI of the sampled households.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

Where,	Y	=	Income from HHSWI
	a	=	Constant
	$b_1 - b_7$	=	Coefficients
	$X_1$	=	Number of looms
	$X_2$	=	Number of weavers
	$X_3$	=	Amount of loan
	$X_4$	=	Benefits gained from technical skill trainings
	$X_5$	=	Number of working hours
	$X_6$	=	Age of weaver
	$X_7$	=	Year of experience

<b>Factors Influencing Income Earning from HHSWI</b>			
Y (Income from HHSWI)	=	- 10,065.700 + 2,333.112 * Number of looms + 10,016.417 * Benefits gained from technical skill training + 609.525 * Number of working hours + 1,030.503 * Number of weavers	
Multiple R	= 0.914	R <sup>2</sup> = 0.836	Adjusted R <sup>2</sup> = 0.820
Standard Error	= 1,474.671	F = 53.492	Significant F = 0.000

Table 4.1 shows that among the four determinants, the benefits gained from the technical skill training (RC = 10,016.417) has the highest correlation with the income earned from HHSWI, followed by the number of looms (RC = 2,333.112), the number of weavers (RC = 1,030.503) and the number of working hours (RC = 609.525).

Table 4.1. Regression Coefficient

Independent Variables	Regression Co-efficient
Constant	- 10,065.700**
Number of looms	2,333.112**
Benefits gained from technical skill training	10,016.417**
Number of working hours	609.525**
Number of weavers	1,030.503**

Note: \* Significant at 95% confident level; \*\* Significant at 99% confident level

Based on these findings, technical skill training is the most influential determinant of income from HHSWI. The sampled households used to receive the technical skill training from PASS<sup>23</sup> (Project D'Appui au Sector de la Soie) on new warping, dyeing and degumming methods in 2003. All of them are strongly satisfied with the trainings on these new methods because they can reduce the time used in the preparation stage and improve the quality of the *Hols*. Some households do not apply these new methods for dyeing and degumming given that they are accustomed to using the traditional ones, and in their view, the new methods do not improve the quality of their fabrics. In this case, those who had a more positive opinion on the benefits gained from the training are those who believe the new methods assist them to improve the quality of their silk fabrics and generate more income.

<sup>23</sup> Project d'Appui au Secteur de la Soie (PASS) was a development project funded by the French Development Agency (FDA) for a three-year period from 2002 to 2005 for strengthening the silk sector in Cambodia. PASS undertook a large technical skill training program aiming to support weaving sector in southern Phnom Penh, known as Takeo silk weaving region. Head weavers were trained to be responsible for training others from their group and for the distribution of equipment. Over 6,000 weavers attended the technical training on warping, degumming and dyeing organized through the PASS programs. Furthermore, the PASS introduced a warping frame, also called a frame warper, which allows the weavers to save time when the thread is prepared and during weaving with an added value of 6 to 10 percent.

The number of looms is another significant factor for determining income from HHSWI. The loom is the most important production component for HHSWI. The more looms a household owns, the more income they generate from HHSWI. The relation is also evident from the findings presented above which show that a household with one loom earns about 3.3 million Riel per year on average, while ones with two and three looms can generate about 6 million and 9.5 million Riel respectively (see Table 4.1).

The number of weavers is another important determining factor for earning income from HHSWI. Households with more weavers can earn higher incomes than those with fewer weavers because the former have a higher production capacity. Following, the study demonstrates that households consisting of just one weaver earn about 3.2 million Riel per year, while ones with two, three and four weavers can generate around 4.7 million, 7.4 million, and 8.7 million Riel per year, respectively (see Table 4.1). Those households who have more weavers and more looms generate more income than those who have more weavers but fewer looms, but the number of weavers tend to have a strong correlation with the number of looms in terms of generating income from HHSWI.

The number of working hours is another major factor affecting income earning potential from HHSWI. Generally, the more hours the weavers work, the more units they produce. The number of working hours also strongly correlates with the demographic and socio-economic characteristics of the weavers such as age, health, burden of work in the household and financial capital. Some industrious households work more hours than average because they have access to electricity from battery power for working during the night.

## V. Key Problems and Challenges of HHSWI

Based on the findings from this study, key problems and challenges of Cambodia's HHSWI identified are as follow: lack of capital, marketing support from the government and development agencies, raw material, poor access to formal credit and skill improvement training.

- *Lack of capital.* Inadequate capital, mostly working capital, constrains weavers from increasing their production capacity because they cannot consistently purchase cheap raw materials. Essentially, households are not able to buy the raw materials in cash but rely on middlemen for buying on credit, which is usually more expensive than buying in cash as the middlemen include interest in the sale price of yarn and dye. In some cases, the households have more than one weaver but work only with one loom due to lack of fixed capital. The households believe that they would be able to increase production if they had more adequate looms and equipment.
- *Lack of marketing support.* Lack of marketing support from the Government and development agencies is also a hindrance to improving the productivity of Cambodia's household silk-weaving industry. Weavers currently depend largely on middlemen for market information and marketing of silk fabrics. They also prefer dealing with middlemen rather



than marketing their products independently even when they can afford to buy raw materials in cash. Two reasons explain why contracted business is the preferred arrangement: first, weavers are afraid that retailers provide lower price for their fabrics, particularly during the rainy season during which there is a lower demand for silk products; secondly, weavers are not able to take out a loan from middlemen in case of emergency, like a loan for medical expense, and especially during the farming season when they require money to invest in paddy production, like buying fertilizer and hiring wage labourers for transplanting and harvesting.

- *Lack of support to purchase raw materials.* Lack of support for purchasing raw materials is also a problem faced by Cambodia's household silk weaving industry. The weavers perceive that if the Government or development agencies subsidize silk yarn, they would have more working capital for investing in their businesses. In their experience, they gained benefits from yarn support provided during the PASS training in 2003. In this respect, the weavers consider yarn support the same as financial support for working capital.
- *Limited access to formal credit.* Low accessibility to formal credit is also a great challenge for silk weavers in Cambodia. In fact, there are many MFIs based in Bati district, but the high interest rates offered discourage weavers from applying for credit. As a consequence, the weavers prefer buying raw materials on credit from middlemen although they know that the middlemen charge a higher price of raw materials, such as yarn and dye, than buying in cash. Based on the information proved by the weaving households, buying a kali<sup>24</sup> of yarn in cash costs 210,000 Riel (US\$52.5), while buying a kali on credit from a middleman costs about 240,000 Riel (US\$60), a difference of about 15 percent of the total cost. However, the weavers are able to take out a small loan in cash from the middlemen without interest when they have an urgent need.
- *Lack of technical training.* The households mentioned that lack of new technical skill trainings, including design, and introduction of modern tools and equipment was also a major problem. In fact, the households only realized that there are other modern weaving methods and techniques when PASS provided training on the new warping, dyeing and degumming methods. Through the PASS trainings they also learned that there are other modern tools and equipment used by weavers such as a frame wrapper and stainless steel reed in other areas of Cambodia and other countries in the region.
- *Lack of participation in weaving and saving groups.* Lack of participation in weaving and savings groups is also another challenge for the development of Cambodia's HHSWI. Two kinds of local groups exist in the study area. One is a savings group, and the other is a weaving group.

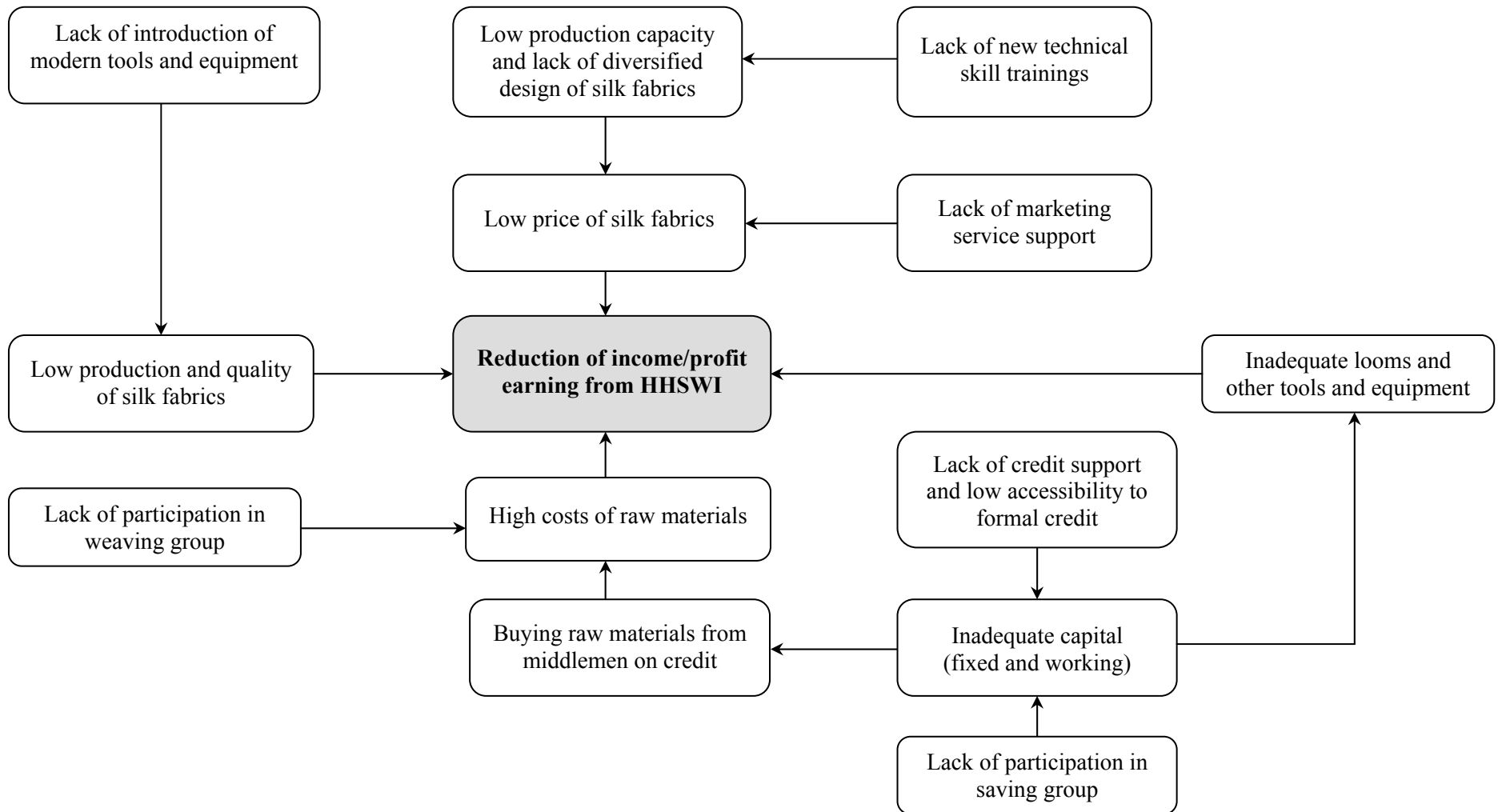
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<sup>24</sup> One kali equal two kilograms.

The savings group allows its members to borrow loans from their group, while the weaving group allows its members to buy cheap raw materials. However, most of the weavers in each village do not participate in the groups due to a lack of knowledge about the benefits of the group.

The linkages between the challenges to increasing the productivity of the household silk-weaving industry in Cambodia are illustrated in Figure 4.1.

Figure 4.1. Problem Loop of HHSWI



## **VI. Concluding Remarks**

Silk weaving contributes significantly to generating year-round employment and income for rural people, especially women and young girls who have limited opportunities to work in the formal sector. Weaving households are mostly engaged fully in silk weaving and rely heavily on income from their handloom industry to cover various household expenditures as income earnings from other sources are minimal. Notably, income from agriculture is significantly smaller than that from HHSWI.

Despite the enormous economic benefits to partaking in the industry, some key challenges and their limitations for improving the productivity of the household silk weaving industry have been explored. These consist of lack of credit support, inadequate technical skill training, insufficient tools and equipment lack of modern technology and limited marketing support. These aspects should be taken into account for future improvements of HHSWI and translated into clear policies and development programs from both the RGC and development partners to improve economic opportunities in rural areas.

It is important to provide credit support which an acute need of silk weavers. Programs targeting credit projects should be expanded to provide direct loans with favourable interest rates and no collateral requirements. To tailor these programs specifically to the household silk weaving industry, these loans should be provided primarily for working capital rather than for fixed capital; second, the loans should be screened carefully by project or program officers who work closely with local people to ensure it reaches poorest households.

It is also crucial to establish local weaving and saving groups in the form of self-help groups and encourage increased participation to make weavers more self-reliant for accessing to credit. Furthermore, technical skill training and the introduction of modern tools and equipment will ensure a higher production capacity, high quality silk fabrics and diversified design models. These kinds of institutional support increase the value-added of silk weaving and income earning of rural people.

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# **Cambodia's PRSP and Public Resource Allocation: How Pro-Poor is the Policy in Practice?<sup>25</sup>**

By

Ngo Sothath

## **Abstract**

This paper examines the “pro-poorness” of the priorities and implementation process of NSDP 2006-10. The first will be determined by measuring the objectives outlined in the NSDP to its ability to address the poverty issues in Cambodia and by observing whether it meets the World Bank’s principles of Poverty Reduction Strategy Paper. The latter is assessed by measuring the NSDP’s priority objectives against the public resource allocation and expenditure in the National Budget. The study reveals that while the NSDP 2006-10 captures many essential dimensions of development issues in Cambodia, it is also able to meet international principles of addressing poverty. However, the NSDP fails to produce a policy matrix, leaving a void for decision-making base on development priorities, no specific timeframe for implementation, and an unclear division of responsibilities among government agencies. The implementation of the NSDP, on the other hand, is not properly financed. Although the NSDP identifies Agriculture, Health, Education, and Rural Development as the highest priority sectors for poverty reduction, the allocation of public resources in the national budget are not aligned with these policy priorities while further actual public expenditures go unpredictable.

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## Cambodia's PRSP and Public Resource Allocation: How Pro-Poor is the Policy in Practice?

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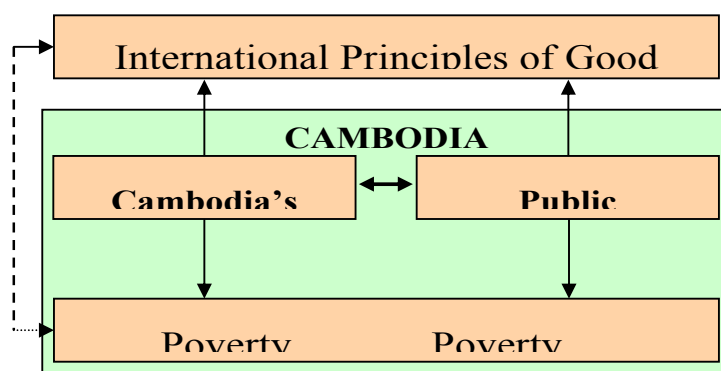
### I. Introduction

In late 1999, the World Bank and the IMF launched a new approach to the provision of their concessional assistance to low-income countries. With this new approach, governments of low-income countries were required to prepare their own Poverty Reduction Strategy Papers (PRSPs) through a participatory process in order to qualify for concessional loan from the World Bank, through the International Development Association, or the IMF, through the Poverty Reduction and Growth Facility. These have been on the agenda of some 70 low-income countries.

As a developing country, Cambodia produced its first PRSP (National Poverty Reduction Plan 2003-05) to meet the requirement of the Bank and the Fund in particular while the National Strategic Development Plan (NSDP) 2006-10 is considered as the second generation of PRSP in Cambodia. As a single overarching national policy document aimed to reduce poverty in Cambodia, the NSDP should reflect the reality of poverty in Cambodia and employ appropriate policy measures to address the poverty issues in Cambodia, meanwhile is supposed to meet the principles as requirement of the Bank and the Fund. Further, the NSDP implementation needs to be financed by the public resources through the national budget.

This paper will examine the “pro-poorness” of the priorities and implementation process of NSDP 2006-10. The first will be determined by measuring the objectives outlined in the NSDP to its ability to meet the poverty reduction priorities identified for Cambodia in the Poverty Profile of Cambodia and by observing whether it meets the World Bank's principles of poverty reduction. The latter will be assessed by measuring the priority objectives against the public resource allocation and expenditure in the National Budget.

Figure 1. Scope of this Paper



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In order to determine the coherence between the NSDP and the national budget to assess the pro-poorness of the policy and implementation process, this paper will address the following questions:

1. What are international principles of addressing poverty?
2. What are the characteristics of poverty in Cambodia?
3. What are the characteristics of policy responses adopted in the National Strategic Development Plan?
4. How are public investments allocated to address these identified needs?

## **II. Context of Cambodia's Development Policy**

### **2.1. National Policy**

Since its adoption of the UN Millennium Declaration in 2000, the Royal Government of Cambodia (RGC) undertook a program of public administration reform in order to reduce poverty and realize other intended outcomes of the Millennium Development Goals (MDGs). Following, the Cambodia Millennium Development Goals (CMDGs) were developed in 2003 introducing nine goals, 25 overall targets, and 106 specific targets.

In order to operationalize the first goal of poverty reduction, as well as all other goals declared in the CMDGs, a National Poverty Reduction Strategy (NPRS) was developed in 2003, which was supposed to be implemented between 2003 and 2005. The World Bank and the IMF required the development of a NPRS to receive concessional loans and other assistance. However, the purpose of the NPRS 2003-05 was observed to coincide with that of the second Socio-Economic Development Plan (SEDP-II) 2000-05 that also aimed to bring about macro-economic growth, social development, and poverty alleviation, and that was supported by the ADB. Later, both national plans were consolidated into a single national plan, the NSDP 2006-10.

The National Strategic Development Plan 2006-10 was built on the Rectangular Strategy (RS) principles, guided by the CMDGs and informed by experiences from the implementation of the SEDP I and II and the NPRS and other preceding national plans and strategies. Therefore, the RGC was in a solid position to bring about growth and reduce poverty. However, in order to facilitate the reduction of poverty in a fastest possible manner, the government needs to use its available resources wisely.

### **2.2. Public Financing**

The NSDP 2006-10 indicates US\$3,500 million is needed over the period 2006-10 to implement the policies stated in the NSDP, of which, US\$2,500 million must be financed by development partners. In order to target poverty reduction in rural areas, the NSDP specifies that 62% of the public investment must be spent in these areas while the education and health sectors should receive the remaining 33% of the resources.

This framework for public investment provided in the NSDP will be operationalized by the Public Investment Program (PIP) through its investment programming, and by



the annual national budget. The PIP and the national budget are the necessary tools for transforming the NSDP into development results. Yet, the actual financing of the NSDP will only be fully reflected in the expenditure of the national budget. Therefore, the national budget is the key to either the success or failure of the NSDP.

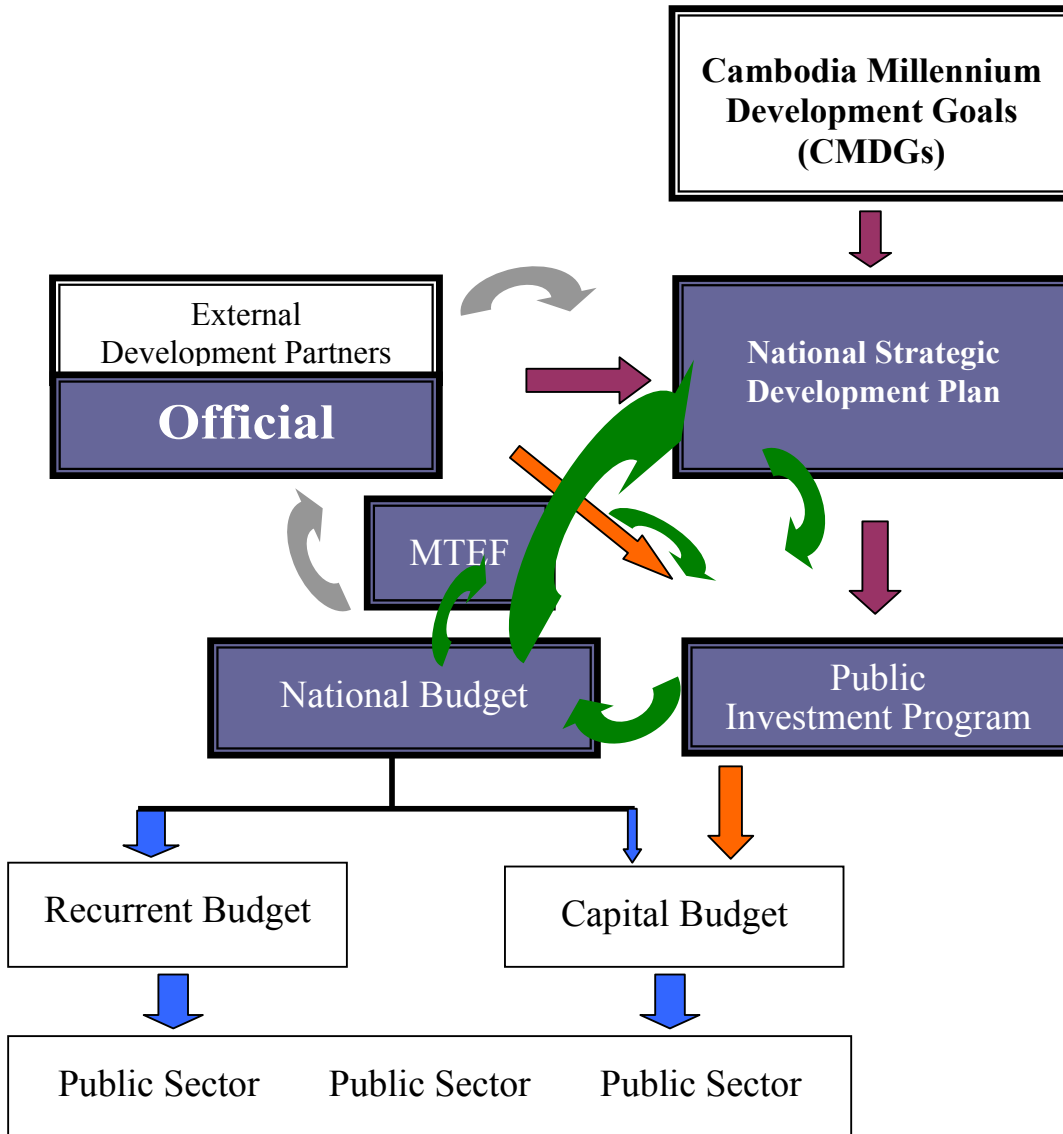
As commonly found in low income countries, the government's budget is usually underfunded by domestic resources. Typically, this occurs because the government cannot generate enough income to finance the country's public expenditure needs, including those investments necessary to finance development. Likewise, the government needs assistance from development partners to fill the budget discrepancies between the need of development priorities and the national budget needed to finance it.

Annual revenue for the RGC accounts for approximately 12% of the GDP, enabling Cambodia to meet its recurrent expenditure needs; a small proportion of this is used to finance public investment programs. Therefore, the public investment program is largely funded by external assistance through grants and soft loans. Given that all donor-funded public investment programs are considered as capital expenditures and recorded as part of the capital budget, all donor support should theoretically be based on the PIP's programming.

While PIP is a three-year rolling program, it represents only half the picture of the national budget: the capital budget. Whereas, the national budget presents both the capital and recurrent budgets, it operates on an annual planning cycle and lacks medium-term projection through the Medium Term Expenditure Framework (MTEF). The MTEF usually operates on a three-year rolling plan indicating 1) the resources needed to finance the implementation of the national policies; 2) resources available from domestic revenue within a macroeconomic stability framework; and 3) a spending framework reconciling the resources needed and resources available. MTEF provides prospective data for the following two years based on the budget year, providing the national budget outlay over the medium-term of 3 years.

In order to reduce confusion amongst the multiple budget planning cycles and processes – the NSDP, PIP, national budget, MTEF, and donor assistance – planning should be coordinated on a yearly basis and feed into the same multi-year framework as illustrated the diagram below.

Figure 2. Cambodia’s Development Policy Context



### III. Principles for Poverty Reduction Strategy

#### 3.1. Nature of Poverty

The World Development Report 2000/01 emphasized that poverty is multidimensional, extending beyond low levels of income. To investigate the causes of poverty, the WDR 2000/01 suggested examining the following three dimensions: i) lack of income and assets; ii) voicelessness and powerlessness; and iii) vulnerability to adverse shocks.

### ***Lack of Income and Assets***

The poor lack the income and assets needed to attain basic necessities such as food, shelter, clothing, and acceptable levels of health care and education. Assets are fundamental for wealth creation, as they facilitate productivity function. Therefore, they are determinants of poverty. A person's assets can be classified in several ways such as *human assets* (capacity for basic labor, skills, and good health), *natural assets* (land), *physical assets* (access to infrastructure), *financial assets* (savings and access to credit), and *social assets* (networks of contacts and reciprocal obligations that can be called on in time of need, and political influence over resources).

### ***Voicelessness and Powerlessness***

Being economically disadvantaged, the poor find themselves lacking voice, power, and independence in relation to the rest in the society. This may lead them to being further socially deprived. The poor are often subject to rudeness, humiliation, shame, inhumane treatment, and exploitation at the hands of the institutions of state and society. Threats of physical force and arbitrary bureaucratic power make it difficult for the poor to engage in public affairs, to make their interests known, and to have those interests taken seriously into account (WDR, 2000/01). The WDR 2000/01 continues that in agrarian societies insufficient assets and income-earning opportunities for poor people often tie them to rich landowners in a patron-client relationship. This further explains the social norms and barriers that can also contribute to voicelessness and powerlessness where people cannot exercise their potential in a democratic manner.

### ***Vulnerability to Shocks***

Vulnerability is defined as the 'risk of falling into poverty in the future', even if a person is not necessarily poor now. It is associated with shocks such as drought, a drop in farm prices, or a financial crisis (WBI, 2005). Given the circumstances of the poor and the near-poor, the WDR 2000/01 describes "risks that poor people face as a result of their circumstances are the cause of their vulnerability". It clarifies that the underlying cause is the inability to reduce or mitigate risks or cope with shocks.

Limited assets (physical, natural, or financial) make poor people especially vulnerable to adverse shocks. Those who own more assets are often more equipped to deal with shocks as long as those shocks are temporary. For those with fewer assets, dealing with short-term shocks may worsen deprivation in the long term and drive the poor and near-poor into a vicious downward spiral, leading them to, for example, pull children out of school to earn extra income during an economic crisis; deplete natural resources beyond the sustainable level; make quick sales of land or livestock at desperately low prices; or lower nutritional intake below the levels necessary to sustain health. (WDR 2000/01, p. 37)

Klugman (2001) describes insecurity as vulnerability to a decline in well-being and exposure to shocks that can occur at the individual/household (micro) level, local/community (meso) level, and national and international (macro) level. She stresses that 'vulnerability need not be unexpected and could be seasonal.' While

everywhere, the risk of illness is a prime concern of the poor, risks affecting the harvest are common and most important in poor rural areas. (Klugman, J., PRSP Sourcebook, p.11)

### **3.2. Addressing Poverty**

In response to the three dimensions of the causes of poverty, the WDR 2000/01 suggests a framework for action which is needed to effectively reduce poverty. It recognizes that national economic development is central to success in poverty reduction. However, poverty reduction is not merely the outcome of economic processes, but also social and political processes that interact with and reinforce each other in ways that can worsen or ease deprivation. Although actual priorities and actions to address poverty should ideally be worked out in each country's own context, those priorities and actions should be considered with specific attention to the following dimensions: i) promoting opportunities; ii) facilitating empowerment; and iii) enhancing security.

#### ***Promoting Opportunity***

Opportunities for individual income generation can be facilitated and expanded by economic growth. Often, the private sector is, in a free market economy, viewed as the main driving factor of economic growth. Therefore, the business environment which is favorable for private investment is as crucial, as is the political and social stability that underpins public and private investment. As investment and other capital are preconditions to growth, the distribution of assets (including human, natural, physical, financial, and social assets) are fundamental to ensure the direction and distribution of that growth.

In order for growth to be pro-poor, efforts must be made to ensure opportunities are made available to the poor. In other words, how can the poor take advantage of these opportunities so that they can actively participate in producing growth, which will eventually benefit them and society as a whole? This will not come about without employing sound public policies. To ensure this, the WDR 2000/01 emphasizes that "key in expanding economic opportunities for poor people is to help build up their assets". Human capacity such as education and health is of intrinsic value for the poor to utilize the available opportunities. In supporting the poor to expand their assets, the state has a central role in ensuring that the poor have access to land, infrastructure, and basic social services.

#### ***Facilitating Empowerment***

Empowerment means enhancing the capacity of poor people to influence the state institutions that affect their lives, by strengthening their participation in political processes and local decision-making (WDR 2000/01). Making and expanding economic opportunities available to the poor is actually empowering them. However, efforts are needed to make state and social institutions work in the interests of poor people. Empowering poor people is part of the broader agenda of sound governance and accountability of state institutions to their citizens. It enables the poor to interact effectively with the state and hold state institutions accountable for services and obligations that are meant to serve the general public.

***Enhancing Security***

While pro-economic growth policies are central to poverty reduction, social protection measures also play an important role in reducing vulnerability and protecting the welfare of the poor from shocks. Social protection or social safety net measures are crucial to ensure that poor households are able to maintain minimum consumption levels and access to basic social services during periods of crisis. Therefore, a pro-poor PRSP should promote policies that protect the poor from domestic and external shocks. (Ames, B., et al, 2001, p.22)

The first step in choosing an appropriate mix of social protection policies is to analyze the main sources of risk and vulnerability of the population and identify the population groups most affected. Once the groups and their characteristics are identified, social protection programs and policies should then be formulated to address the issues individually and/or in combination (WB website, PovertyNet, Social Protection). Typical measures of social protection or safety nets can take the form of portfolio diversification and insurance schemes (Klugman, J., PRSP Sourcebook, 2001, p.18).

Portfolio diversification may include: income source diversification, investment in physical and human capital, rotating savings and credit associations, investment in social capital, bank savings, and microeconomic finance. Insurance schemes may include sharecropping tenancy, old-age annuities, accident and disability insurance, pension systems, unemployment insurance, health and disability insurance (Klugman, J., PRSP Sourcebook, 2001, p.18).

Poor people are vulnerable to shocks and shocks can drive people into poverty. Efforts to help reduce vulnerability to shocks by enhancing poor people's security through a range of approaches can reduce the volatility of household income and provide the means for poor people to manage risk by themselves, and strengthen market or public institutions for risk management. Therefore, improving the capacity of risk management institutions should be a permanent feature of poverty reduction strategies. Approaches have to employ different schemes to cover different types of shocks/risks and different groups of the population. Safety nets are important to support immediate consumption needs and to protect the accumulation of human, physical, and social assets of the poor.

**3.3. Approaches to Poverty Reduction**

Because the nature of poverty is multidimensional, addressing poverty through specific targets does not necessarily resolve underlying causes, which can be cross-cutting and a challenge to the entire country's development. Therefore, general policies which aim to address cross-cutting and underlying factors such as governance, growth, agricultural modernization, and infrastructure may generate greater impact on poverty reduction on the ground (Curran and de Renzio, ODI's CSPP, p.2). This means that the current practice of implementing targeted policies, rather than tackling some of the wider framework issues that prevent poverty reduction, will not have a long-term and sustainable impact on poverty.

Hughes and Conway (2004) suggest that the distinction between proximate and structural causes of poverty must be made and borne in mind because policy-makers often have to make choices between addressing the immediate triggers that directly reduce household poverty or the structural issues that indirectly and over the long term address the fundamental causes of poverty. Therefore, any broad poverty reduction framework should balance between targeted actions which directly benefit the poor (e.g. equity funds to allow the poor to use health services); inclusive actions which benefit the poor and non-poor alike (e.g. policies to improve the quality of health services); and enabling actions (e.g. policies to improve the capacity of ministries to plan and manage resource effectively) (Hughes and Conway, 2004, p.14).

Reducing poverty through targeted approaches will not be successful unless interventions targeted to the poor are based on knowing who they are, where they are, and why they are poor (WBI, 2005, p.10-12). Therefore, identifying and understanding the poverty profile is important for an intervention to be successful. To facilitate an effective intervention, more specific characteristics of poverty should be observed. For example, the poverty profile should be able to examine the pattern of poverty as to whether it varies by geography (e.g. by region, rural/urban, mountain/plain, etc.), by community characteristics (e.g. communities with and without a school etc.), and by household characteristics (e.g. by male- or female-headed household, by education of household head, by size of household etc.). (WBI, 2005, p.10-12)

As exposure to vulnerability is also a driver of poverty, Hughes and Conway (2004) continue to recommend that distinction be made between chronic and transition poverty. While some groups are born into or trapped in a vicious cycle of poverty, others dip in and out of poverty on the basis of short-term shocks or cyclical periods of stress. The distinction suggests that reducing poverty can potentially be achieved through two different approaches. The first – a promotional approach – involves public actions that lift the currently poor (chronically poor) out of poverty. The second approach – a preventative or protective measure – is meant to prevent the currently non-poor (those vulnerable to transitory poverty) from falling into poverty. (Hughes and Conway, 2004, p.14-15)

## **IV. Poverty Profile of Cambodia**

### **4.1. Distribution of Poverty**

The poverty headcount index has been reduced from 45-50% in 1993/94 to 35% in 2004. Over the same period, a greater proportion of the poor became less poor as they moved closer to the poverty line (NSDP 2006-10, p.112). However, the income inequality between the rich and the poor over the same period has widened. The Gini-coefficient within the geographically comparable sampling frame of the 1993/4 baseline survey indicates that this gap has increased from 0.36 in 1993/94 to 0.40 in 2004. The increase in inequality was due primarily to rising inequality *within* the rural population, as inequality decreased among people in Phnom Penh and remained unchanged in other urban stratum (WB, 2006, p. 29).



The distribution of the poor can also be seen, on a smaller scale, by disaggregating by provinces. The three provinces with the highest incidence of poverty are Kampong Speu (57%), Kampong Thom (52.4%) and Siem Reap (51.8%). The next highest poverty rates are found in Kampong Chhnang and Pursat (39%), Prey Veng (37.2%), and Kampong Cham (37%). These provinces are located in the Plains and the Tonle Sap regions and are known as the main rice and agriculture producing regions apart from the Kampong Speu, which is highland.

#### **4.2. Characteristics of Poverty**

The poverty phenomenon in Cambodia is strongly correlated with the level of education of the household head. The higher the level of education attained by the household head, the lower the poverty rate. Therefore, the poverty rate is the highest in households whose heads have no schooling or are illiterate. Almost 48% of households falling into this category are poor. Although the incidence is lower for households where the head has primary schooling, the rate is still high (nearly 36%). More than 70% of Cambodia's population or 80% of Cambodia's poor are members of households whose heads are either illiterate or have completed only primary education (MoP, Feb 2006)

When observing the incidence of poverty by sectors of employment, the poverty rates are the highest within households whose heads are working in mining (44%), followed by agriculture (43%) and construction and utilities (42%). The proportion of the poor engaged in agriculture is 63%. Poverty rates also tend to be lower in households whose heads are employed in public administration and defense, education or health services. The poverty rate among these groups is about 13%. (MoP, Feb 2006)

The Poverty Profile of Cambodia 2004 also categorizes the incidence of poverty by types of employment. It highlights that poverty is high among households whose heads are employed as domestic workers. Around half of the people employed in this type of work are poor and this group represents about 13% of the poor. The poverty rate among household whose heads are self-employed in farm activities is 41%, far higher than those who are self-employed in non-farm activities (28%). Self-employed farmers represent almost half of the poor.

Poverty in Cambodia is also associated with household size: the poverty rate gets higher as the number of household members increase. The poverty rate is between 38-48% among households with 6-8 members. This segment of the poor accounts for more than 50% of Cambodia's total poor. Grouping households by ages of the household heads, the poverty level among households whose head is between 30-49 years old is 38%. The rate tends to decline with household heads aged 50 years and older. One possible explanation for this finding is that these households have lower dependency ratios, higher incomes and more assets due to the longer life span of the household head.

The level of poverty appears insignificant among households heads characterized by gender (male-headed vs. female-headed). However, the situation of poverty is found to be worse among households whose heads are divorced or who are afflicted with



two or more disabilities. The poverty rate rises with the number of reported disabilities. Poor disabled people constitute about ten percent of the total poor.

Quality of life is closely related with nutrition and access to safe water and sanitation. The incidence of malnutrition in Cambodia is high (MoP, Feb 2006). Child malnutrition is strongly associated with the income level of the household. However, low income is just one factor. Other factors that influence variations in nutritional status include access to safe drinking water and sanitation, health facilities, and quality of village infrastructure (MoP, Feb 2006). In 2005, only 42% of rural households were estimated to have access to safe drinking water, while only 16% had access to sanitation (NSDP 2006-10).

Other poverty statistics show that 94% of the poorest quintile households do not have any toilet facilities, 79% use kerosene as their source of lighting, and the other 19% only have access to grid, generator, or battery (MoP, Feb 2006). More than 97% of the poorest quintile largely depends on firewood as source of fuel, and less than 2% of them have access to piped water or public tap. Dependent on firewood, the poor spend significant time and labor to collect firewood which may contribute to their loss of economic and/or education opportunities; burning firewood is also one of the main causes of respiratory disease (JBIC, Dec 2001, p.2).

The poorest households in Cambodia are more vulnerable to disasters. More than 90% of the poorest households are living in the villages that experienced disasters during the past five years. The poor are also more vulnerable to illnesses. In times crisis, poor households sell off their asset to cope with illness. Disasters in Cambodia are often in the form of agricultural production shocks due to floods, droughts, and pests. (MoP, Feb 2006, p.84)

The majority of Cambodian poor (91%) reside in rural areas. While more than 60% depend on agriculture for their livelihoods (NSDP 2006-10), 46% of rural households are landless and land-poor – owning less than half a hectare per household (WB, June 2007, p.56).

As an agrarian society, owning land is very important. However, only 37% of households in the poorest quintile own land secured by paper, compared with 63% in the richest quintile. It's important to note that only 16% of households in the poorest quintile households own land which is secured by a title compared with 29% in the richest quintile (MoP, Feb 2006). This is a source of great vulnerability for poor households. Further, only 20% of Cambodia's agricultural land in 2005 was estimated to be irrigated and approximately 3-4 million land mines were laid on the land area of 2,100km<sup>2</sup> (JBIC, 2001, p.4), which is about 1.16% of the country's total territory and is unusable for agriculture production or other productive purpose.

#### **4.3. Issues and Challenges for Poverty Reduction**

The National Strategic Development Plan 2006-10 identifies a number of challenges that it must overcome to reduce/eradicate poverty in Cambodia. While the incidence of poverty is closely associated with education, progress in this sector has been minimal. Literacy rates, primary enrollment and survival rates remain almost unchanged. The current literacy rate is 83% compared to 82% in 1999 and the

survival rate from grade 1 to 9 has dropped from 33% in 2001 to 30.18% in 2005 (NSDP 2006-10, p.103). A Poverty Profile of Cambodia 2004 states that low enrollments cannot be fully explained by child labor alone as the proportion of children, who are not working, never register at school. A possible reason for this discrepancy is the informal costs of education and perceptions that the quality of education in Cambodia is low thereby discouraging enrollment (MoP, Feb 2006).

Despite the fact that more than 60% of rural Cambodians are reliant on agriculture, forestry and fisheries, the growth rates of these sectors are uneven from year to year in part because agricultural production is very dependent on natural factors which are susceptible to shocks such as erratic rainfall patterns, floods, droughts, and pests. Additionally, the large majority of the agricultural land is not irrigated. This restricts farmers to harvesting their crops only once per year. The yield of paddy rice is around 2 tons per hectare, which is still far below production yields in neighboring countries that share similar agro-climatic conditions (NSDP 2006-10, p.18-19). However, it is notable that 70% of Cambodia's fruit and vegetable consumption is imported.

Food security and nutrition are also areas affecting Cambodia's development. Malnutrition accounts for 54% of child mortality (NSDP 2006-10, p.20). Challenges remaining in the health sector include providing easier and less costly access to the poor (NSDP 2006-10, p.28). Despite substantial achievements in access to basic health infrastructure, the proportion of rural households with access to safe drinking water and sanitation remains low. Access to safe drinking water improved from 24% in 1998 to 42% in 2005 and access to sanitation improved from 9% in 1996 to 16% in 2005 (NSDP 2006-10, p.xvii,106).

Successes in poverty reduction thus far reflect the peace dividends that Cambodia received after emerging from two decades of conflict. Peace encourages the flow of investment to generate growth, and eventually reduce poverty. Yet, the pattern of private and public investments has been urban-biased and growth has been narrowly-based, driven mainly by a few sectors: garment industries, construction, and tourism (NSDP 2006-10, p.112).

## **V. National Strategic Development Plan 2006-10**

### **5.1. Poverty Reduction Goals**

Those priority goals and targets are shown in NSDP 2006-10's Table 3.2 highlighting poverty reduction as the highest priority. The following top four priorities are: enhanced agricultural production and productivities; improvement in health; improvement in education; and rural development. The remaining priorities include: environmental sustainability; gender equity; governance reforms; sustained high macroeconomic growth; improved budget performance; accelerated industrial growth and employment; tourism development; de-mining and victim assistance; infrastructure; and energy.

These priority sectors adequately reflect the needs and challenges Cambodia is facing in its efforts to reduce poverty as they are all essential areas which are crucial to poverty reduction. These poverty reduction goals are characterized as macro/strategic and are identical to the goals and sub-goals outlined in the CMDGs.

## 5.2. Characteristics of Policy Response

The RS framework captures many essential elements of the development issues particular to Cambodia. This framework allows the NSDP to employ policy measures that address the multidimensional causes of poverty from a long-term perspective. The NSDP regards ‘good governance’ as core and cross-cutting as compared to all other elements of development angles and underpinning factors for equitable development to take root. Dedicated to good governance, the NSDP commits to a number of critical reforms: i) fighting corruption; ii) legal judicial reform; iii) public administration reform; and iv) armed forces reform and demobilization. In this regard, the NSDP attempts to address the structural and multi-dimensional causes of poverty.

The NSDP incorporates the four angles of the RS (enhancement of the agriculture sector; rehabilitation and construction of infrastructure; private sector development and employment generation; and capacity building and human resource development) as growth rectangles. It recognizes that the fruits of socioeconomic development will primarily be facilitated by the policies and actions announced in these rectangles.

The commitments to enhancing agriculture, improving infrastructure, and developing private sector are intended to promote growth, an essential ingredient for development. The fourth angle – capacity building and human resource development – is explicitly the government’s aim to improve the social service including education and health. The NSDP underscores that the implementation of policies and actions under these rectangles will not be possible without social, economic, and political stability, also a pre-condition for growth and development.

Section 4.73 in the NSDP identifies agriculture, agro-industry, and infrastructure as promising sources of pro-poor growth, given the potential for growth through multiplier effects throughout the economy from increasing incomes in rural areas. Yet, other than a general statement to encourage, facilitate and provide support for private sector investment in these sectors, the RGC doesn’t introduce any concrete policies or direction to facilitate either domestic or foreign investment. Further, even though the NSDP continues to regard tourism, manufacturing, and other labor-intensive industries as priority sources of growth, it does not propose mechanisms that allow Cambodian people, especially the poor, to participate and to maximize domestic benefit from these sources of growth.

Although the NSDP includes a number of social safety net measures in section 4.83 to protect vulnerable groups such as the disabled, homeless, orphans, elderly, poor widows and widowers, and veterans, no proper analyses of vulnerability is provided in the NSDP. Further, despite mentioning groups of vulnerable people, no proper statistics on the characteristics and distribution of these people are available in the NSDP. Therefore, it is doubtful that a thorough assessment of the factors of poverty and vulnerable groups in Cambodia were undertaken compromising the effectiveness of the measures to address the needs and challenges of those groups, or to have optimal impacts on their livelihoods.

Shocks do not have to be unexpected, especially those that are seasonal. Recognizing the underlying factors of risk for vulnerable people, the NSDP identifies rainfall, flood, drought, pests, and illnesses as common features of natural disasters and shocks

for the large majority of Cambodian people. However, the causes of vulnerability can also be a matter of inability of the state or communities to develop appropriate mechanisms to mitigate the risks. Therefore, occurrences, sources, and damages of these phenomena should be properly analyzed and taken into account for disaster management. As such, a specific section or chapter on vulnerability and disaster management would enable the NSDP to provide clear direction for insulating vulnerable people against shocks.

Lack of division of responsibilities among government ministries or agencies has also been an impediment to the success of the NSDP. Poor articulation of roles and responsibilities undermines the ability to hold implementing ministries accountable for their actions. This is particularly problematic, especially in areas where policy measures fall into the jurisdiction of more than one sector and where joint responsibility and accountability are required.

Also related to the issue of poor accountability of implementing agencies is the absence of timelines for specific policies or actions to be started or completed in the NSDP. Though the NSDP is meant to be strategic and completed in five years' time, it is necessary to assign time-boundaries to key actions in order to ensure robust implementation and monitoring. The lack of time-bound targets is due in part to the absence of a policy/action matrix, one of the explicit requirements for World Bank and International Monetary Fund PRSPs. Such a matrix is not found in Cambodia's NSDP.

Prioritization is crucial for decision-making and flexibility when implementing policies, especially when resources are limited, but not one of the policy measures identified in the NSDP is given priority, let alone creating a system of prioritization. This is problematic, especially under circumstances of budget shortfalls or other instances in which policy-makers must make choices about which policies to fund or how much to allocate to each. Failure to prioritize the policy measures in order of importance for achieving poverty reduction leaves policy-makers as well as monitoring institutions with no sense of which policy or action deserves more attention than the other.

### **5.3. Poverty Reduction Costing**

The Table 1 below is an extract from the Table 5.2 of the NSDP 2006-10 (p.87). It provides information on the resource allocation by sector with reference to rural and urban areas. The NSDP commits to channel 62% of the resources to rural areas. This reflects a commitment to address the incidence of rural-concentrated poverty in Cambodia.

Of the total estimated resources needed for implementing policies and actions contained in the NSDP, the RGC assigns the resources in the following manner: i) 33% to social sectors which include health and education (60% earmarked for basic education); ii) 22% to economic sectors (agriculture and land management, rural development, and manufacturing, mining and trade); iii) 25% to infrastructure which includes transportation, water and sanitation (excluding rural), power and electricity, and post and telecommunication; iv) 14% to services and cross-sectoral programs; and v) 6% is left unallocated.

Table 1: NSDP Allocation by Sector, 2006-10 (in million US\$)

Sectors	Amount		Rural		Urban		
	t	t	%	%		%	
<b>Social Sectors</b>							
Education (of which Basic Education to receive 60%)	550		15.71%	330	60%	220	40%
Health	600		17.14%	420	70%	180	30%
<b>Sub-Total</b>		<b>1150</b>	<b>32.86%</b>				
<b>Economic Sectors</b>							
Agriculture & Land Mgmt: other than crops	150		4.29%	143	95%	8	5%
Seasonal Crops: Rice and others	200		5.71%	200	100%	0	0%
Rural Development	350		10.00%	350	100%	0	0%
Manufacturing, Mining & Trade	80		2.29%	12	15%	68	85%
<b>Sub-Total</b>		<b>780</b>	<b>22.29%</b>				
<b>Infrastructure</b>							
Transportation (Roads, Ports, Rlys, Civil Aviation)	550		15.71%	275	50%	275	50%
Water and Sanitation (excluding rural)	150		4.29%	15	10%	135	90%
Power and Electricity	120		3.43%	60	50%	60	50%
Post and Telecommunications	60		1.71%	30	50%	30	50%
<b>Sub-Total</b>		<b>880</b>	<b>25.14%</b>				
<b>Services and Cross Sectoral Program</b>							
Gender Mainstreaming	30		0.86%	9	30%	21	70%
Tourism	30		0.86%	8	27%	23	77%
Environment and Conservation	100		2.86%	90	90%	10	10%
Community and Social Services	80		2.29%	60	75%	20	25%

Source: NSDP 2006-10, Table 5.2 (p.87)

The priority sectors are reflected in this costing framework. However, only aggregate amounts are given for each sector, leaving out significant details about how the money is allocated in each sector. Therefore the costing table is too simple to adequately assess the poverty reduction efforts of the RGC compared to the budget allocations in the NSDP.

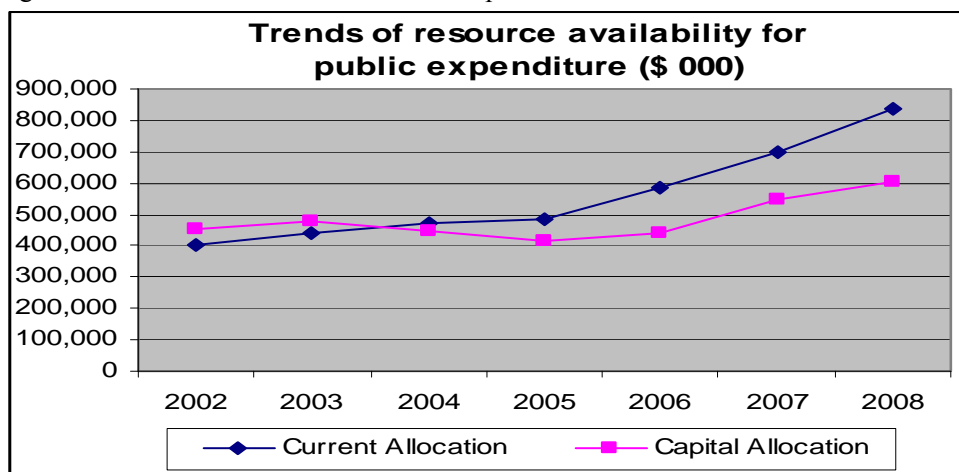
The costing shown in Table 1 supplies only the lump-sum amount of the whole 2006-10 period without a year-by-year breakdown. This format does not provide any idea of expenditures needed on an annual basis. Further, in this format, it will be impossible to analyze the trends in resource allocation. This makes it hard for the public to observe and argue about any trends that may occur from one year to another. Further complicating the matter, neither allocated nor actual amounts of the resources in the past year are provided to serve as a baseline for comparison and judging whether the each year's allocation is a continuation or shift in practice from previous years.

## VI. Public Investment Allocation

The NSDP 2006-10 sets out strategic goals and targets to be achieved within five years' time. To achieve those goals and targets, the costing laid out in Table 5.2 in the NSDP indicates only broad directions to move forward. Further, the three-year rolling PIP, which is an integral part of the NSDP, will annually prepare the programming and cost estimate to operationalize public investments based on inputs from various sectors, sub-national government, and the central agencies, which include the MoP, MEF, SNEC, and CRDB/CDC (NSDP 2006-10, p.85). Nevertheless, the practical public resource allocation will only be reflected in the annual national budget. Each year, the government proposes the draft budget law and seeks approval from the National Assembly.

### 6.1. Availability of Public Resources

Figure 5: Available Resources for Public Expenditures



Source: Budget Law 2002-08

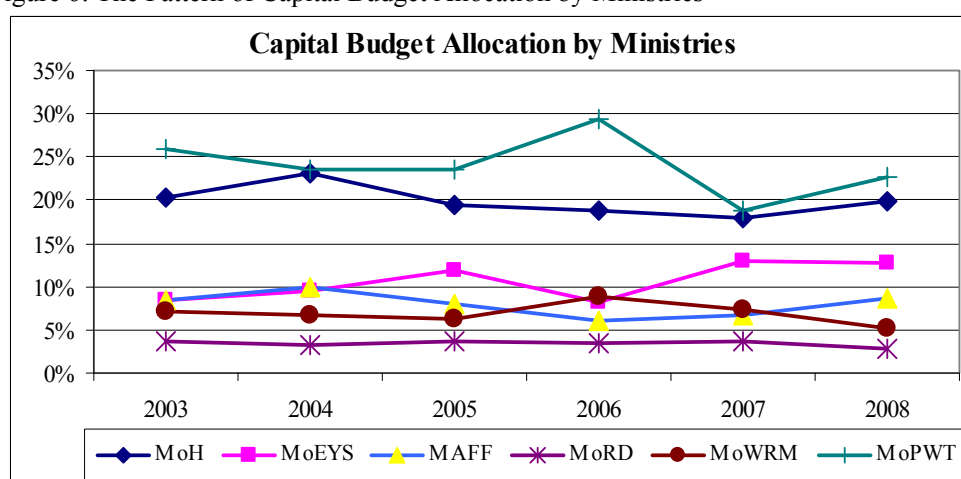
Generally, figure 5 shows a shift in resources available for recurrent and capital expenditures. Since 2004, the resource allocation for recurrent expenditures started to exceed the resource available for capital expenditures. The trend continued and increased considerably between 2006 and 2008, which means the government was able to generate more resources available for public expenditures. This also reflects the government's effort to bring about high economic growth during this period. The resources available for recurrent expenditures in 2006 were about \$600 million

(increased from \$500 million in 2005) and this continued to go up to about \$700 million in 2007 and \$840 million in 2008. The increase is large compared to the government's effort to increase the recurrent budget allocation from about \$400 million in 2002 to nearly \$500 million in 2005.

## 6.2. Capital Budget Allocation and Expenditure

It is important to note that figure 6 presents the resource allocated by individual ministries, rather than by sectors (as provided in the NSDP). Therefore, there are limits to the ability to interpret the relationship between the resource allocation, actual expenditure and the NSDP provision. Nevertheless, the analysis of the allocation by ministries will help identify some implications involved in resource allocation and expenditure.

Figure 6: The Pattern of Capital Budget Allocation by Ministries



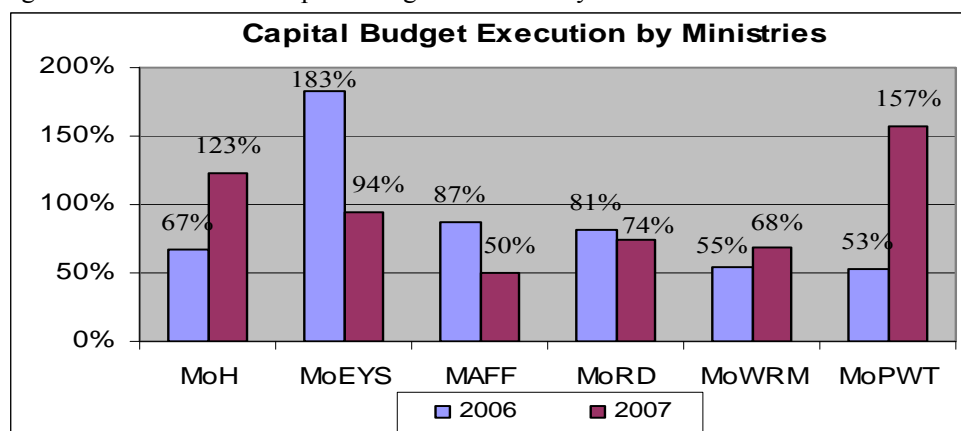
Source: Budget Law 2003-08

Compared to the allocation pattern in 2006 and previous years, the distribution of the capital budget for 2007 and 2008 to a number of ministries presented in figure 6 was more stable over time and better aligned to the NSDP requirement. The MoPWT continued to receive the largest funds from the capital budget, followed by the MoH. However, the allocation to the MoPWT (30%) over 2006-08 remained far higher than the NSDP allocation (16%). The MoPWT's budget dropped from about 30% of the total capital budget in 2006 to less than 20% in 2007, before it increased again to 23% in 2008. The MoH receives about one fifth of the capital budget each year. This share is 1-3 percentage points above the level set by the NSDP.

Expenditures by the MoEYS, MAFF, and MoRD have been below the NSDP requirements. The MoEYS' capital budget was about 8% in 2006 and went up to about 13% in 2007 and remained constant in 2008. While the NSDP suggests that 10% of the budget should be allocated to rural development, the MoRD's budget share was 4% in 2006 and 2007 and declined to 3% in 2008. Though underfunded, the MAFF saw its allocation on a steady rise of one percentage point each year during 2006-08 (6% in 2006, 7% in 2007, and 8% in 2008). In contrast, allocation to the MoWRM reduced by about two percentage points each year. The allocation fell from

about 9% in 2006 to about 7% and 5% respectively of the total capital budgets in 2007 and 2008.

Figure 7: The Pattern of Capital Budget Execution by Ministries



Source: Budget Law 2007-08

Although the capital budget allocation for the MoPWT in 2007 fell to about 19% of the total capital budget, the ministry actually overspent by more than 50% as shown in figure 7. Similarly, despite a low allocation in 2006 (8% of total capital budget), the MoEYS spent nearly twice as much (183%) of its allocated budget. Worst of all, the MAFF and the MoRD never spent the limited resources they were allocated. The MAFF spent only 87% of its capital budget in 2006 and 50% in 2007. Likewise, the MoRD managed to spend only 81% and 74% respectively of its capital budget in 2006 and 2007. The pattern of under-expenditures in these sectors makes their shares even farther below the NSDP allocation. Because the capital expenditure is mainly financed by development partners, the under-expenditure may be explained by either the capacity of the ministries to spend, or the disagreement between the ministries and development partners.

## VII. Conclusion

In sum, it can be concluded that the NSDP is pro-poor in terms of the priority policy goals set forth in the document. Collectively, they respond to the overall poverty situation, particularly the challenge to poverty reduction in Cambodia and also align with some internationally recognized principles of addressing poverty: addressing governance issues, ensuring enabling environment through macroeconomic, social and political stability; promoting opportunities by facilitating growth; and enhancing security through social safety nets.

However, the policy measures in the NSDP are not prioritized, the timeframe for getting the policy implemented is not clearly determined, and the implementing/responsible government agencies are not clearly assigned. Failure to do so is explained by the absence of a 'policy matrix' in the NSDP. Further, the poverty diagnostic fails to identify the dynamics of poverty in Cambodia – transitory versus chronic poverty. The causes are mentioned, but the NSDP lacks a study of structural



versus proximate causes that may require policy-makers to employ different policy options to address those causes.

On the other hand, through public resource allocation, the NSDP implementation is far from pro-poor since the practical resource allocation for public investment in the annual national budget does not adequately reflect the provisions set out in the NSDP. Further, the allocated amounts in the national budget have not been spent as planned leaving the pattern of public expenditure unpredictable. While the allocation of public investment to some sectors remains overfunded, even when these sectors overspend, the priority sectors – agriculture and rural development – continue to suffer from both low allocation and under-expenditure.

**LIST OF ACRONYMS**

CDC	Council for the Development of Cambodia
CEA	Cambodian Economic Association
CMDGs	Cambodia Millennium Development Goals
CRDB	Cambodian Rehabilitation and Development Board
CSES	Cambodian Socio-Economic Survey
CSPP	Civil Society Partnership Program
IEO	Independent Evaluation Office
IMF	International Monetary Fund
JBIC	Japan Bank Information Center
NGO	Non-Governmental Organization
NPRS	National Poverty Reduction Strategy
NSDP	National Strategic Development Plan
MAFF	Ministry of Agriculture, Forestry and Fisheries
MDGs	Millennium Development Goals
MEF	Ministry of Economy and Finance
MoEYS	Ministry of Education, Youth and Sport
MoH	Ministry of Health
MoP	Ministry of Planning
MoPWT	Ministry of Public Work and Transport
MoRD	Ministry of Rural Development
MoWRM	Ministry of Water Resource and Meteorology
MTEF	Medium Term Expenditure Framework
ODI	Overseas Development Institute
OED	Operation Evaluation Department
PIP	Public Investment Program
PRS	Poverty Reduction Strategy
PRSP	Poverty Reduction Strategy Paper/Plan
RGC	Royal Government of Cambodia
RS	Rectangular Strategy
SEDP	Socio-Economic Development Plan
SNEC	Supreme National Economic Council
US\$	United States Dollar
UXO	Unexploded Ordnance
WB	World Bank
WBI	World Bank Institute
WDR	World Development Report

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# Assessment of the Feasibility of Growing Jatropha for Electricity

A Case Study  
in Paoy Cha Commune,  
Phnom Srok District, Banteay Mean Chey Province

by  
Chan Sophal

## Abstract

Commissioned by GTZ-Private Sector Development Programme, the study assesses the feasibility of growing jatropha for electricity production in Paoy Cha commune. The analytical framework employed herein includes the appraisal of the market-based profitability of jatropha production by taking into account the opportunity costs of factors of production and current market prices for jatropha. It also assesses the villagers' affordability of electricity at current market prices in similar settings.

The findings provide sufficient evidence to conclude that the prospects of both growing jatropha and providing electricity in Paoy Cha commune are very promising. Both the opportunity costs of land and labour are favourable at present. Large sizes of land are abundant and available, although its suitability may require technical assessment. The estimate based on the household survey is that a total of **670 ha** of land can be used to grow jatropha. The total diesel requirement to supply electricity to all the 1,733 households in Paoy Cha commune would be **76,000 litres per year**. This would require approximately 250 tons of jatropha seeds per annum.

There is an even greater potential demand for jatropha oil in the commune than that for electricity production. The current consumption of diesel in the commune is remarkable because of the agricultural machinery use. The household survey in combination with the census of tractors, koyun, rice mills and other machines showed that the commune uses at least 441,000 litres every year for machinery. If jatropha oil can efficiently replace diesel use, the market for jatropha production would be great enough to warrant substantial production of jatropha in the commune.

# **Assessment of the Feasibility of Growing *Jatropha* for Electricity in Paoy Cha Commune, Phnom Srok District, Banteay Mean Chey Province**

Chan, Sophal<sup>27</sup>

## **I. Introduction**

### **Background**

Economic development in rural areas of Cambodia is hampered by the lack of electricity. To overcome these obstacles, one solution is to have private power suppliers invest in small grids to provide households and firms with power on a commercial basis. An advantage of this is to ensure that villagers have sustained access to a constant supply of electricity. One solution envisaged is a pilot project to provide electricity through renewable energy sources based on *jatropha* plants. Local residents would not only contribute to generating electrical power by planting *jatropha* and selling seeds to private energy suppliers, but they could also directly trade in their seeds for electricity.

In a meeting with the local authorities and representatives in Phnom Srok district on 3 December 2007, the idea for a pilot project was introduced and discussed. The interviewed entrepreneur who has been successfully operating as a private electricity supplier for 83 households in Bot Trang commune, Mungkul Borei district, Banteay Mean Chey province is presently considering a similar venture but at a larger scale in Phnom Srok district, provided that necessary requirements and supports are met.

### **Objectives**

The objectives of the study are two fold: (i) to produce baseline data and information for the Paoy Cha commune, and (ii) to assess the feasibility of growing *jatropha* for electricity production in the locality. Achieving the first objective is relatively straight forward. A number of key indicators such as assets, household amenities, land ownership, economic activities, income and income sources, consumption and poverty rates are generated through a household survey.

Meeting the second objective entails assessing the availability of production inputs, the willingness of the villagers to grow *jatropha* and the potential demand for electricity in the commune. Presumably, the people of Paoy Cha commune will benefit from the availability of electricity, which is not yet present.

### **The Analytical Framework**

The analytical framework employed herein includes an appraisal of the profitability of *jatropha* production taking into account the opportunity costs of factors of production

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<sup>27</sup> Mr Chan Sophal is President of the Cambodian Economic Association (CEA). The responsibility of the report rests with individual author only. It does not represent the views of the CEA. The authors and study team are grateful to **Mr War Samnang**, PSP Programme Coordinator of GTZ for his guidance and support during the course of this work. Contact emails are: <[sophal.chan@gmail.com](mailto:sophal.chan@gmail.com)>

and market prices of jatropha produce. The study also assesses the affordability of electricity at current market prices for the villagers. Since profitable jatropha production depends on the profitability of cultivating jatropha in comparison with other alternative uses of land, it is not advisable to encourage villagers to grow jatropha only for the sake of electricity production if growing something else is more profitable. Similarly, electricity producers or suppliers will continue to run generators on jatropha oil only if it is less expensive than using diesel or other substitutes. Therefore, the price of jatropha oil will move along with the price of diesel because they are close substitutes and the viability of growing jatropha will therefore depend critically on the price of diesel.

## Research Methods

### *Sampling Methods*

523 households were selected randomly for the survey. This is equal to 30 percent of the 1,733 households in the commune and is large enough to produce representative statistics. The survey team leaders obtained a list of households for each village from the village chief. The order of the households on the list normally goes from one to the other side of the village, which is technically conducive to selecting one out of every three households as a random method. A small number of households were not available during the survey because they were busy working far away (as explained later a considerable number of villagers migrate to Thailand for work) which might affect the representation slightly.

Table 1.1. Differences Between Survey, Census and Administrative Data (Number)

Name of village	Source of data	Motor-bike	TV	Boat wooden	Thresher	Rice Mill	Tractor	Koyun	Car
1. Paoy Snuol	Survey	145	152	61	0	7	3	83	3
	<b>Census</b>	<b>128</b>	<b>151</b>	<b>36</b>	<b>2</b>	<b>16</b>	<b>4</b>	<b>79</b>	<b>1</b>
	Admin. Data	62	..	2	3	2	2	81	1
2. Trapaing Thmar Kandal	Survey	82	106	32	0	15	6	50	3
	<b>Census</b>	<b>90</b>	<b>107</b>	<b>47</b>	<b>1</b>	<b>12</b>	<b>7</b>	<b>55</b>	<b>2</b>
	Admin. Data	50	..	3	1		6	32	4
3. Trapaing Thmar Cheung	Survey	82	82	3	0	7	13	36	3
	<b>Census</b>	<b>63</b>	<b>75</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>9</b>	<b>39</b>	<b>0</b>
	Admin. Data	45	..	1	0	1	6	22	0
4. Sambour	Survey	0	22	79	0	11	0	13	0
	<b>Census</b>	<b>15</b>	<b>30</b>	<b>62</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>14</b>	<b>0</b>
	Admin. Data	9	..	30	2	6	0	10	0
5. Pong-ror	Survey	42	68	49	0	11	4	59	0
	<b>Census</b>	<b>53</b>	<b>93</b>	<b>34</b>	<b>3</b>	<b>11</b>	<b>2</b>	<b>63</b>	<b>1</b>
	Admin. Data	38	0	15	2	3	2	50	1

Source: - Survey of 523 households in Paoy Cha commune, 19-31 December 2007  
 - Census of 8 assets on 19-21 January 2008  
 - Interview of Village Chief (Admin. Dada)

Since the results of the survey will be used for implementation of the project and investment by the entrepreneur, which require a high level of accuracy and reliability, a census was later conducted to count eight items of assets that were straightforward

for counting in five out of the eight villages. The census was added on 19-20 January 2008 because the figures provided by the village chiefs and commune councils were generally far different from the survey results. For instance, the survey found 145 motorbikes in Paoy Snuol commune but the village chief provided a figure of only 62. The result of the census was close to that of the survey, raising confidence in the accuracy of the survey data. The results rule out the data provided by the village chiefs, who were consulted after the census and agreed that their figures were inaccurate.

## II. Baseline Situation in the Commune

One of the main purposes for the household survey was to produce baseline data for the commune so that measurement of the intervention impact can be robustly carried out in the future. A set of key indicators on household assets and income are presented initially in order to provide a picture of the commune and surrounding villages in various aspects. More detailed data on are available in the Appendix.

Located 64 km northwest of Banteay Mean Chey, Paoy Cha is one of six communes in the Phnom Srok District bordered by Odor Meanchey Province to the North, Srah Chik commune to the South, Tean Kam Commune to the East, and Namtao and Ponley Commune to the West. The commune has 8 villages as listed in Table 2.1 and has recently annexed another village, called Kon Kleng located 15 km away from the commune centre. Kon Kleng was not included in the sampling frame of the study.

### 2.1. Demography and Household Amenities

#### *Demography*

With a population of 8,393 and 1,733 households, Paoy Cha is a relatively large commune by population. Consistent with the rest of Cambodia, it is comprised of an extremely young population: those up to 15 years of age (2,501) out-numbered people over 15 years of age (860) almost three to one. There were no substantial variations between male and female populations, except in Paoy Cha village.

According to the administrative data generated by the village chiefs, the adult literacy rate in most villages in the commune is above 70%, which is similar to the national average of 67%. This is favourable in terms of skill training for villagers to grow jatropha as well as learn other basic skills.

#### *Household Amenities*

The roof of a house is a good indicator of standard of living. Aside from concrete houses, a tile roof is considered the best in rural areas, followed by a tin sheet roof. In Paoy Cha commune, 61% of the houses were covered by tin sheets. Only 16% had tile roofs, while 23% were thatched. Overall, this suggests that the commune enjoys an average standard of living.

Table 2.1. Population and Adult Literacy in the Paoy Cha Commune

Name of village	Total number of households in village	Number of households surveyed	Population	Population under age 15	Adult literacy rate (%)
Paoy Snuol	334	99	1,718	454	75
Paoy Cha	219	69	1,055	525	78



Trapaing Thmar Tbong	286	93	1,357	309	71
Trapaing Thmar Kandal	170	58	863	212	71
Trapaing Thmar Cheung	138	42	704	181	67
Ta Ong	209	61	983	225	78
Sambour	104	29	437	95	71
Pongror	273	72	1,276	500	69
TOTAL	1,733	523	8,393	2,501	73

Source: Interview of village chiefs

Since there is no grid electricity service available in the commune, 65% of the households still depend on kerosene as their main source of lighting and 34% on battery. However, most households use both battery and kerosene lamps. The costs of using these two sources of lighting will be elaborated in the later sections. Firewood remained the main source of energy for cooking for 91% of the households even though the availability of this resource has become more limited.

The commune is blessed with an abundance of water from the Trapaing Thmar reservoir, the largest reservoir in Cambodia. The reservoir covers 12,650 hectares and is 1-2 meters deep. It has been recently renovated by the Cambodian and the Japanese Governments and can provide a year-round supply of water for household consumption. However, the main water source pattern varies for the rainy and dry seasons. A clean water supply system has been installed in the commune, although 6 of the 8 villages in the commune benefit from the system, only 48% of the households in those 6 villages have access to the water system in dry season. During the rainy season, most people reported use of rainwater.

The majority of the households did not seem to be very concerned about hygiene. Only 10% of all households had a bathroom and a proper toilet. Drinking water collected from wells or hand pumps was still widely consumed by the households. 67% of the respondent households drank untreated water while 29% drank boiled water on a regular basis.

## 2.2. Asset Ownership

Assets in terms of durables, machinery and big livestock are good indicators of socio-economic status and standard of living. According to the household survey in 8 villages and the census of eight items of assets in 5 villages, as presented in Table 2.2, Paoy Cha commune has 20 cars, 51 tractors, 373 koyuns, 617 motorbikes, 380 mobile phones, 51 rice mills including the small ones for family use, 18 threshers, 780 TVs, and 327 wooden boats. These assets imply that there will be future demand for fuels or jatropha oil, which is a substitute for diesel. This will be discussed in detail in Section 5.

Table 2.2. Number of Assets in Paoy Snuol Commune by Village

Name of village	Paoy Snuol	Paoy Cha	Trapaing Thmar Tbong	Trapaing Thmar Kandal	Trapaing Thmar Cheung	Ta Ong	Sam-bour	Pong-ror	Total
Motorbike	128	73	157	90	63	38	15	53	617
TV	151	114	141	107	75	69	30	93	780
Stereo	51	35	43	26	20	45	11	38	268

Boat wooden	36	10	31	50	5	99	62	34	327
Machines*	34	19	18	13	8	17	0	11	120
Thresher	2	0	9	0	0	3	0	3	18
Rice Mill	7	10	6	12	4	0	6	11	56
Tractor	3	3	25	7	9	0	0	4	51
Trailer	0	0	15	6	10	0	0	0	31
Koyun	79	57	40	55	39	26	14	63	373
Mobile phone	71	41	108	50	76	31	0	4	380
Car	1	6	6	2	3	0	0	1	20
Oxcart	61	10	22	6	0	3	18	15	134
Sewing machine	30	44	71	56	66	91	4	11	373
Cow	523	295	409	196	191	247	226	300	2,386
Buffalo	0	16	6	0	0	51	72	163	308
Pig	540	286	400	361	99	164	136	114	2,099

\* Including pumps, battery charging generators, wood-processing machines

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007 and census of 10 assets on 19-21 January 2008

Assets are generally easy to count and good baseline data to document. However, there could still be a number of people who hide valuable assets that are not obvious to enumerators. The number of televisions reported in the household surveys (after extrapolation) matched the number counted in the census well. This is because TVs are obviously identified in the house. It should be noted that Ta Ong, Sambour, and Pongror villages were asset-poor (Table 2.3). These villages are located at the end of the commune and the households are widely dispersed. However, they have the most land available for jatropha cultivation.

Table 2.3. Percentage of Household Owning Assets in Paoy Snuol Commune by Village

Name of village	Paoy Snuol	Paoy Cha	Trapaing Thmar Tbong	Trapaing Thmar Kandal	Trapaing Thmar Cheung	Ta Ong	Sambour	Pongror
Motorbike	39	30	44	43	55	15	6	15
TV	43	51	49	62	60	31	21	25
Stereo	14	16	15	16	14	15	10	14
Boat	18	4	11	19	2	48	76	18
Machines*	10	9	6	9	5	7	-	3
Thresher	-	-	3	-	-	2	-	-
Rice Mill	2	4	2	9	5	-	10	4
Tractor	1	1	9	3	10	-	-	1
Trailer	-	-	5	3	7	-	-	-
Koyun	25	29	15	31	31	16	14	22
Mobile phone	19	14	28	24	45	10	-	1
Car	1	1	2	2	2	-	-	-
Oxcart	18	4	8	3	-	2	17	6
Sewing machine	8	14	14	28	38	11	3	4
Cow	57	57	48	45	48	44	59	42
Buffalo	-	1	1	-	-	7	28	22
Pig	54	45	40	48	29	39	52	17

\* Including pumps, battery charging generators, machines to process wood

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007 and census of 10 assets on 19-21 January 2008

Overall, Paoy Cha commune is relatively rich in assets: 31.5% of the households owned a motorbike or more and 42.5% possessed a TV, although most were black and white TVs running on battery (Table 2.4). About 17% of households owned a mobile phone, which is relatively better-off compared to the national average in rural areas. The most valuable asset in the commune excluding house and land was a tractor; 51 were found. At the time of the survey, they were worth about \$0.5 million each in total.<sup>28</sup>

Table 2.4. Household Ownership of Assets and Values of Assets in the Whole Commune

Name of village	% households owning asset	Value per owning household on average (US\$)	Quantity in commune (survey data)	Total value in commune (US\$)
Motorbike	31.5%	534	617	291,547
TV	42.5%	46	780	33,680
Stereo	14.7%	26	268	6,533
Boat	21.0%	48	327	17,587
Machines	7.2%	309	120	38,317
Thresher	0.7%	3,115	18	39,410
Mill	3.8%	1,499	56	98,613
Tractor	3.1%	9,590	51	517,324
Trailor	2.0%	1,449	31	49,524
Koyun	22.8%	849	373	336,033
Mobile phone	17.5%	69	380	21,084
Car	0.9%	8,891	20	138,956
Oxcart	7.7%	71	134	9,459
Sewing machine	14.9%	148	373	37,994
Cow	49.6%	456	2,386	392,486
Buffalo	6.3%	504	308	55,144
Pig	40.0%	261	2,099	181,233

\* Including pumps, battery charging generators, wood-processing machines.

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007 and census of 10 assets on 19-21 January 2008

### 2.3. Land ownership

Land is a very important asset that is critical for the assessing the feasibility of jatropha production. Paoy Cha commune is land abundant according to both the household survey and administrative data of the commune. While 20% of the households in rural Cambodia were landless according the Socio-Economic Survey 2004, only 3% of households in Paoy Cha were without agricultural land. On average, a rural household in Cambodia owns 1.5 ha of agricultural land, whereas the average household in Paoy Cha owns 3.27 ha. The survey even captured a few households that owned nearly 80 ha. As illustrated in Table 2.5, the majority of households possessed more than two plots of agricultural land. About 34% of households owned 4 plots each or more. This is favourable for promoting jatropha production. In addition to a large area of rice fields, the commune has lands that are not flooded and suitable for other cash crops and potentially good for jatropha.

<sup>28</sup> The results of the household survey are generally higher than the figures reported by the village chiefs.

Table 2.5. Number of plots possessed by households

Number of Plots	Number of households	% households
0	54	3.1
1	202	11.7
2	404	23.4
3	484	28.0
4 or more	586	33.9
Total	1,733	100.0

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007.

No households in Sambour and Pongror villages were landless (Table 2.6). This reflects the abundance of bush land in the villages. On average, each household owned about 4 ha of land. Variation in land ownership measured by the standard deviation was relatively small in the two villages, compared to some of the other villages. However, these two villages are the worst off in the commune since they have less land for producing rice because their former land was turned into a reservoir constructed during the time of the Khmer Rouge.

Table 2.6. Land Ownership by Village

Name of village	Number of Landed households	% landless households	Mean size (ha)	Max. size (ha)	Std. Deviation
Paoy Snuol	324	3.0%	2.42	21.92	2.73
Paoy Cha	209	4.3%	2.33	40.32	4.87
Trapaing Thmar Tbong	264	7.5%	5.12	78.87	10.39
Trapaing Thmar Kandal	167	1.7%	3.39	27.36	4.09
Trapaing Thmar Cheung	135	2.4%	3.26	12.29	2.42
Ta Ong	202	3.3%	1.87	8.64	1.58
Sambour	104	0.0%	3.93	8.64	2.34
Pongror	273	0.0%	3.88	12.96	2.53
TOTAL	1679	3.1%	3.27	78.87	5.20

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

Although a considerable amount of land is not used for growing rice (5,633 ha), land for rice production occupies a dominant share of land in the commune. Nearly 78% (4,381 ha) of the total agricultural land area in the commune is under rice cultivation, according to the household survey. This compares highly with the figures provided by the commune council, which registered land in rice production at just 3,413 ha. However, the council admitted that the administrative statistics were not entirely accurate. It was neither based on household interviews nor actual measurement. The other reason could be that two villages, Sambour and Pongror still counted their land now flooded in the reservoir, while the commune council did not consider that land as land for rice cultivation.

There is a remarkable amount of land (477 ha) that was cleared of forests and bushes but has not yet been cultivated. The land has been left idle according to the villagers because (i) it was not good enough for growing cash crops such as watermelon, beans, maize and sesame seeds, which was unsuccessful in the past partly because of insects, (ii) insufficient land for animal grazing, and (iii) limited labour to make the best use of the land from traditional cash crops. However, it was believed that this land is

suitable for jatropha, which does not need very fertile land. There is also bush land that is available for jatropha production if needed. Since no returns to these two types of land were reported, there is little or no opportunity cost that would prevent cultivation of jatropha as far as idle land is concerned. The land partially used for cash crops or fruit trees cultivation has minimal opportunity costs, since the returns (\$151 per year) are far lower than what could be achieved with jatropha. For the purposes of this study, it is assumed that one third of this land could be used for growing jatropha without competing for land use for rice and other cash crop production.

Gross returns for rice production in the 2006/2007 season was \$297 per ha, compared with \$554 per ha for rice and watermelon cultivation and \$427 per ha for other cash crops. These returns closely reflect the prices of land which were \$1,888 per ha for rice, \$2,751 per ha for rice and watermelon combined, and \$2,449 per ha for other crops since the less productive the land, the lower the prices, (Table 2.7). Land prices were estimated by individual households. While the villagers did not find difficulty estimating prices of their rice profits per ha, other crops were more complicated to determine.

Table 2.7 Use of Agricultural Land

Type of land	Number of plots	Size (ha)	% area	Returns (\$/ha/year)	Land price (\$/ha)*
Cultivated rice only	2,748	4,381	77.8%	297	1,888
Cultivated rice and watermelon	19	30	0.5%	554	2,751
Fully cultivated other crops	449	142	2.5%	427	2,449
Partially cultivated other crops	668	353	6.3%	151	1,378
Cleared but not cultivated	567	477	8.5%	..	1,169
Unused land (sparsely bush)	278	249	4.4%	..	595
Total	4,730	5,633	100.0%		

\* Considering land sizing above 0.2ha to neutralise biases to small, expensive land.

The price was estimated by the interviewees.

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

For land that was not cultivated with rice, villagers grew mango, jackfruit, cassava, sweet potatoes and mulberry for silk production. While these crops are planted to a large area of land, they are not a major source of income. Therefore, jatropha could be grown between long-term crop plants such as mango and jackfruit and even short-term crops such as sweet potatoes, cassava, and sesame provided sufficient space between the plants is provided. Alternatively, these crops could easily be forgone if jatropha proves to be more profitable to grow.

Paoy Cha commune has not yet been issued land titles. Most people have land ownerships application receipts to claim ownership of land or they just have customary rights to their land. However, they do not seem to need land titles. Less than 50% of rice plots were distributed by the State in the 1980s. However, a considerable amount of rice land changed hands through market mechanisms and inheritance. The other crop land was mostly cleared from the nearby forests or given by relatives (Table 2.8).

Table 2.8. Percentage of Land Acquisition by Type of Land

Type of land	Given by the authority	Cleared forest	Purchased	Gift from relative	Total
Cultivated rice only	41.6	15.2	19.6	23.5	100.0
Cultivated rice and water melon	66.7	-	33.3	-	100.0
Fully cultivated other crops	3.7	8.1	20.7	67.4	100.0
Partially cultivated other crops	3.4	13.3	11.8	71.4	100.0
Cleared but not cultivated	1.2	17.9	12.5	68.5	100.0
Unused land (sparsely bush)	-	58.2	3.8	38.0	100.0

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

## 2.4. Economic Activities

According to the village chiefs, there were a marked number of economic activities in the villages (Table 2.9). However, the overwhelming majority of households were engaged in agricultural activities, which consisted mainly of rice farming and raising livestock and poultry. Fishing was not reported as a significant occupation despite the fact that the commune has a large reservoir that many people draw on to fish. Likewise, this is contrary to the data obtained in the household survey, which indicated that 39% of households earn income from fishing (Table 2.11). Paoy Snuol and Trapaing Thmar Cheung villages engaged in a more diversified set of jobs: respectively 40% and 30% of households produced silk, traditional to the commune.

A large number of villagers seek employment opportunities outside the commune. The village chiefs collected data on the people who migrated to work elsewhere on a seasonal or more permanent basis. A total of 430 people were recorded as seasonal out-migrants in addition to the 256 permanent out-migrants (Table 2.10). There are marginally more men than women migrants. This slightly disrupts the household survey because the required respondents of a small number of households randomly selected were not present during the survey.

Table 2.9. Economic Activities Reported by Villages Chiefs

Main Occupations	Number of families							
	Paoy Snuol	Paoy Char	Trapaing Thmar Tbong	Trapaing Thmar Kandal	Trapaing Thmar Cheung	Ta Ong	Pong-ror	Sambour
Rice farming	98	100	98	98	92	80	98	96
Raising poultry	99	100	98	76	94	81	98	96
Raising pig	96	91	49	71	62	72	88	72
Raising cattle	94	100	58	34	45	57	47	67
Growing vegetable	4	1	-	-	-	0	-	-
Selling snacks	1	0	2	5	2	1	2	-
Selling groceries/small business	2	3	1	3	5	2	2	5
Producing palm sugar	1	2	1	-	1	0	-	-
Taxi driver	0	0	-	1	-	0	-	-
Labourer	31	0	3	16	36	26	32	60
Producing silk	40	3	17	3	30	-	-	-
Silk craft	15	4	-	4	33	1	-	-

Government employees	13	4	17	16	39	6	8	20
Private companies/NGOs employees	3	6	4	4	3	-	-	-
Fishing	-	-	1	-	-	-	-	-
Crocodile raising	-	-	1	-	-	-	-	-

Source: Interview of village chiefs

Every village had individuals and even entire households working elsewhere including Thailand. As shown in Table 2.11, most of the migrants (from 18% of households) migrated to work in Thailand, which reportedly receives 218,000 migrant workers from Cambodia annually. Typically they enter Thailand illegally and often face additional risks and harassment. Despite these challenges, many Cambodians still migrate to Thailand because there are fewer employment opportunities available to them in their villages and provinces. People are willing to accept 30% less pay if they have guaranteed employment near their homes. Some migrated internally and went far away inside central areas of the country for construction work and to the South for fishing in the sea, while some just went nearby the border to do agricultural work. It should be noted that while the migration rate was relatively high (27%), the remittances from that activity made up only 6% of the overall income for the commune. However, remittances are like savings. On average, a household with members migrating to work elsewhere received about \$200 per year as remittance. For the whole commune, this added up to \$100,146.

The phenomenon of labour out-migration raises some concern with respect to the potential lack of available labour to cultivate jatropa. However, it could be argued that jatropa production would provide employment opportunities that could keep the workers at home, assuming the wages and returns to labour are comparable.

Table 2.10. The number of migration Out of Paoy Cha Commune in 2007

Village name	Seasonal Out-migrants			Permanent out-migrants		
	Male	Female	Total	Male	Female	Total
Paoy Snuol	82	45	127	10	14	24
Paoy Char	8	11	19	32	16	48
Trapaing Thmar Tbong	10	3	13	0	0	0
Trapaing Thmar Kandal	9	4	13	23	7	30
Trapaing Thmar Cheung	6	0	6	23	11	34
Ta Ong	44	56	100	19	21	40
Sambour	20	50	70	3	3	6
Pong Ror	56	26	82	25	49	74
<b>TOTAL</b>	<b>235</b>	<b>195</b>	<b>430</b>	<b>135</b>	<b>121</b>	<b>256</b>

Source: Interview of village chiefs

## 2.5. Income and Income Sources

Table 2.11 presents the ranges of household incomes from agriculture and other sources in 2007. Percentages of the respondent households earning an income from these sources are also provided. The majority of the farmers reported at least one source of income. Agriculture played the most significant part, followed by wage labor and self-employment.

On average, household annual income was about \$1,000 in 2007. While slightly above the average level of income in rural areas, it is far below the national average income (measured by GDP), which was nearly \$600 per capita or \$3,000 per household in 2007. Income earned from selling agricultural produce, generated by 67% of the households, accounted for nearly 50% of the total income. These figures exclude produce that was used for personal consumption, which is counted as household income as well in national accounting. Income from common property resources, which generally refers to fishing and foraging, accounted for 7.2%, nearly all of which from fishing.

Table 2.11. Income and Income Sources for Paoy Cha commune

Source of income	Percent of Household earned income	Average income per household actively engaged in labour (US\$)	Average income per household (US\$)	Total income for the commune (US\$)	Percentage of income for the commune
<b>Selling agric. produce</b>	<b>86</b>	<b>583</b>	<b>515</b>	<b>865,581</b>	<b>49.15</b>
Selling rice	67	489	332	554,675	31.49
Selling pigs	46	262	123	207,327	11.77
Selling cattle	18	290	53	89,554	5.08
Selling poultry	26	30	8	14,025	0.80
<b>Wage and self-employment</b>	<b>53</b>	<b>566</b>	<b>309</b>	<b>518,131</b>	<b>29.42</b>
Mototaxi	1	126	1	1,561	0.09
Taxi	1	1,903	25	42,027	2.39
Petty trade at home or market	36	438	162	272,025	15.44
Hiring out machinery	12	355	43	71,825	4.08
Working for state, NGO, comp.	17	510	87	147,091	8.35
<b>Migration remittances</b>	<b>27</b>	<b>211</b>	<b>56</b>	<b>100,146</b>	<b>5.69</b>
Working Thailand	13	248	32	57,165	3.25
Working in Thailand but near border	5	129	6	10,981	0.62
Working in Cambodia near border	4	129	5	8,254	0.47
Working elsewhere in Cambodia	7	194	13	23,747	1.35
<b>Income from common property resources (CPR)</b>	<b>42</b>	<b>174</b>	<b>73</b>	<b>126,904</b>	<b>7.21</b>
Fishing	39	181	71	123,933	7.04
Non-timber product collection	2	41	1	1,347	0.08
Other CPR source	2	36	1	1,624	0.09
<b>All other income</b>	<b>49</b>	<b>175</b>	<b>88</b>	<b>150,516</b>	<b>8.55</b>
Interest earnings	2	441	10	17,374	0.99
Remittances from relatives overseas	2	314	5	9,260	0.53
Other source	46	154	72	123,882	7.03
<b>ALL SOURCES</b>	<b>100</b>	<b>1,016</b>	<b>1,041</b>	<b>1,761,279</b>	<b>100.00</b>

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

## 2.6. Consumption

Consumption is the best measure of well-being and commonly used as a proxy of poverty. In rural Cambodia, 65% of household expenditure is spent on food and about 70% of protein intake comes in the form of rice consumption. Often food security boils down to rice security. In Paoy Cha commune, the average per capita rice consumption is 0.47 kg per day, which is marginally higher than the national average



of 0.45 kg in rural Cambodia. Of note, the most prosperous village of Trapaing Thmar Kandal had the lowest level of rice consumption, which reflects Engel's law that as income rises, consumption of basic foodstuffs declines. Rice is certainly an inferior food, which negatively correlates with income. When people have more income they tend to eat more of other food such as meat, fish, vegetables, and fruits.

Besides rice, which is mostly produced and stocked by individual households, households spend on average 4,236 Riel (\$1.06) per day to purchase other types of food for consumption. The worst-off villages of Sambour and Pongror had the least amount of money to spend on other foodstuffs. More than 60% of households collect other food, mainly fish and aquatic resources to supplement their own produced or purchased food. When valued at market prices, this collected food is worth as much as the purchased food, about 4,500 Riel per day. Thus, the average household food consumption including rice was higher than the national average, about 7,000 Riels per household in 2004, according the Socio-Economic Survey of Cambodia.

Table 2.12. Household Consumption of Rice and Other Food

Name of village	Rice consumption (kg/day)		Purchased food besides rice		Percent of households collecting food	Value of collected food (Riel/day)	
	Per household	Per capita	Mean	Max.		Mean	Max.
Paoy Snuol	2.22	0.48	4,495	13,000	66	5,485	15,000
Paoy Cha	2.06	0.46	4,241	10,000	74	5,047	15,000
Tropaing Thmar Tbong	1.95	0.46	5,043	15,000	55	4,727	10,000
Tropaing Thmar Kandal	2.05	0.44	4,966	20,000	62	5,353	10,000
Tropaing Thmar Cheung	2.32	0.45	5,195	15,000	71	5,233	15,000
Ta Ong	2.20	0.47	3,579	12,000	75	3,967	15,000
Sambour	2.39	0.47	3,586	10,000	83	4,854	15,000
Pongror	2.16	0.48	2,882	7,000	79	2,724	10,000
All 8 villages	2.15	0.47	4,236	20,000	100	4,554	15,000

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

Table 2.13. Household Self-Sufficiency in Rice Production

Name of village	Had surplus	Just enough	Enough for 7-10 months	Enough for less than 6 months	Fully dependent on purchased rice	Total
Paoy Snuol	55	25	8	5	7	100
Paoy Cha	49	24	19	1	7	100
Tropaing Thmar Tbong	70	10	6	2	12	100
Tropaing Thmar Kandal	82	9	4	4	2	100
Tropaing Thmar Cheung	90	2	2	1	5	100
Ta Ong	38	18	21	8	15	100
Sambour	10	14	31	21	24	100
Pongror	31	28	18	10	14	100
All villages	53	18	13	6	10	100

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

Overall, only 53 households reported that they produced rice beyond their own consumption needs. This varies remarkably among villages, ranging from 10% in Sambour, where land for rice production is scarce, to 90% in Trapaing Thmar Cheung, perhaps the richest village in the commune. Except for Sambour, the majority of households in the commune could at least produce enough rice to meet their consumption needs for at least 7 months of the year (Table 2.13).

### III. Feasibility of Jatropha Production

The main intent of the current study is to assess the feasibility of jatropha production in the Paoy Cha commune. The research, therefore, critically assesses factors of production (land, labour and capital), awareness, knowledge and willingness of the villagers to grow jatropha, and input and output markets for jatropha production.

#### 3.1. Land availability

The first and foremost factor of production for jatropha is land. Considerable effort was devoted in the household survey to look into land availability and suitability. Land for rice production was considered unavailable for jatropha production. However, according to the local authorities, there was considerable land that is not under water all year-round and potentially suitable for growing jatropha. Households were asked directly how much land they had that was (i) fully available for growing jatropha, which can be grown on already cleared land, (ii) bush land to be cleared, and (iii) partially free land that can accommodate Jatropha between sparse fruit trees or other crops.

According to the official data, Paoy Cha commune is endowed with a lot of land, including the largest reservoir in Cambodia. The total area including the reservoir is 20,488 ha. Rice is grown on 3,341 ha, compared with 1,034 ha of land used for *chamkar* or other crops (Table 3.1).

Table 3.1. Land Availability in Paoy Cha Commune

Type of land	Size (ha)
Rice land	3,341
Forest land	3,018
Chamkar land	1,034
Residential land	445
Reservoir	12,650
Total	20,488

Source: Official Commune Data

As seen in Table 3.2 below, there are substantial areas of available land in every village in the commune that can be used to grow jatropha. A total of 343 ha was still free land without crops. There are also 201 ha under bushes that could be cleared for jatropha production. In addition, 420 ha were currently under loose cropping that could also accommodate jatropha to a decent extent. Assuming that 30% of this 420 ha is available for jatropha as the villagers believed, it can be conservatively estimated that 126 ha are available for jatropha production. **Then, the estimate is that a total of 670 ha of land can be used to grow jatropha based on extrapolation from the**

**sample size.** However, these figures only describe land availability. Suitability of soil and moisture in the areas are technical subjects beyond the scope of the current study. It is advisable to conduct an assessment of soil suitability and the most appropriate levels of moisture for optimal jatropha production.

While jatropha productivity in this area is still unknown, if a range of 1 to 10 tons per ha per year is assumed, then Paoy Cha commune could produce between 670 and 6,700 ton per year.

Table 3.2. Land Available for Growing Jatropha

Name of village	Percentage of households with land available for jatropha production			Type of land available for jatropha production (ha)		
	Free land	Bush land	Partially free land	Free land	Bush land	Partially free land
Paoy Snuol	35%	4%	39%	35.86	4.05	30.21
Paoy Cha	23%	4%	36%	125.89	5.36	40.17
Trapaing Thmar Tbong	17%	11%	52%	19.28	26.68	80.54
Trapaing Thmar Kandal	22%	9%	57%	32.50	10.64	45.17
Trapaing Thmar Cheung	26%	7%	60%	12.71	10.38	45.60
Ta Ong	30%	18%	46%	31.36	29.46	66.02
Sambour	52%	31%	38%	41.02	47.05	35.86
Pongror	29%	31%	44%	44.01	67.19	76.49
TOTAL	28%	13%	46%	342.63	200.81	420.06

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

### 3.2. Labour availability

It is important that the villages have adequate labour to cultivate jatropha. The household survey looked into this issue by asking the availability of the people aged 15-54 whom have the capacity suitable for producing jatropha. The survey found that labour abundance was considerable. There were 5,802 villagers aged 15-54, 96% of whom were considered as having excess time that could be directed towards jatropha production. These figures reflect the general underemployment in rural Cambodia (Table 3.3).

Table 3.3. Labour Availability in Paoy Cha Commune

	Number			Distribution (%)		
	Male	Female	Total	Male	Female	Total
Total household members aged 15-54	2,885	2,917	5,802	100%	100%	100%
With free time to do more work	2,715	2,833	5,548	94%	97%	96%
Without free time to do more work	170	84	254	6%	3%	4%

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

### **3.3. Capital**

Considering that jatropha may not require plowing, start-up capital for machinery may not be necessary. However, to process jatropha seeds for oil significant investment is needed because this is a new technology for Cambodia. People may also need credit to initiate the growing process. Even though they rely on their family members during the initial investment period, the poor would still need to forgo some income, which is important for their daily subsistence. Credit might also be needed for seeds, which are currently sold at up to \$10 per kg, if there are many households that enter into production at once. Others however could rely on existing jatropha trees in the commune. Those fortunate enough to access these seeds would be able to do so at no cost. Even though these seeds would be free and possibly more desirable considering they may be resistant to droughts and local diseases, their yield productivity is unknown and should be tested.

Currently, there are few micro-credit schemes and banks available in the district. If the business is promising, it is likely that farmers will receive loans either from NGOs or MFIs. It would be very helpful if intervention projects help facilitate eager farmers to access affordable loans to start up their jatropha production. This will help the poor tremendously since they live from hand to mouth and jatropha takes at least one year to yield returns.

### **3.4. Awareness of Jatropha and Willingness to Grow It**

Villagers in the commune have been aware of jatropha for a very long time. 33% of the households reported that they already had jatropha plants on their land. Of these, 85% said they grew it mostly to fence-in their land, whereas 15% reported that it grew naturally. These households, therefore, could be in a favourable position to adopt the crop although they would still require additional seeds and technical information to achieve profitable yields. However, 38% of the households reported that they had never heard about jatropha. When asked if they were aware of the possible uses of jatropha, 61% claimed they had heard of using it for oil and other things, however, they did not know that it could replace diesel for fueling generators and other machinery.

After the enumerators provided villagers with some basic information about jatropha cultivation, production, market and uses, 92% of the respondent households that had the land for growing jatropha, expressed a keen interest in growing jatropha. Interestingly, 45% of the respondents believed they already knew how to grow jatropha, while 55% did not but were willing to learn how to grow. Few expressed a concern over technical issues. The majority were concerned about the lack of buyers and low prices.

### **3.5. Inputs Market**

The expected cost of producing jatropha on one hectare has not been determined, partly because jatropha production in Cambodia is in its infancy. The reported cost per hectare of jatropha production in the first year varies from US\$214 to \$1,500. Inputs such as land preparation, seeds, manure, fertilizer, pesticides and irrigation equipment are crucial but vary depending on the situation. Jatropha seeds of high quality from Thailand, China, Malaysia and India are available for about US\$10/kg.

At present, many private entrepreneurs are importing seeds from these countries. However, there are also locally produced seeds available at about US\$3/Kg. The rest of the inputs can be easily obtained from international markets.

According to Top Rank E. S. Agriculture Co. Ltd (TESA), a private company which possesses a jatropha plantation in Kampong Speu, to achieve the best yield, farmers need US\$2,000 for inputs, operations and maintenance to grow 1 ha of jatropha for the first 2 years. The requirement 75 % (\$1,500) of the start-up capital in the first year raises questions of affordability for small farmers who wish to enter into the market.

There is, however, a more convincing figure presented by Food and Agriculture Organisation (FAO) in Cambodia about the input cost of jatropha production. Based on the feasibility study of the potential for bio-fuel production in rural community-based projects, farmers need US\$350/ha for the initial investment for non-irrigated land and US\$850/ha for irrigated land. Farmers can also produce jatropha using traditional practices, which means they can use family labour to prepare land and use their own fertiliser and local seeds. This method requires significantly lower initial investment costs: US\$124/ha for the first one year, or US\$248/ha for the first three years (Table 3.4). If there is no pruning during the first year of jatropha production, the total cost for the first year would only be \$42/ha and \$176/ha, which is relatively affordable for resource-poor farmers. Below is the table presenting the cost breakdown for jatropha farming using traditional practices from a FAO study in 2007. At these costs and with abundant family labour, jatropha production would be feasible in Paoy Cha commune.

Table 3.4. Cost of Jatropha Cultivation Per Hectare (Traditional practice)

Tasks	Unit	Cost Per Year (US\$)			Total Cost for first 3 years (US\$)
		Year 1	Year 2	Year 3	
Site Preparation	9MD	13.50			13.50
Alignment & staking	9MD	13.50			13.50
Planting	9MD	13.50			13.50
Fertilizer including transportation					
Maintenance including pruning	200R/plant	82.00	82.00	82.00	246.00
Seeds	1kg	2.00			2.00
Total		124.50	82.00	82.00	248.00

Source: FAO Commissioned Study in 2007

**Note:** MD=Man-day

- Farmers actually make land preparation themselves. Labour cost in rural area is \$1.50/day. The farmers use their own fertilizer and no other costs, using local seeds and spacing of 3m x 2m

### 3.6. Output Market

The potential demand for jatropha oil in the commune is enormous so long as it is a competitive substitute to diesel as the demand for diesel is acute. Even in the Paoy Cha commune, consumption of diesel is around 400,000 litres per annum or about 1.2 million tons of jatropha seeds in equivalent energy production. However, in Cambodia, there are no clear markets or production scale large enough for functioning of the market.

In response to the question “If your household decides to grow jatropha, what is the first thing you are concerned with?” about 68% of the households said they were afraid that there would be no buyers. Also, 47% expressed concerns regarding the price of the crop (Table 3.5). They thought that if there was too much supply, the crop would be too cheap. Some considerations for overcoming this concern could be contract farming or barter system where farmers trade their jatropha seeds to a local entrepreneur for oil that is used by their generator(s) to supply electricity to the commune. This ‘solution’ can also be potentially problematic. For barter trade like this, farmers can put at the disadvantage of not knowing whether their products are under-valued or the electricity they receive is over-valued.

Table 3.5 Villager’s Concerns about Growing Jatropha

Reason for concern	1st Concern	2nd Concern
No buyers	67.7	16.6
The product is too cheap	4.2	47.4
No technical support	8.3	13.8
Drought	1.8	2.6
Other	14.1	16.1

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

### **Pricing Issues**

The entrepreneur interviewed would buy jatropha seeds at the price of 700 riels per kg. He also offered that three kilos of quality jatropha seeds produce one litre of Jatropha oil. Assuming this conversion rate, it would cost 2,100 Riel to produce one litre of jatropha oil and if one litre of jatropha oil sells for 2,800 Riel, the profit generated from converting three kg of seeds to one litre of oil would be 700 Riel. Furthermore, another 200 Riel could be earned by selling the residual, which can be used as fertilizer, at 200 Riel per kg.

If jatropha oil were to sell for 2,800 Riel per litre it can compete very well with diesel, which is currently sold at 3,800 Riel per litre. However, since the energy content of jatropha oil is 7% less than diesel, it is not surprising that diesel is more expensive. Since jatropha oil is a close substitute to diesel and it is often used to replace diesel completely, the price of diesel should determine the price of jatropha oil and thus the price of seeds as well. At the current market price of diesel at 3,800 Riel per litre in December 2007 the price of jatropha oil should be around 3,500 Riel per litre which would work out to 900 Riel per kilo of seeds. Following, either the price of jatropha seeds should go up from 700 Riel per kg or the price of electricity running on jatropha oil should come down.

At the price of 700 Riel per kg, a low case scenario, one ton of jatropha seeds is worth \$175. If one planted ha of jatropha produces one ton of seeds, the gross revenue will be only \$175 which is high enough to cover the initial production costs for the first year assuming use of the traditional approach described above.

However, productivity will increase as the jatropha plants grow bigger over time, while the maintenance cost will decrease from the cultivation costs in the first two years. This will increase the profit margin. If productivity increases to 10 tons, the gross revenue will increase to \$1,750 per ha at the assumed price of 700 Riel per kg for seed. Table 3.6 provides three scenarios of seed prices set at 700 Riel, 800 Riel

and 900 Riel per kg. Profitability for growing jatropha therefore looks promising if the yield reaches two tons per ha or more. Currently, rice and other cash crops production yields a gross margin of about \$300 - \$500 per ha, of which 50% is consumed in production costs.

Depending on the initial costs for land preparation, from year 3 onwards, farmers could be able to make an ample profit of about \$300 per ha, assuming the yield of 2 tons per ha. In the medium and long terms, the profit will be much higher than other crops given the current prices because yield is likely to increase.

Table 3.6. Gross Revenue to Land Growing Jatropha at Current Prices

Yield (ton/ha)	Gross Revenue per Hectare (US\$) per Year		
	700 riels/kg	800 riels/kg	900 riels/kg
1	175	200	225
2	350	400	450
3	525	600	675
4	700	800	900
5	875	1000	1125
6	1050	1200	1350
8	1400	1600	1800
10	1750	2000	2250

Source: Authors' calculation

Further, there is an ample potential for export if the production of jatropha is successful given that there is high demand for bio-fuels as jatropha is one of the best crops for producing oil and ethanol. There is also abundance of land that could produce surplus for export after satisfying electricity needs in the commune.

#### IV. Potential Demand for Jatropha Oil

Paoy Cha commune is relatively well-off in terms of machinery because it relies heavily on rice cultivation on large areas of land. These machines are potential consumers of jatropha oil if it is produced and processed locally to substitute diesel. There is no market price for locally processed jatropha oil due to the lack of the jatropha production. The interviewed entrepreneur, a leading farmer and processor, had been processing jatropha seeds on a very small scale for his own use to run a generator to supply electricity for 83 households in his commune. His jatropha supply is not adequate enough for him to meet even this limited demand. It requires him to purchase other types of seeds called kapok or “Kroap Kor” in Khmer. Since it has been established that the expected price of jatropha oil under all scenarios is competitive with diesel, if it also proves to be as effective as diesel, the machines are appropriately modified to use jatropha oil and the adjustment costs are not prohibitive, then machinery owners would likely switch to using jatropha oil.

##### 4.1. Assessing the Demand for Jatropha Oil for Producing Electricity

The central idea behind this research is to determine the feasibility of jatropha as both a source of income generation and electricity supply in Paoy Cha commune. Electricity is critically important for raising living standards and for the development of other business activities. There are many small-scale electricity suppliers who

process jatropha seeds into oil to run generators and supply electricity in rural areas. Thus, this research sets out to assess this possibility for Paoy Cha commune, where both large amounts of land and labour are readily available. Currently, there are 15 generators consuming about 5,000 litres of diesel per year. However, these generators do not supply electricity to the whole commune. They are privately used for less than 1% of households. The majority of villagers use battery and kerosene lamps for lighting. If there electricity were available at affordable prices, the potential demand could be tremendous.

The entrepreneur currently uses about 12 litres of diesel per day to run a generator to supply electricity to 83 households from 5:00pm to 11:00pm. This provides a basis for estimating how much jatropha oil will be needed if all 1,733 households were to use electricity in Paoy Cha commune. A linear projection would result in needs of 260 litres of diesel per day or 94,900 litres per year. However, the actual diesel needs would likely be lower if larger generators are employed; generally there are gains from using economies of scale. Assuming the gain is a 20% reduction in diesel use, **the total amount of diesel required to supply electricity to 1,733 households would be about 75,900 litres.**

Since three kilos of jatropha seeds generates one litre of oil that is nearly equivalent in energy content to diesel, **250 tons of jatropha seeds per annum would be needed to produce 79,000 litres of jatropha oil.** Considering a productivity rate of one ton per ha, **it would require 250 ha of land to produce 250 tons of jatropha seeds.** As discussed above, **at least 670 ha is available for jatropha production,** so there are no land availability constraints to supply all the households in Paoy Cha commune with electricity from jatropha oil. The amount of available land is even large enough to produce surplus for export or meet the anticipated increase in demand for electricity as household income rise. The productivity of jatropha is also expected to rise as the trees become bigger.

Table 4.1. Potential Demand for Jatropha Oil and Land Requirements

Number of households	Diesel consumption per day (litre)	Diesel consumption per year (litre)	Jatropha Seeds Needed (kg)	Land Needed at 1 ton/ha (ha)
80	12	4,380	13,140	13
433	65	23,707	71,120	71
866	130	47,414	142,241	142
1,733	260	94,882	284,645	285
Existing machinery		441,386	1,324,157	1,324
Land available				670

Source: Authors' calculation based on information provided by The interviewed entrepreneur

#### 4.2. Other Sources of Demand for Jatropha Oil

In Paoy Cha commune, there were 51 tractors, 373 koyuns, 19 pumps, 23 rice mills, 15 generators, and 4 battery chargers (Table 4.2). In addition to the household survey, all the tractor and rice mill owners were interviewed in order to accurately measure their diesel consumption. In total, **441,386 litres of diesel** in 2007 were consumed by these machines in Paoy Cha commune. At the current price of \$0.95 per litre, total diesel costs were \$419,316 in 2007. Considering the demand for diesel to operate



machinery 5.4 times greater than household electricity demand, there could be a large market for cheaper diesel substitutes such as jatropa oil

If income increases, the number of machines in the commune is likely to increase as well. Current expansion of the canal network to access water from the Trapaing Thmar reservoir is only expected to increase the use of pumps to irrigate rice fields during the dry season suggesting yet another reason why the demand for fuels is only likely to rise. However, certain machines require a small unit to warm up the jatropa oil before it can be combusted, for which some additional costs would be needed to measure the competitiveness of jatropa to diesel.

Table 4.2. Machinery Diesel Consumption

Type of machine	Total number (based survey and census data)	Average consumption per year per unit	Actual use of diesel per year
Tractor	51	3,968	202,349
Koyun	373	482	179,859
Pump	19	457	8,683
Rice Mill	23	1,506	34,644
Generator	15	341	5,121
Battery Charger	4	2,683	10,730
TOTAL (litres)			441,386
Price (\$/litre)			0.95
Total cost (\$)			419,316

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

## V. Potential Demand for Electricity and Development Prospects

In addition to electricity demands for lighting, electricity is important for fans, stereos, television, electric equipments and other business process in garments and textiles, wood processing, and beauty salons. Under current circumstances, not all the households are likely to be able to afford electricity. However, there are enough better-off households who are likely to afford electricity. And for those poor households that cannot afford electricity may consider investing their own labour and land to produce jatropa seeds in exchange for electricity. If they cultivate jatropa on 0.5 ha of land, they could produce enough seeds for enough electricity to run two lamps all year round. Since the household survey found that households already spend money on battery and kerosene consumption, which is as much as electricity consumption by other households in similar settings, it is unlikely that households would need to earn more to access electricity provided from jatropa oil fueled generators. Thus, sufficient demand for commercially available electricity already exists in the commune.

### 5.1. Affordability of Villagers

To assess the household demand for electricity use, it is important to know the household's level of income, purchasing power, and lighting expenditures. Table 5.1 presents the distribution of households in different income categories. Groups (3) and (4), which accounts for nearly half the households in the commune, generate more than \$600 in income per year. These groups of households are likely to be able to afford electricity at the current prices. The entrepreneur charged different prices by different

degrees of consumption as presented in Table 5.2 below. According to him, the poor households used to have only one fluorescent light for which he charged 6,000 Riel (\$1.50) per month. At \$18 per year, most households were able to afford these prices. However, currently he charges his clients at least 15,000 Riel (\$4.25) per month for two fluorescent lights, a colour TV and occasionally additional items. The average expenditure per household among his 83 clients is about 30,000 Riels (\$7.50) per month or about \$90 per year. It should be noted that Mr Hak's rates expensive compared to other sources such as national grid and a Thai company (Table 5.2). However, these expensive rates are common in rural villages. If the cost of fuel is lowered by an abundance of jatropha, the price of electricity will also become cheaper.

Table 5.1. Percentage of Households in Different Income Groups

Name of village	Below \$300	\$300 to \$599	\$600 - \$999	\$1,000 and above	Total
	(1)	(2)	(3)	(4)	
Paoy Snuol	30	20	25	24	100
Paoy Cha	29	39	13	19	100
Trapaing Thmar Tbong	15	28	16	41	100
Trapaing Thmar Kandal	16	24	24	36	100
Trapaing Thmar Cheung	12	31	12	45	100
Ta Ong	23	26	25	26	100
Sambour	34	24	31	10	100
Pongror	33	35	24	8	100
<b>Total</b>	<b>25</b>	<b>28</b>	<b>21</b>	<b>26</b>	<b>100</b>

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

Table 5.2. Current Prices of Electricity in Similar Locality

Source of electricity	Riel per kwh
	Prices charged by The interviewed entrepreneur
1 kwh, normally for one light	6,000
1 - 10 kwh	3,800
10 - 20 kwh	3,000
Over 20 kwh	2,500
National grid for household consumption	1,220
Thai electricity run by Anco company	600 – 700

Source: Interview with The interviewed entrepreneur and others

While 36.5% of households did not have any fluorescent lights using car batteries, 45.7% only had one light per household (Table 5.3) which cost 7,000 riels (\$1.77) per month. For those who used two fluorescent lights, they spent 12,676 riels (\$3.17) per month. Less than 20% of the households used two fluorescent lights or more. It should be noted that this is not the total expenditure on lighting the house. Every household also used kerosene lamps, which cost even more compared with the costs of battery recharging (see Table 5.4 below). Nonetheless, the use of kerosene lamps will still be needed if electricity supply is not available throughout the night.

Table 5.3 Cost of Battery Operated Lights

Number of lights	% households	Recharging cost per month per household (riels)	
No fluorescent lights	36.3	Riels	\$
One fluorescent light	45.7	7,065	1.77

Two fluorescent lights	15.9	12,676	3.17
Three fluorescent lights	1.8	16,362	4.09
Four fluorescent lights	0.2	40,500	10.13

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

The majority of villagers used both kerosene and battery for lighting inside the house. Most households still used kerosene even though they had a battery for lighting because most had only one battery operated light that was not adequate for lighting the whole house. Each village spent about 1,000,000 Riel (\$350) a month on kerosene alone. Each household on average spent 7,478 Riel (\$1.80) on kerosene and 5,806 Riel (\$1.42) on battery recharging per month. This amounted to 13,284 Riel (\$3.30) per month per household or about **\$69,000** for the whole commune (Table 5.4 and 5.5). In addition, the cost of purchasing a new battery is \$39 on average. On average, these expenditures cover two lights per household running on a commercial generator from 5:00pm to 11:00pm.

Table 5.4. Household Expenditures for Kerosene and Battery Recharging for Lighting

Name of village	Riel per Month per Household					
	Kerosene		Battery		Kerosene and Battery	
	Mean	Maximum	Mean	Maximum	Mean	Maximum
Paoy Snuol	6,884	30,000	5,401	35,000	12,286	52,143
Paoy Cha	6,209	22,800	5,447	21,000	11,656	30,000
Trapaing Thmar Tbong	7,151	40,000	5,839	32,000	12,989	45,143
Trapaing Thmar Kandal	7,915	28,500	7,120	45,000	15,035	60,429
Trapaing Thmar Cheung	9,001	24,000	6,011	25,000	15,011	37,000
Ta Ong	9,478	60,000	6,486	40,500	15,964	75,000
Sambour	7,348	15,000	4,335	15,000	11,683	30,000
Pongror	7,040	24,000	5,676	20,000	12,716	30,600
All villages	7,478	60,000	5,806	45,000	13,284	75,000

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

Table 5.5. Expenditure on Kerosene and Battery Recharging for Lighting by Village

Name of village	US\$ per Month			US\$ per Year		
	Kerosene	Battery	Total	Kerosene	Battery	Total
Paoy Snuol	575	451	1,026	6,898	5,412	12,310
Paoy Cha	340	298	638	4,079	3,579	7,658
Trapaing Thmar Tbong	511	417	929	6,135	5,010	11,145
Trapaing Thmar Kandal	336	303	639	4,037	3,631	7,668
Trapaing Thmar Cheung	311	207	518	3,726	2,488	6,215
Ta Ong	495	339	834	5,943	4,067	10,009
Sambour	191	113	304	2,293	1,353	3,645
Pongror	480	387	868	5,765	4,649	10,414
All villages	3,240	2,516	5,755	38,876	30,188	69,064

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

Table 5.6 shows that 41% of the households in Paoy Cha commune spent 10,000 Riel or less on kerosene and battery for lighting their houses every month. About 60% of the households already spend more than 10,000 Riel per month on kerosene and battery. At least, 16% of the households spend more than 20,000 Riel. Therefore,

these households which already spent at least as much on kerosene and battery would be able to afford electricity generated from jatropha oil at the same prices.

However, it should be noted that this expenditure includes battery usage during the day time for a black and white TV. If the generators did not operate during the day, battery- powered electricity would still be needed for television watching. Nevertheless, given the large number of households in the commune, it could be still profitable to run a generator to supply electricity during day time so long as there is enough demand.

Table 5.6 Kerosene and Battery Recharging Expenditures for Lighting by Village

Name of village	% households by level of expenditure on battery and kerosene for lighting the house		
	0 - 10,000 riels/month	10,000 – 20,000 riels/month	>20,000 riels/month
Paoy Snuol	44	43	12
Paoy Cha	49	41	10
Trapaing Thmar Tbong	44	40	16
Trapaing Thmar Kandal	38	43	19
Trapaing Thmar Cheung	32	41	27
Ta Ong	30	51	20
Sambour	48	41	10
Pongror	42	43	15
All villages	41	43	16

Source: Survey of 523 households in Paoy Cha commune, 19-31 December 2007

## 5.2. Prospective Services That Will Demand Electricity

Electricity demand from other services in the commune includes but are not limited to, tailoring, beauty salons and parlors, restaurants and other retail outlets. Paoy Cha commune has 60 household garment producers or tailors (Table 5.7). With electricity, electric motors can be used and productivity can be improved. The six beauty salons in the commune will also stand to benefit from the availability of electricity. New services may also be set up once electricity becomes available. Though, there is a question of affordability. For businesses, the cost of electricity is sensitive. In general, the cost of electricity in urban areas is 3 to 4 times higher than that in Thailand, Vietnam or Laos for which businesses in Cambodia suffer tremendously. To be competitive, they need access to cheaper electricity.

Hopefully, the availability of jatropha oil at a lower cost than diesel will reduce the price of electricity. Therefore businesses will be able to expand and become more competitive. As discussed above, at the price of 700 Riel per kilo for jatropha seeds, the cost of one litre of jatropha oil will be 2,800 Riel per litre which is 1,000 Riel cheaper than diesel that is currently sold at 3,800 Riel per litre, including imported tax. Thus, the cost of electricity generated by jatropha oil should be cheaper.

Table 5.7 Services that Demand Electricity

Service	Total	Paoy Snuol	Paoy Char	Trapaing Thmar Tbong	Trapaing Thmar Kandal	Trapaing Thmar Cheung	Ta Ong	Pong Ror	Sam- bour
Taylor/hh garment	60	2	15	9	13	11	5	0	5
Battery chargers	11	1	1	4	1	0	2	2	0
Beauty salon	6	0	1	3	0	0	2	0	0
Barber shops	7	2	1	1	0	0	2	1	0
Restaurant	1	0	0	0	1	0	0	0	0
Renting Audio Visual System	11	1	1	2	0	1	2	3	1
Telephone service	6	1	1	2	0	1	0	0	1

Source: Interview of Village Chiefs

## VI. Conclusion and Recommendations

The prospects for developing jatropha seed production and oil processing for electricity use in Paoy Cha commune appears promising and conditions are favorable for GTZ to invest in this endeavor. Based on the findings of this study, there is enough land and labour available for jatropha production that would not compete for land with food production, initial start-up costs appear affordable even to poor households, demand is strong and growing and introducing a reliable diesel substitute will reduce electricity costs.

Determining the profitability of jatropha production depending in part on cost of producing jatropha is not yet reliable. Jatropha production and thus pricing for production costs in Cambodia is in its infancy. The reported cost per hectare of jatropha production in the first one year varies from US\$125 to \$1,500. However, given the abundance of family labour and land in the Paoy Cha commune, the costs of growing jatropha should be around \$100 per ha. This will allow villagers to have access to good quality seeds and some fertilizer. At this cost, it is profitable for villagers to cultivate jatropha given that seeds sell for \$175 per ton (or 700 riels per kg).

Jatropha production could be economically viable compared to other possible cash crops if the yield reaches 2 tons per ha after year 3. According to production performances in other places, this is an attainable goal. From year 3 onwards, farmers should then be able to make an ample economic profit. In the medium and long terms, the profit will be much higher than other crops such as beans and maize given the current prices. This would mean the poor, who generally live from hand to mouth or have very high discount rates, would need credit to cultivate jatropha.<sup>29</sup> Thus additional credit provided by micro finance institutions (MFIs) might be a necessary condition for poorer households to participate. The response by MFIs to emerge in Paoy Cha commune may be slow.

<sup>29</sup> Discount rate refers to the percentage of the future value of something is forgone in order to consume the present. For instance, between receiving \$100 one year later and receiving \$90 now, the poor may choose \$90 now. This means the discount rate is 10%.

Data from the entrepreneur provides a basis for estimating how much jatropha oil will be needed if all the 1,733 households decided to use electricity in Paoy Cha commune. A linear projection would result in a need for 260 litres of diesel per day or 94,900 litres per year. However, actual needs are likely to be just **75,920 litres** if larger generators are employed to improve efficiency. To meet this demand, 250 ha of land would be required to cultivate jatropha, based on a yield of one ton per ha and three kilos of jatropha seeds needed to produce one litre of jatropha oil. The household survey found that at least 670 ha of land is available for jatropha production that would not compete with food production. So few if any constraints arise from land availability to supply electricity for all the households in the commune. The size of available land is even large enough to produce a surplus for export or meet the potential increases in demand for electricity if household income rises.

Other types of machinery could also be major consumers of jatropha oil. These machines currently consume about 441,000 litres of diesel per year. This is 5.4 times greater than the demand from running generators to supply electricity to all the households from 5:00pm to 11:00pm. Therefore, if jatropha oil remains a close, competitive substitute of diesel, the market could be huge.

In conclusion, there is sufficient evidence that the prospects for both growing jatropha and providing electricity in Paoy Cha commune are promising. Neither the opportunity costs of land or labour are deterrents at present. Affordability of electricity is not a question. Further, a project to install generators and provide electricity to villagers on a commercial basis would be profitable, regardless of whether it is fueled by jatropha oil or diesel.



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