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FOREWORD

This is the second issue of the Cambodian Economic Review that contains articles written by both academicians and development practitioners who have been established long interests in keep tracking on Cambodian development and economic issues.

The Review again presents critical challenges of contemporary issues that Cambodia is facing. And, these issues -- agricultural sector development and growth are key for reducing extreme poverty further; farm size and labor input are the most important factors to improve rice production; two main economy drivers tourism and garment are not sufficient to create jobs for employment seekers; garment exports have contributed to reduce poverty -- are not new; they have been well recognized by policy makers and analysts. Yet, these articles are not only trying to scientifically-research-based identify the current critical challenges but also trying to offer more policy options; so that new thoughts have been raised for consideration and decision making.

On behalf of Cambodian Economic Association, I would like to express my sincere thanks to authors who contributes written pieces to us: Srey Chanthy, Michael Powell, Chea Marong, Heng Phalpiseth, and Tatsufumi Yamagata.

Sok Hach
President of CEA

CAMBODIA'S AGRICULTURE SECTOR UPDATE¹

Srey, Chanthy*

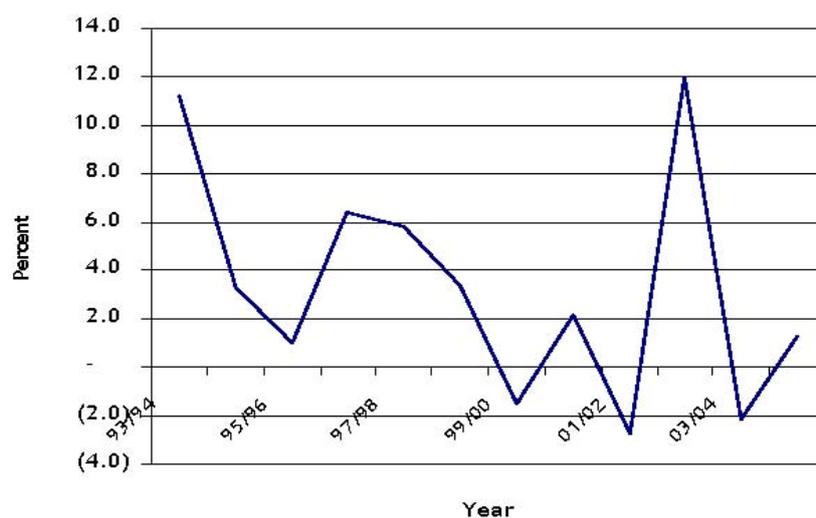
SECTOR STATUS AND PERFORMANCE

In real terms, agricultural GDP has increased, but its share of GDP has decreased as the service and industrial sectors expand. The fastest growing areas have been garment and tourism.

The agricultural sector's growth is highly variable and vulnerable to natural conditions. It is particularly susceptible to droughts and floods as well as endemics in livestock production such as avian flu. During 1993-2005 the sector recorded an annual growth of only 3.4 percent. The peak (11.2 percent) was registered in 1993-1994 and the deep trough (-2.7 percent) in 2001-2002.

Currently the sector's gross value-added comprises over 30 percent of the GDP, down from 45 percent in the 1990's. This still reflects its importance in the country's economy. Even though its GDP share is declining the sector employs some 75 percent of the country's 7 million labourers.

Figure 1: Agricultural Sector Growth, % (at 2000 Prices)



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¹ In this paper agriculture is defined to cover crops farming, livestock production, forestry and agro-forestry production, and fisheries production. This is consistent with the national accounting practice.

More than half of the agricultural workforce consists of women. Given the nature of poverty and significance of agriculture, in the medium term, improving productivity, expanded diversification and market-sensitization of the sector might be the key to poverty reduction and promotion of women's status.

Crop Productivity and Diversification

After the war, area under crop production has been recovered and expanded. For example net increase in cultivated areas under annual crops accounts for 23 percent during 1994-2005. Rice cultivated areas is the most expansive one, which accounts for 80 percent of all crops, including perennials and rubber, in 2004/2005.

While planted areas have been enlarged, productivity remains quite low. Labour and land productivity is estimated at US\$170/worker, and US\$518/ha, respectively (ACI 2005). By regional standards, yields of Cambodia's agricultural crops are relatively low. Cambodia does slightly better than Lao PDR in maize and soybean.

Table 1: Yields of Selected Crops of Cambodia's Neighbours, ton/ha

Country	Paddy	Maize	Soybean
Cambodia	1.98	3.32	1.31
Laos	3.28	3.01	0.84
Thailand	2.75	3.62	1.36
Vietnam	4.85	3.49	133

Sources: FAOSTAT (2004) & MAFF (2005)

Yields of most crops including rice are far below potential yields. Rice yields have risen slightly, and planted areas have also been expanded, contributing significantly the expansion in production. The high increase in both yield and planted areas of paddy rice is observed during 2000/2001-2004/2005.

Table 2: Growth Rate for Paddy Production, 1995/96-2004/05

	Planted Area	Yield	Production
Arithmetic Growth, %			
96/97-04/05	5.9	8.8	13.6
96/97-00/01	3.7	5.7	7.0
00/01-04/05	9.2	13.7	20.8
Geometric Growth, %			
96/97-04/05	5.0	8.0	13.5
96/97-00/01	3.6	5.4	6.7
00/01-04/05	9.1	13.7	20.5

Expanded production of paddy rice is derived more from yield increase rather than from expansion of cultivated area. However, raising yield, which should be the target, remains a potential that is not beyond reach.

Table 3: Source of Growth for Paddy, 1995/1996-2004/2005

Arithmetic (%)	Area-based	Yield-based
96/97-04/05	43.4	64.4
96/97-00/01	52.9	80.8
00/01-04/05	44.0	66.0
Geometric (%)	Area-based	Yield-based
96/97-04/05	37.0	59.1
96/97-00/01	54.2	81.2
00/01-04/05	44.3	66.5

The contribution of cultivated area expansion to total output is quite small. While expansion of cultivated areas by one unit can only increase output by less than one unit, the increase in yield by one unit could double it. This implies that yield has more potential to expand the output².

² Here other factors such as price of paddy rice, prices of other agricultural produce, prices of inputs, weather, and so on that have influence on production decision made by producers/farmers are held constant. A simple first-order autoregressive model for agricultural growth at one time lag period with weather dummy takes the form: $AGDP = 0.01 - 0.384AGDP_{t-1} + 0.004Year + 7.55 Dummy$ (where, $AGDP_{t-1}$: lag value of AGDP growth; Year: year of production; and Dummy: dummy variable in which 1 represents good weather; and 0 otherwise); R-squared = 87.8%; R-squared (adjusted) = 81.7%; F-value = 14.38; and P-value = 0.004. Note that the constant is not important in this case.

$$Q = -2.18 + 0.77X_a + 2.25X_y$$

$$R^2 = 0.77$$

$$\bar{R}^2 = 0.74$$

$$F_{-value} = 27.1; p = 0.00082 \quad (\text{Eq.1})$$

Where,

Q: total paddy rice production (ton),

X_a : planted area (ha), and

X_y : yield (ton/ha)

Higher yield in paddy rice could be attained to the level of the neighbouring countries, if improved technologies developed over more than a decade are affordable and reach the majority of farmers. This will expand paddy rice output even further.

Rice dominates all seasonal and annual crops in terms of its share in planted area and production. However, its gross value per unit area of land is relatively lower than most crops. And, while its production is growing its value does not, in real terms.

Table 4: Gross Margin of Seasonal Crops (4,000 Riel=US\$1)

Crop Name	Gross Margin USD/ha	Crop Name	Gross Margin USD/ha
Tobacco (traditional)	3,334.51	Floating rice	256.05
Lettuce	1,364.81	Sugar cane	237.74
Eggplant	1,256.88	Mung bean	229.44
Cabbage	950.56	White Yam	216.29
Water melon	831.58	Cassava	197.69
Sweet pepper	830.71	Dry season rice	195.38
Tomato	791.25	Peanut	187.50
Tobacco (modern)	661.38	Jute	173.85
Chinese cabbage	630.31	Wet season rice	158.79
Long bean	586.28	Receding rice	115.98
Corn	574.04	Upland rice	109.42
Cucumber	503.81	Vegetable (mix)	283.89
Sesame	501.88	Soy bean	268.22
Cauliflower	394.88		

Source: ABiC Survey for Cambodian Agrarian Structure Study (World Bank/GTZ/CIDA 2005)

Domination of paddy rice in the crop production sector reflects the low level of agricultural crop diversification. This is confirmed by the low value of area diversification index. The level of diversification over the last ten years has only been slightly improved.

Table 5: Area Diversification Index

	1994/1995	2004/2005
All seasonal and annual crops	1.096	1.855
All crops, excluding rubber	1.193	1.248
All crops, including rubber	1.215	1.265

Livestock Production

Livestock production remains traditional and small in scale, especially cattle and buffaloes. These animals are essential for farmers as they are the only source of traction power for farming.

For poultry and pig raising some medium scale production is observed. On average, the sector produces 13.3, 0.7, 2.1 and 2.8 million heads of poultry, buffaloes, pigs and cattle, respectively, during 1994-2004.

Table 6: Livestock Production Status – Production (mil. heads)

	Poultry	Buffalo	Pig	Cattle
Average 94-04	13.27	0.69	2.13	2.80
Standard deviation 94-04	2.39	0.06	0.18	0.17
Average 94-99	11.47	0.73	2.11	2.67
Standard deviation 94-99	1.42	0.06	0.16	0.08
Average 99-04	15.06	0.65	2.15	2.94
Standard deviation 99-04	1.29	0.03	0.20	0.08

During this period, production of most livestock species expanded, except for buffaloes. However, growth is generally poor and quite variable, especially during 1999-2004. Poor and highly variable growth in poultry during this period might be attributable also to the occurrence of avian flu.

	Poultry	Buffalo	Pig	Cattle
Average 94-04	2.83	-2.01	1.59	2.08
Standard Deviation 94-04	8.88	4.89	8.98	4.06
Average 94-99	3.74	-3.74	0.03	2.54
Standard Deviation 94-99	7.45	2.65	8.28	4.70
Average 99-04	1.82	-0.90	1.75	2.80
Standard Deviation 99-04	10.01	6.21	10.19	4.49

Weak veterinary services and lack of good breeds are the hindrance to livestock sector development in Cambodia. Since the veterinary services remain weak the sector, especially poultry, is vulnerable to shock/endemic such as avian flu. Fortunately, however, the animal death rate remains relatively low. Notably, that the death rate in pigs has slightly increased from 2003 to 2004.

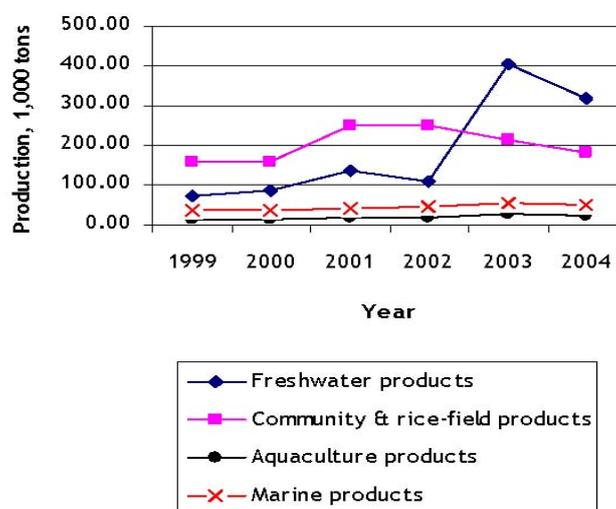
Table 8: Animal Death Rate (Hd/1000)

	2003	2004
Buffalo	1.3	1.2
Pig	3.5	4.4
Cattle	0.5	0.4

Fisheries Production³

Fish remains the main protein source in daily meals of Cambodians. It is only second to rice in the Cambodian diet. Fishing is, therefore, important for many to support their families. Its contribution to the Cambodian economy cannot be overlooked. It consists of more than one-fourth of agriculture's GDP in 2004. Average production over the period 1999-2004 is 543,000 tons. Freshwater fishery production takes the lion share (86.1 percent).

³ Fisheries production includes mainly aquaculture, and freshwater and marine fisheries.

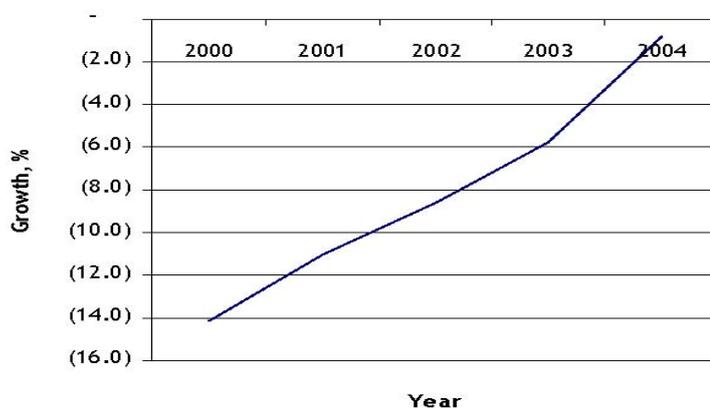
Figure 2: Fisheries Production

The sector grew slowly with an annual average of 1.14 percent during 2000-2004. The slow growth can be explained by the over and intensive illegal fishing that happened prior to 2003 and limited contribution from marine and aquaculture production. Therefore, the sector still has a potential to grow further if natural fisheries is better managed, aquaculture is boosted, and the application of chemicals in paddy rice production is rationalized or properly controlled.

Forest Production

Forestry has the least share in the agriculture GDP. Its real value in GDP is dismally small; its average share over the past five years is less than 3 percent. Its growth has experienced a negative trend. The sector's worse growth was observed in 2000. The average growth rate of the sector has declined by 8.1 percent over the past five years.

This poor performance may be attributable to two factors: (a) unsustainable logging operations practiced until the early 2000's by both illegal loggers and forest concessionaires have degraded Cambodia's forests leaving the remaining forest with low economic value, and (b) moratoriums on logging operation and log transport imposed by the government remain in effect. The latter will have long-term beneficial impact on the future of the forest and economy of Cambodia as well as remote rural Cambodians who rely on forest-related resources for their livelihoods.

Figure 3: Forestry Growth

Land Management

Cambodia is relatively small in size, but less populated. Its population density is far lower than that of neighboring Thailand and Vietnam. As a result, it has higher land-to-labor ratio. However, it is less urbanized.

Table 9: Population Density and Labor-to-Land Ratio

Country	Population density, person/sq. km.	Rural population, %	Land-to-labor ratio	Land-to-farm labor ratio
Cambodia	77.33	81.30	0.75	1.08
Laos	27.89	79.40	0.66	0.87
Thailand	122.45	68.20	0.55	0.99
Vietnam	245.34	74.20	0.22	0.34

Source: FAO 2005

Although, the land-to-labour ratio seems high, average land holding is not large. An agricultural household now owns or operates on less than a hectare of farmland. While landlessness in the poor population has risen, land is being concentrated in the hands of a handful of the rich and/or powerful people and economic land concessionaires. Certain economic land concessions are granted at the expense of poor smallholders. In addition, large plantations under certain circumstances are not as effective as smallholder producers⁴.

⁴ Cambodian Agrarian Structure Study (World Bank/CIDA/GTZ, August 2005) seems to suggest that small and medium scale farmers with land size ranging from less than 3 ha to 10 ha in many crops including especially vegetables perform better than large scale producers with land size larger than 10 ha.

Recent household surveys showed the top ten of holdings accounted for about 45 percent of total land held in 1999 and about 65 percent in 2003 (SNEC & HKS, 2006). Apart from this, the majority of poor landholders do not possess land titles, making them vulnerable to land deprivation, eviction and conflict. This is reflected in the regular occurrence of land conflicts over the past several years. The issue becomes significant and has alerted the government that action needs to be taken. “If we do not deal with land issues delicately, we will have to face a farmers’ revolution against the RGC ... We have to find a solution that could ensure that farmers have land for food production and livelihood development ...”, Prime Minister Hun Sen was quoted as addressing the National Forum on Land Management on October 18, 2004.

With support from various donors under the Land Management and Administration Project (LMAP), the government has implemented a systematic land titling and registration program; however, progress is slow. While the current target is to issue 1 million land titles in 10 provinces and the municipality of Phnom Penh by 2007, around 209,000 titles were distributed by the end of 2005. However, one must consider that 270,000 titles were produced. With the current capacity and system in place, the government could register around 20,000 plots of land per month.

Lack of land deeds does not only cause conflicts that deprive the poor of their land, but also gives no incentive for the occupants to make appropriate capital investment, hampering their access to credit services, which in turn could encourage unsustainable land use. This continues to have strong implications for rural poverty reduction, unless alternative decent employment opportunities are created in the rural sector.

Water Resources for Agriculture

Geographically, Cambodia is situated at a favourable location free of most natural disasters, apart from floods and droughts. With monsoon weather, the Tonle Sap Lake, the Mekong River, the Tonle Sap River and the Bassac River, Cambodia is rich in water resources. The Tonle Sap Lake alone constitutes 5.52 percent of Cambodia’s territory at the height of the wet season⁵.

Annually, 500 billion cubic meters and 17.6 billion cubic meters of surface and groundwater, respectively, are available for extraction. The irrigation potential of surface water is estimated at 1.7 million hectares. However, only a small fraction of this (15.88 percent) is under irrigation.

⁵ The area of the Great Lake Tonle Sap during the dry season is 30,000 sq. km and swells to 1,000,000 sq. km during the rainy season becoming a big and rich habitat and spawning ground for freshwater fishes.

Table 10: Irrigated Farmland, 1000 ha

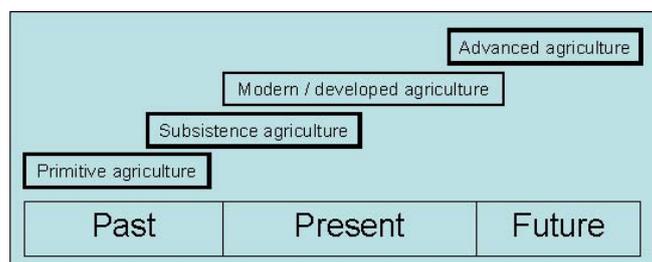
Country	1960s	1970s	1980s	1990s	Early 200s
Cambodia	83.2	95.4	171.5	263.9	270.0
Laos	14.1	45.0	119.9	154.0	175.0
Thailand	1,759.0	2,382.0	3,664.6	4,598.9	4,959.7
Vietnam	1,033.3	1,335.6	2,320.0	2,970.0	3,000.0

This represents a huge loss of resource for development, which is due to: (a) limited capacity in the sector, and (b) lack of investment in maintaining existing systems and in developing new facilities and infrastructures. This means that farming will continue to depend on the precarious nature of the weather for quite some time.

Agribusinesses

The distinction between subsistence and modern agriculture is in production activities and productivity. The former is observed when farming households follow traditional practices with limited improved inputs struggling to produce enough for household consumption. This is more common in various regions of developing countries such as Cambodia.

The latter is found when farming households have access to improved technologies, infrastructure and inputs that help with increasing productivity. In this instance, households can produce some surplus for marketing. When it is expanded, agricultural commercialization can be achieved.

Figure 4: Stages of Agricultural Development

Most sub-sectors of Cambodia's agriculture remain more or less subsistence. Even though certain sub-sectors have moved towards modern levels of practices, commercialization is not without constraints.

Major issues are the low level of development of agribusiness activities such as limited availability of agricultural market information, lack of grade standards and quality certification system,

limited direct access to international markets (mostly through Thailand and Vietnam), lack of post-harvest facilities and agro-industries (including processing, packaging), and lack of marketing ability/skill.

Reliance on imported high cost and often un-assured quality inputs, including seeds, chemicals and fuel, from neighbouring countries render Cambodian farm produce uncompetitive for marketing, not to mention the high transport and shipping costs, lack of agro-services (including agricultural credit⁶), unorganized production, and lack of demand-driven planning skills. All these combined with the lack of appropriate strategy have hindered the development of the agribusiness sector, which could contribute, if well developed and organized, to adding values to agricultural produce, generating employment and increasing farm income⁷.

POVERTY AND AGRICULTURE

Given the state of Cambodia's economic development, agriculture will continue to be significant for Cambodia⁸ over the next decade because it is the only sector that employs most of the labour force, the majority of whom remains poor. Among them are women, who are engaged in both agricultural production and marketing. Poverty of rural people living off agriculture remains high because of low productivity and diversification and other issues as discussed above, rice monoculture practice, limited access to and degradation of natural resources (especially, land, forest, and fisheries) and limited rural employment opportunities.

The value of rice has decreased in both world and domestic markets⁹. This is the classic agricultural problem. Its per-unit-area gross value is relatively lower than most crops. This means that the monoculture of rice practiced in Cambodian agriculture may help Cambodia to achieve food security but will not be able to help reduce poverty of the rural farming population in significant terms.

⁶ There has been a great loss of value addition and employment annually due both legal and illegal exportation of raw agricultural produce such as paddy rice, maize, soy bean, cashew, pepper. For example, the World Bank (2004) estimated that at least 1.4 million tons of paddy rice was exported.

⁷ Although Cambodia is reported to have oil and natural gas reserves, it would take several years down the road before the real benefit could be materialized. This could be the good news. However, from experience, mismanagement of these resources could become the resource curse rather than blessing.

⁸ Rural/micro-credit is limited in terms of both access and availability. Savings and/or supply have not been able to meet the demand. It was reported that by the end of 2005, outstanding loans was 118.01 million US\$ serviced by 12 MFIs. Many more MFIs have been registered for operation.

⁹ In the 1980s rice price averaged around US\$1,200/ton on international market, but has since decreased to less than US\$350.0/ton, at the present time.

Although management of natural resources has been improved, especially with regard to fisheries, a lot has been degraded over the past 15 years. Conflicts over and abuses of natural resources have made headlines in local newspapers nearly on monthly basis.

Illegal logging and land conflicts have drawn a lot of attention. An estimate shows that destructive logging and land conflicts have adversely affected some 1.7 million rural Cambodians over the past 15 years. This is perhaps one of the reasons why a lot of them remain poor. The recent World Bank's Poverty Assessment suggested: "Poverty rates remain the highest in those areas with the richest forest resources – and where exploitation has been most severe".

Besides farming and extraction of natural resources, no alternative employment exists for people in rural areas. This prevents them from being able to support their living and keeps them in the vicious cycle of poverty.

Growth Determinants

Growth of different agricultural sub-sectors is limited. Though, non-rice crops seem to grow more significantly than the rest despite fluctuations and weather-dependency.

Growth in general is attributed to accumulation of factors of production, which include land, labour and knowledge and capital investment. Hard data on knowledge and capital investment are difficult to find, in present day Cambodia, to prove how they could contribute to agricultural growth.

Over the past decades two important factors of production have been well accumulated, namely agricultural land and labour. Land has been brought into agricultural production with an annual growth of 1 percent, at the expense of forests. The active labour force in the agricultural sector has grown about 2.7 percent from 3.88 million 1994 to 4.88 million in 2003. Agricultural GDP expansion seems to be driven more strongly by the increase in agricultural land than increase in labour. Note that agricultural labour is relatively low-skilled and of low cost compared with that of most ASEAN nations.

$$\begin{aligned}AGDP &= 532.15 + 320.39Lana \\R^2 &= 0.87 \\ \overline{R}^2 &= 0.83 \\ F_{-value} &= 20.86, p = 0.02\end{aligned}\quad (\text{Eq.2})$$

Where,

AGDP: agriculture GDP (million USD), and

Land: agricultural land (million ha)

$$AGDP = 270.04 + 226.53Labour$$

$$R^2 = 0.48$$

$$\bar{R}^2 = 0.30$$

$$F_{-value} = 2.74, p = 0.2 \quad (\text{Eq.3})$$

Where,

AGDP: agriculture GDP (million USD), and

Labour: farm labour force (million workers)

DEVELOPMENT PLANS

During the period 2000-2005 several national-level development plans, in particular, Socio-Economic Development Plan ii (2001-2005) and National Poverty Reduction Strategy (2003-2005), were developed and implemented. All of these plans acknowledged the roles of agriculture in reducing poverty in rural Cambodia. However, the strategies were not adequate; and most importantly investment resources have never been matched to promote and accelerate the sector's development.

New plans and strategies were and have been developed for implementation during 2006-2010, which include the Rectangular Strategy (2004-2008) and National Strategic Development Plan (2006-2010). These new plans and strategies seem to give more focus on and to allocate more resources towards the agricultural and rural sectors.

The Rectangular Strategy has five main components, including agricultural sector enhancement, with good governance as the hub. Main focus areas for the agricultural sector are to (a) improve agricultural productivity and diversification; (b) accelerate land reform and de-mining; (c) accelerate fisheries reform; and (d) accelerate forestry reform. It is the lead strategy from which sectoral strategies have been developed.

However, some sectoral strategies do not really reflect the sectoral vision, concept and approach. Some of them are more departmentalized or compartmentalized. The fact is there are several government agencies, which are responsible for the same and overlapping areas and for

separate areas that require linkages and coordinated effort. But, these agencies developed their strategies based on their own individual political mandates.

Table 11: RGC's Rectangular Strategy (2004-2008)

	Agricultural Sector enhancement	
Private sector growth and employment	Good governance and enabling environment	Physical infrastructure improvement
	Capacity building and human resources development	

The Agricultural Sector Strategy developed by Ministry of Agriculture and Fisheries and Water Resources Sector Strategy developed by Ministry of Water Resources & Meteorology MOWRA which were used as inputs for the NSDP are a good example of disconnection between relevant areas that are required to support the sector development. The government recognizes the necessity to link the two areas together in order that the sector can be developed and poverty can be reduced. In the NSDP 2006-2010, therefore, the government requires that a comprehensive Agriculture and Water Resources Strategy be formulated.

The process of formulating the “Agriculture and Water Resources Sector Strategy” started since December 2005 prior to the approval of the NSDP 2006-2010. At this stage it is difficult to say how this strategy would look like.

Regardless of a good strategy and better budget allocation to the sector as demonstrated in the NSDP 2006-2010, the issue still rests with the practice of disbursement. In the past a number of ministries and sectors, except the Royal Palace, the Ministry of Economics and Finance, the Ministry of Defence, the Ministry of Interior, had late and low disbursement. In the past decade, while investment in the sector was limited, the disbursement was problematic. This could be one of the main hurdles for the sector.

The government has named itself the “Irrigation Government”. This shows the government's commitment to develop the irrigation system and network to support irrigated agriculture. In general the government seems to favour a large and medium scale irrigation system and network rather than micro and small scale ones that could be easily managed, operated and maintained, and that could promote local community empowerment.

The focus on irrigated areas could divert resources, out of proportion, away from public investment in improving productivity and diversification in rain-fed and upland agricultural areas that

constitute the largest part of the Cambodian agricultural sector. This could be also a risk to the sector development as a whole.

At this stage there is no clear understanding about the benefit and potential of the two types of agriculture in terms of economic efficiency, economic development potential and poverty alleviation impact¹⁰.

CONCLUSIONS AND STRATEGIC CONSIDERATION

Over the past decade, the sector performance was very poor. While it continues to have a major role in rural economy and poverty alleviation, its development is faced with a lot of barriers and challenges. Accelerating the development of the sector will significantly boost rural economy and associated sectors; improve food security and living conditions of the rural poor; and enhance the status of women who always have a significant stake in agricultural production, processing and marketing.

The government's policy focuses on the four core areas: (a) productivity improvement and diversification; (b) land reform and de-mining; (c) forestry reform; and (d) fisheries reform, is good; but investment and disbursement pending on the right strategies to achieve them are equally important. Budget allocation and spending for the sector need to triple from the 2005 base.

The balance in investment in irrigated vs. rain-fed and upland agriculture should be made before the advantages and disadvantages of the two systems could be completely understood. There must equally be a balance between promoting large plantations vs. smallholder agricultural production.

The government and stakeholders concerned should strike a balance between investing in the rice sector to ensure food security and high-value agricultural commodities. Promoting production of high-value products could potentially contribute to faster, and more sustained poverty reduction in a smallholder system in an efficient manner.

This could happen if improvement of agri-services, especially, agricultural extension, veterinary services, agricultural marketing and agricultural credit; promotion of and facilitation for farmer organisations for market-oriented, organized production; pro-poor land distribution; and promotion of private sector investments in agro-industries and integration of smallholders/farmers into the value chain through fair contract farming arrangement are implemented.

¹⁰ This would imply that a comparative study on cost-effectiveness of investment in irrigated vs. rain-fed and upland agriculture should be considered.

Table 11: Agriculture Sector Development Indicators: Update and Projection (2000-2006)
(All dollar Value is at Constant 2000 Prices)

Indicator	Year 2000	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006
Agricultural crops (US\$ million)	603.2	595.7	568.3	703.3	672.5	702.4	727.0
Paddy rice (US\$ million)	328.2	324.9	299.8	361.5	313.7	327.9	328.7
Other crops (US\$ million)	224.1	220.3	218.3	294.7	313.1	329.8	355.1
Rubber (US\$ million)	51.0	50.5	50.2	47.1	45.6	44.6	43.2
Livestock (US\$ million)	196.2	214.3	211.9	219.7	226.7	233.7	240.4
Fisheries (US\$ million)	392.8	409.1	411.9	413.1	395.3	407.1	408.0
Forestry (US\$ million)	120.3	107.1	97.9	92.2	91.5	80.1	72.8
Agriculture GDP (US\$ million)	1,312.5	1,326.1	1,290.0	1,428.2	1,385.9	1,423.3	1,448.2
Industry GDP (US\$ million)	797.6	872.6	1,024.1	1,130.7	1,299.5	1,403.4	1,529.6
Service GDP (US\$ million)	1,355.5	1,383.5	1,445.5	1,428.0	1,544.0	1,557.7	1,599.9
Real GDP (US\$ million)	3,465.6	3,582.2	3,759.5	3,987.0	4,229.4	4,384.4	4,577.6
GDP per capita (US\$)	275.6	279.8	288.3	300.1	312.3	317.6	325.1
Population living below S\$1/day, GDP-based (% total)	24.5	23.3	21.0	17.8	14.4	13.0	10.9
Exchange rate: US\$1 to Riel] (year average)	3,859.0	3,924.0	3,921.0	3,975.0	4,016.0	4,100.0	4,200.0
Inflation in Riel (% year average)	(0.7)	(0.9)	0.0	1.0	3.9	5.3	6.0
Agriculture share in GDP (%)	37.9	37.0	34.3	35.8	32.8	32.5	31.6
Paddy in AGDP (%)	25.0	24.5	23.2	25.3	22.6	23.0	22.7
Other Crops in AGDP (%)	17.1	16.6	16.9	20.6	22.6	23.2	24.5
Rubber in AGDP (%)	3.9	3.8	3.9	3.3	3.3	3.1	3.0
Livestock in AGDP (%)	14.9	16.2	16.4	15.4	16.4	16.4	16.6
Fisheries in AGDP (%)	29.9	30.8	31.9	28.9	28.5	28.6	28.2
Forestry in AGDP (%)	9.2	8.1	7.6	6.5	6.6	5.6	5.0

Indicator	Year 2000	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006
Agriculture Growth (%)	(2.3)	1.0	(2.7)	10.7	(3.0)	2.69	1.75
Paddy growth (%)	(2.6)	(1.0)	(7.7)	20.6	(13.2)	4.52	0.23
Other crops growth (%)	0.7	(1.7)	(0.9)	35.0	6.2	5.35	7.66
Rubber growth (%)	8.7	(0.9)	(0.6)	(6.2)	(3.1)	(2.12)	(3.16)
Livestock growth (%)	(10.2)	9.3	(1.1)	3.7	3.2	3.08	2.85
Fisheries growth (%)	3.8	4.1	0.7	0.3	(4.3)	2.99	0.22
Forestry growth (%)	(14.2)	(11.0)	(8.6)	(5.8)	(0.8)	(12.48)	(9.06)
AGDP per farmer or farm worker (US\$) /a	328.4	317.5	311.2	340.0	321.2	324.5	323.6
Daily per capita income of agriculture population (US\$) /b	0.37	0.37	0.36	0.40	0.38	0.39	0.40
Agricultural population living below US\$1/day, AGDP-based (% agricultural population)	62.94	62.57	63.86	60.02	61.77	60.86	60.47
Landholding per household (ha)	1.5	1.5	1.5	0.8	0.8	n.a	n.a
Landlessness rate (%)	16.0	17.0	18.0	19.0	20.0	21.00	22.00
Land-to-labor ratio, (agricultural area-to-economically active population)	0.82	0.80	0.77	0.75	0.73	0.70	0.68
Cultivated area under seasonal and annuals (million ha)	2.40	2.49	2.40	2.71	2.74	2.83	2.92
Cultivated area under paddy rice (million ha)	2.16	2.24	2.14	2.31	2.37	2.40	2.45
Cultivated area under seasonal and annuals (million ha)	0.24	0.25	0.26	0.40	0.37	0.43	0.47
Agriculture trade balance (US\$ million)	210.00	153.00	99.00	181.00	90.00	93.00	118.00
Agriculture expenditure / budget allocation (US\$ million)	9.3	13.2	17.5	17.4	21.8	26.1	31.6
ODA disbursement for agricultural sector (US\$ million)	35.0	35.0	35.0	40.0	45.0	45.0	45.0
Agriculture expenditure / budget allocation (% GDP)	0.3	0.4	0.5	0.4	0.5	0.6	0.7
Agriculture expenditure / budget allocation (% AGDP)	0.7	1.0	1.4	1.2	1.6	1.8	2.2
Capital investment in agriculture (US\$ million)	n.a	n.a	6.2	n.a	n.a	n.a	n.a
Share of agriculture's capital investment (% of total)	n.a	n.a	9.0	n.a	n.a	n.a	n.a

Indicator	Year 2000	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006
Total population (million) – population growth (1.81% per annum)	12.57	12.80	13.04	13.29	13.54	13.81	14.08
Agricultural population (million)	8.81	8.92	9.04	9.16	9.28	9.40	9.53
Agricultural population (% total)	70.10	69.71	69.31	68.91	68.51	68.10	67.70
Population density (person/sq. km)	69.5	70.7	72.0	73.4	74.8	76.3	77.8
Labor force (% of total population)	42.8	43.6	44.3	45.0	45.8	46.60	47.30
Total employment (% of labor force)	94.4	95.7	93.0	92.2	91.6	90.5	89.2
Total employment (million)	5.08	5.34	5.37	5.51	5.68	5.82	5.94
Employment by agriculture (million)	3.63	3.84	3.83	3.93	4.03	4.14	4.25
Paddy	2.56	2.73	2.71	2.78	2.86	2.94	3.01
Other Crops	0.44	0.47	0.47	0.48	0.50	0.51	0.52
Livestock	0.34	0.36	0.37	0.38	0.39	0.40	0.41
Fishery	0.240	0.245	0.248	0.251	0.254	0.256	0.259
Rubber & Forestry	0.047	0.038	0.037	0.036	0.037	0.038	0.039
Employment by agriculture (% of total employment)	71.5	71.9	71.3	71.3	71.0	71.1	71.5
Percent of women employed in agriculture (%)	55.6	55.4	55.2	55.1	54.9	54.73	54.56
No. of women employed in agriculture (million)	2.0	2.1	2.1	2.2	2.2	2.3	2.3
Ratio of non-working to working population	2.5	2.4	2.4	2.4	2.4	2.4	2.4
Agricultural land (million ha)	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Forest cover (percent)	58.6	58.6	58.6	58.6	58.6	58.6	58.6
Protected areas (% Cambodia's total land area) /c	18.2	18.2	24.3	24.3	24.3	24.3	24.3
Protected areas (million ha) /c	3.3	3.3	4.4	4.4	4.4	4.4	4.4
Irrigated area (1,000 ha)	433.0	460.6	489.9	521.2	554.4	588.7	626.2
Use of chemical fertilizers (kg/ha)	n.a	n.a	11.0	n.a	n.a	n.a	n.a
Use of pesticides (kg/ha)	n.a	n.a	12.0	n.a	n.a	n.a	n.a
Rural credit, outstanding loan (US\$ million)	n.a	n.a	n.a	n.a	118.0	n.a	n.a
Rural credit interest rate (% p.a.) -US\$ loan	36.0	36.0	36.0	36.0	36.0	30	n.a
Demand for rural credit (US\$ million/p.a)	n.a						
Number of registered micro-finance institution	n.a	n.a	n.a	n.a	12.0	16	n.a

Source: NIS, EIC, CDRI, MEF, FAO, NSDP, HKL, consultant's compilation and computation

NB: 2005-2006, Consultant and EIC model projections

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EMPLOYMENT, PUBLIC WORKS AND RURAL CAMBODIA

Powell, Michael*

Every effort has to be made to create jobs for as many of those 250,000 people as possible.....At least half of those will be men. The most explosive dangerous combination a country can have is unemployed men.

-----*Outgoing US Diplomat Warns of Social Upheaval, Cambodia Daily, 1.7.2005, Lee Berthiaume, p. 17*

INTRODUCTION

Poverty reduction through the expansion of employment opportunities is one of the goals of the Cambodian government. However, there are reasons to doubt whether the economy will be able to generate the necessary opportunities for an expanding labor market. The current macroeconomic approach appears likely to restrict rather than promote growth. The government's emphasis on economic integration with the world comes at the cost of a concern with the specifics of the domestic economy, and the government's belief that it only oversees development has prevented it from taking a leading role in determining policies. A review of sectors that have led to job creation in the recent past is less than encouraging. Both the garment industry and tourism sector are unlikely to provide sufficient employment opportunities in the near future and are increasingly vulnerable to changes in the global economy that could affect their expansion. In the countryside, where the bulk of the population is employed in agriculture and farm small plots of land, underemployment is endemic¹.

The task of generating employment opportunities in an economy which is still in the process of rebuilding itself after years of war and isolation is complex. This paper attempts to sketch one aspect of an employment and productivity enhancing strategy and apply it where it is needed most, rural Cambodia.

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¹ Annual Development Review 2004-5 December 2005 Cambodia Development Resource Institute Ed Brett Ballard K A S Murshid pg 47 cite a CDRI report Labour Surplus and Productivity in Cambodia Agriculture, The Case of Takeo Province Tong Kim Sun 2005 and suggest that while definite figures are not available 'there is an abundant labour surplus in rural areas'.

Improvements in infrastructure are key element in economic development and labor based programs have a proven record of generating productive employment when demand is inadequate². The Cambodian government plans to spend over US\$2,000 million between 2006 and 2010 on infrastructure and has indicated that it is prepared to “rely on human labor as much as possible for construction work to boost rural incomes”³. This initiative is welcome but there is a need, first, to increase the infrastructure investment that underpins ongoing gains in productivity and second, to use a labor based approach to provide employment that will boost local economies. But the above policy relies on an equally fundamental change in understanding the role of the state in economic development. The belief that the private sector and market forces will develop Cambodia’s agricultural sector at a time when its farmers are struggling to survive is an argument based on faith, rather than reason. The government needs to re-examine its current role in the process of development and assume greater responsibility for addressing the problems of job creation and poverty reduction that its policy briefs identify.

There are a range of issues to be considered if labor based public works are to be expanded throughout rural Cambodia and applied on an ongoing basis. These include how to administer the scheme, the wage level, and how much of the public budget should be devoted to the program. Consideration of all the issues would stretch this paper to several volumes. Instead, focus will be given to areas where labor based public works have, and could be applied, and how the scheme could be funded. Road building and irrigation works are two key areas of infrastructure that are necessary for the country’s development and could be expanded using a labor based approach. A third area, regeneration of the country’s forests is a little more speculative. Efficient management of this valuable resource is needed, but public works programs that aim to repair the losses of recent years are also a possibility. Funding such a proposal would create a considerable strain on the country’s limited public finances. There is an urgent need for tax measures to redistribute income to fund a policy that can, in turn, promote the equity that the policy documents call for. A recently proposed residential land tax would have allowed the government to generate the kind of revenues necessary for the project. Its rejection by the National Assembly has denied the treasury valuable funds; however, this setback does not undermine the legitimacy of the proposed policy, but rather confirms the need for a more realistic discussion about the role of public finances in Cambodia.

² A Review of the Employment Guarantee Scheme in India Inter-Regional Inequality Facility Raghav Gaiha, Katsushi Imai, draft 11 July 2005. This is one of the longest running labor based public works and started in the Indian state of Maharashtra in 1974.

³ National Strategic Development Plan December 2005 Royal Government of Cambodia pg 34. The actual figure is 2, 384 million. Of course not all will be spent on the infrastructure priorities that are the focus of this paper.

To confine comment to economic issues alone would be misleading. The lack of employment opportunities in rural Cambodia contrasts starkly with the increasing wealth of the country's thriving urban centers⁴. This increase in consumption enjoyed by one section of the population has not gone unnoticed by the many Cambodians who continue to live in poverty and have seen little benefit from the sustained growth of the last decade. The challenge of poverty reduction and employment creation for a small and open economy is complex and certainly requires a coordinated approach using a diverse range of policy instruments. Yet overriding this, is a need for policy to go beyond the dry calculus of the formulas that appear to drive economic policy and have so far failed to provide employment opportunities for a burgeoning number of Cambodians. In its place there is a need for recognition of the seriousness of the situation. A failure to reduce poverty in all its manifestations leads to a sense of despair and exacerbates social *anomie*. The funding of public works in rural Cambodia would confirm the government's commitment to improving agricultural productivity, thereby reducing poverty and the disparities that exist between urban centers and the countryside.

THE EMPLOYMENT CHALLENGE

The specific nature of the unemployment problem in Cambodia is best understood by reference to the separation between growth and employment generation and its possible consequences. The unemployment rate in Cambodia is currently estimated to be at 20 percent⁵ and economic growth, although averaging 7 percent for the last 10 years, is believed to generate only 20,000 to 30,000 jobs a year in the formal sector⁶. The statistics are clear enough but a lack of employment opportunities has far reaching economic consequences. A failure to generate employment will lead to declines in labor productivity, rates of saving and increasing poverty, "...a vicious circle..... from which it will become increasingly difficult to escape"⁷. Another more appealing outcome is built around a steady increase in employment opportunities, a reduction in poverty, and a greater propensity to save and invest; all forming the basis for a sustained broad based economic growth. The simple scenarios outlined above

⁴ Cambodia's Economy in the Election Year 2003, in Economic Review, Economics Institute of Cambodia September October 2003 pp 13-15. The report notes that from 1995 to 2002 per capita income in Phnom Penh rose from just over 600 dollars per annum to less than 1200. For the same period rural incomes declined from about 180 to 170 dollars per capita.

⁵ Unemployment rate. Phnom Penh Post Vol 15 2006 pg 7. The article cites Cambodian Development Resource Institute researcher Sok Sina. The government estimate is considerably lower at 4%. See National Strategic Development Plan December 2005 Royal Government of Cambodia pg 21 citing statistics from the Cambodia Social and Economic Survey 2003/2004.

⁶ Unemployment time bomb ticking Phnom Penh Post Vol 10 No 14 2006, Charles McDermid and Sam Rith pp 1 and 6

⁷ The Challenge of Productive Employment Creation Chan Sophal, Martin Godfrey et al. Cambodia Development Resource Institute Cambodia: 1999 Working Paper No 8 pg 60.

confirm that the pursuit of employment growth is vital, but a review of key sectors suggests they will not be able to make the contribution to employment creation that they have in the past.

Tourism is often portrayed as a sector that may provide Cambodians with employment opportunities. This claim is buttressed by reference to political stability, the possibilities of eco-tourism, the glories of Angkor Wat and more recently, historical sites that wrestle with the country's recent past⁸. The tourism industry employed approximately 100,000⁹ people in 2002 and this figure is expected to increase to 400,000 in the year 2010¹⁰. However, the discussion about this sector's employment generating potential is overly optimistic¹¹. The excitement about the number of tourists visiting Cambodia disregards the fact that this trend is unlikely to be sustained. The increase in arrivals may continue, but at a lesser rate than at present¹² and the industry remains vulnerable to a number of threats outside its control, including concerns about terrorism and SARS. In addition, because there are limited backward linkages the presence of tourists has only a minimal effect on stimulating domestic production¹³. Under such circumstances the enthusiasm for tourism's ability to substantially contribute to improved employment outcomes, either directly through job creation, or encouraging local producers, seems unwarranted.

Cambodia's garment industry has successfully weathered the ending of the MFA (Multifibre Arrangement); however, its ability to absorb an increasing number of people is debatable. Currently the garment sector employs approximately 300,000 people, mostly young women from the countryside. The industry has established a reputation for a commitment to labor standards and some smaller factories have closed, while others are expanding operations¹⁴. While this success is noteworthy the competitive context in which the factories operate has a range of concerns; among them quality, consistent delivery, lead times, and price. Attention to all of them will be required if the industry is to have a secure future¹⁵. In 2008 the restrictions on Chinese garment exports will be lifted¹⁶ and

⁸ The glories of Ankor Wat are well known, while the possibility of Eco Tourism is just emerging. For a brief discussion about historical sites see, Anelong Veng The future KR Disneyland Phnom Penh Post 2003 Vol 12 No 12 Patrick Falby pp 15,16.

⁹ National Poverty Reduction Strategy 2002-2005 Royal Government of Cambodia 2002 pg 75

¹⁰ National Strategic Development Plan December 2005, Royal Government of Cambodia pg 57

¹¹ Cambodia Economic Watch, Economics Institute of Cambodia April 2006 pg 108

¹² Cambodia Economic Watch, Economics Institute of Cambodia April 2006 pg 19

¹³ Cambodia Economic Watch, Economics Institute of Cambodia October 2004 pg 34 cites an NGO study that suggested only 30 per cent of foreign tourist spending in Seim Reap benefited Cambodia.

¹⁴ Cambodia garment industry; one year later, International Labour Organisation, Phnom Penh, Cambodia May 2006 Ivo Spauwen and Marten den Uyl

¹⁵ Cambodia's Garment Industry Meeting the challenges of a post quota environment TA Report For the Asia Development Bank October 2004 pg iv. A further comment on labor standards comes from John Lu, General Manger of the Garment Manufactures Association said "There is no way we can compete with China in terms of price. If buyers are not interested in

generous tax concessions will end, putting further pressure on producers in Cambodia¹⁷. Efforts are being made to improve the industry's competitiveness; however, its current role as a source of steady employment growth in the coming years is unlikely.

The bulk of the Cambodian population earns their living through primary industry: fishing, agriculture and forestry. Any discussion of unemployment and employment must also include a review of this sector and its capacity to provide opportunities for an increasing number of people. The Cambodian environment has been described as 'disaster prone' and is characterized by food insecurity¹⁸. Farmers and their ability to secure a livelihood are undermined by weather dependence and alternating droughts and flooding¹⁹. Their concerns include expanding irrigation to increase production²⁰ and roads to access local markets, while improvements in health and education services are also priorities. The pressing nature of the productivity challenge in the field of agriculture is illustrated by a concern that a failure to seek sustained increased productivity in this area could see the country become "permanently dependent on food imports, for which it would have little or no means to pay"²¹. Yet, the record in this area is disappointing. Agricultural growth was 3 percent per annum from 1991 to 1996 but has since declined and now averages around 2.5 percent²². In such a situation, and with few employment opportunities elsewhere, the agricultural sector takes on an increasing number of people each year who eke out a marginal existence.

taking our reputation for good labor standards into consideration then we cannot compete" from Cambodia jean exports to USA drop after quota lifted Cambodia Daily 23.3.2005, Erik Wasson, pg 14

¹⁶ Pact Aids Cambodian garment industry, Phnom Penh Post Vol 19 No 23 2005 Ayelish McGarvey pp 1 and 7

¹⁷ Hun Sen urges garment workers not to strike Cambodia Daily June 22 Erik Wasson and Yun Samean, pg 12

¹⁸ Assessment on the Localization Millennium Development Goal on Reducing Poverty and Hunger Phnom Penh Cambodia 2003 Food and Agricultural Organization pg 8

¹⁹ Koh Kong Government Says Flooding Worst Ever Cambodia Daily 19/20.8 2006 Kay Kimsong pg 3. Drought May Lead to Massive Food Shortage, Cambodia Daily 16.6.2005, Van Rouen and Lee Berthiaume pp 1 and 2. Gov't efforts falter, Hunger Looms Cambodia Daily 16.11. 2004 Lor Chandra pp 1 and 13.

²⁰ New Irrigation Policies Urgent Farmers Say Cambodia Daily 4.5. 2005 Thet Sambath pg 17 See also Asian Development Bank Participatory Poverty Assessment: Cambodia 2001 pg 31 for further comments by farmers about the importance of infrastructure. Conclusions about Cambodia's roads network are drawn from Connecting: East Asia: A new Framework for Infrastructure, Asia Development Bank, Japan Bank for International Cooperation, World Bank ,March 16th 2005 pg 39

²¹ The Challenge of Productive Employment Creation Working Paper No 8, Chan Sophal. Martin Godfrey et al. Cambodia Development Resource Institute Cambodia 1999 pg 43.

²² The figure from 1991 to 1996 is from Assessment on the Localization Millennium Development Goal on reducing poverty and Hunger Phnom Penh Cambodia 2003 Food and Agricultural Organization December 2003 pg 9. The conclusion that agricultural growth has been steady at about 2.5 per cent comes from the same FOA report and Cambodia Economic Watch

The government's recent National Strategic Development Plan 2006-2010 (NSDP) is a detailed document that outlines the government's development plans for the next five years and how it aims to meet the challenges identified above. It recognizes how the recent high levels of economic growth have failed to make a large impact on poverty in rural Cambodia and voices concerns about poverty reduction and equity. It aims for "robust and equitable macroeconomic growth; [a] strong check on inflation; significant increases in agricultural production and productivity protection and enhancement [of] the environment; strengthening and improvement of infrastructure; robust industrial growth; creation of employment and incomes; reforms in public administration and judiciary; fast growth in private sector investments; unhindered growth in [t]rade; and, growth in the service sector including tourism²³. The role of the government in pursuing all of the above is one of "strategist, guide and manager" of the development process in Cambodia²⁴.

Yet, there are reasons to doubt that the above framework will have the desired result of providing an increase in employment opportunities. The faith in macroeconomic stability as a key to economic development is a legacy of the Washington Consensus, which emphasized getting the fundamentals right to allow the free play of market forces. Increased economic liberalization, it was argued, would unleash the entrepreneurial spirit domestically and attract FDI (Foreign Domestic Investment) to create jobs. But there are mounting concerns that such an uncritical application of market policies may not produce the desired outcomes and that this approach to development should be discarded. In the case of Cambodia the UNDP has declared that the current approach may stunt economic growth and that there is room for an increase in government spending without dangerously fueling inflation²⁵. More troubling is that the document views economic integration as being a development strategy of itself²⁶. This overlooks the cost of effectively administering the rules of the WTO²⁷, and the increasingly small benefits that might accrue to developing countries from free trade²⁸.

April 2006 p 11. In contrast the World Bank: Halving Poverty by 2015 believes that agriculture grew by 3.4 per cent per annually from 1994 to 2004. Given the amount of poverty that exists in rural Cambodia this figure is questionable.

²³ National Strategic Development Plan Royal Government of Cambodia December 2005 pg ix

²⁴ National Strategic Development Plan Royal Government of Cambodia December 2005 pg 54

²⁵ For further details about the UNDP's suggestions for poverty reduction see The Macro Economics: Thematic Summary Report on Fiscal Policy, United Nations Development Project John Weekes, Rathin Roy, May 2004. For a response from the IMF in Cambodia see Higher Inflation, Larger Deficits Will Not Reduce Poverty by Robert Hagemann Cambodia Daily 23.4. 2003 pg15

²⁶ Can integration into the world economy substitute for a development strategy Dani Rodrik, May 2000: Retrieved , <http://ksghome.harvard.edu/~drodrik/ABCDE-Paris.pdf> August 2006

²⁷ Rodrik, op cite notes a study by Michael Finger suggesting that the average cost for a developing country of meeting the requirements of the WTO were 150 million dollars.

The focus on FDI as a source of employment growth is misplaced. The main ‘pull factor’ for FDI is a large domestic market which is absent in Cambodia. However, even when secured, the presence of FDI is not always beneficial, and its ability to contribute to economic growth can be both positive and negative, with success ‘depend [ing] on domestic policies, capabilities and institutions’²⁹. Cambodia cannot isolate itself from the world trading system, but the current high level of exposure to the whims of the global economy and the policies that underpin this neglect the development of domestic capacity. Ultimately, the reliance on market forces leaves the country and its people increasingly vulnerable to economic processes beyond their control.

The final concern revolves around the government’s belief that it should have a limited role in economic affairs when a more historically grounded appreciation of economic development would suggest otherwise. Debate on the role of the state and the market are central to the formation of public policy, yet contrary to the more accepted history of the developed nations or the success of the Asian Tigers, tariffs, subsidies, state ownership of key industries and a range of interventions have been used to successfully promote economic development³⁰. The concern is not that the government should replicate the policies of other countries, rather that in the NSDP the role of the state is constrained by an ideological preference for market solutions rather than a more historical and country-specific approach that acknowledges the complementary nature of state and market in securing development outcomes. Cambodia’s economic development is dependent upon a range of factors, not all of which can be covered in this paper. The many manifestations and causes of poverty ensure that designing policy to reduce it and increasing employment opportunities is difficult. However, the pressing nature of the employment challenge requires that the government temper their faith in market theories and growth charts, recognize the legitimate role they can have in shaping economic development, and start to design and direct economic policies tailored to the circumstances of Cambodia³¹.

²⁸ The Shrinking Gains from Trade: A Critical Assessment of Doha Round Projections Working Paper No. 05-01 Frank Ackerman, October 2005 Medford, MA: Global Development and Environment Institute, Tufts University. The report notes that there has been a considerable decline in the benefits of a move to free trade and that some of the modeling exercises used to justify such a change are doubtful.

²⁹ Rethinking Foreign Investment for Development Kevin P.Gallagher and Lyuba Zarsky, Post-Autistic Economics Review, issue no. 37, 28 April 2006, article 2, pg 10 <http://www.paecon.net/PAERreview/issue37/GallagherZarsky37.htm>

³⁰ The market the state and institutions in economic development, Ha Joon Chang pp 41-60 in, Rethinking Development Economics, ed Ha Joon Chang, Anthem Press 2004. Chang details the accepted version of capitalist development as opposed to the real version of how capitalist economies developed. For a detailed critique of the alleged rigor of mainstream economics see Steven Keen. Debunking Economics: The Naked Emperor of the Social Sciences Pluto Press, Australia 2001

³¹ The concern that development economic fails to consider the specifics of developing countries has been well made by Ravi Kanbur. In Economics, Social Science and Development he wrote “Development economics nowadays is mainstream economics applied to poor countries.” For further details see World Development Volume 30, Issue 3 , March 2002, pp 477-486

INCREASING PUBLIC WORKS IN CAMBODIA

A single policy cannot hope to address the pervasive nature of poverty or stimulate productivity in the agricultural sector, yet the large scale expansion of labor based public works represents a significant policy option for Cambodia. Such a policy initiative raises a number of points. These include the administration of the scheme, which areas should be targeted, the nature of the assets created and the amount of money to be invested. Two of the most salient points are funding and the country's past experience with public works programs. Recent efforts by the International Labour Organisation (ILO) in the area of irrigation works and a review of the various labor based approaches to road building confirm that such work has a record of success in Cambodia. In addition, the success of other countries in using a labor based approach to promote environmental regeneration is also applicable given the devastation that it has recently experienced and its current fragility. The more contentious issue surrounds public funding and the continued reluctance of the Cambodian state to institute taxes to fund public expenditure. Governments have traditionally been unwilling to increase taxes for fear of being punished at the polls, however the current surge in urban development hints at a considerable source of untapped revenue.

Recently, a detailed review of road works in Cambodia came to several conclusions about the construction and maintenance of roads in provincial Cambodia. The report examined a variety of different public works programs that used a labor based approach to construction and contrasted these with other programs that used heavy equipment. Difficulties in making a comparison between the two approaches were acknowledged, but the report stated that the labor based approach was 17 percent more cost effective³². In addition, there was little employment potential in the equipment based approach. The author concluded that changing to a labor based approach "will have no negative implications for the efficiency, cost effectiveness, quality of the business of managing the rural road sector"³³. But the merits of the labor based approach to road works cannot be confined to comparing the costs of producing the infrastructure alone. Discussion has to include the effects of wages on those employed. A survey of road construction and maintenance workers considered that the wages of 4,000 Riel a day for unskilled labor "helped poor people survive in the dry season, when few job opportunities were available"³⁴ and across all classes of workers food was the first spending priority³⁵.

³² Jobs or machine Comparative analysis of Rural Road work in Cambodia International Labour Organisation Paul Munters 2003 pg 45

³³ Jobs or machine op cit pp 7

³⁴ Employment in ILO supported road Construction and Maintenance: The impact of wage earning on workers. Centre for Advanced Study, Alebachew Kassie and Judith Zweers Phnom Penh, August 2000 pg 30

Final confirmation of the employment generation potential of using a labor based approach instead of one that relied on capital is highlighted when the additional work days generated by the use of wage labor and the stimulus that this provides to the local economy are included in the outcomes³⁶.

The use of a labor based approach to infrastructure also has a successful record when applied to the construction and maintenance of irrigation systems. In the northwest of Cambodia ILO has used Labour Based Appropriate Technology (LABAT) throughout the Upstream Project.³⁷ This approach to construction is driven by three principles: optimum use of labor, quality of work and job creation³⁸. The Bovel irrigation system in Battambang and the Barai system in Siem Reap were rehabilitated from 1992 to 1998. Just over 180 kilometers of canals in both systems were constructed, renovated and are now maintained using the LBAT approach. There were increases in the area of land devoted to rice production and in the yields per hectare. In addition, farmers in Bovel reported an increase in vegetable and fruit production, while farmers in Baria also reported an increase in the number of farm animals. Not all of the changes in agricultural production can be attributed to irrigation, as the areas also received support from NGO's that provided agricultural extension services. However, this doesn't undermine the positive outcomes of Bovel and Baria or the value of using LBAT, but suggests that work on irrigation systems needs to be part of a broader development plan.

A final area that could provide employment opportunities lies in the field of environmental regeneration. Cambodia's forest cover has declined dramatically since 1993³⁹. The reduction in forest has "[r]esult[ed] in reduced biodiversity, increased soil erosion, accelerating river silt and.....has contributed in recent years to extensive flooding"⁴⁰. There are clearly management issues surrounding the use of the country's forests; however there are precedents regarding the use of labor based programs in the area of environmental regeneration. The government of Malawi recently started a four-year safety net program of public works to alleviate poverty and a key component of the program involved

³⁵ Employment in ILO supported road Construction and Maintenance: The impact of wage earning on workers. Centre for Advanced Study, Alebachew Kassie and Judith Zweers Phnom Penh, August 2000 pg iv

³⁶ Outcomes of the ILO support to the Bovel and Barai Irrigation schemes. Centre for Advanced Study, Warren Hoye August 2001 pg 9. The International Labour Organisation claim that for each day of work created as a result of the scheme a further 1.6 work days are created indirectly.

³⁷ This project was originally called the Labour-based Rural Infrastructure Works Programme

³⁸ Employment in ILO supported road Construction and Maintenance: The impact of wage earning on workers. Centre for Advanced Study, Alebachew Kassie and Judith Zweers Phnom Penh, August 2000 pp 4

³⁹ Cambodia Third in Deforestation, Says UN Body Cambodia Daily 11.22.05 Erik Wasson and Van Rouen, pg15

⁴⁰ Second Five year Socioeconomic Development plan 2001-2005 Royal Government of Cambodia 2002, Phnom Penh, Cambodia pg 27

forestry activities⁴¹. The program involved tree planting, the establishment of nurseries, and training. The report concluded that there were immediate benefits with the cash payments reducing poverty while the long term benefits came in the form of revenue generated from the sale of timber. In India, a National Tree Growers Cooperative Federation sets up cooperatives at the village level to manage degraded land provided by the government⁴². The local tree growing cooperative society is provided with funds to cover the planting, fencing and protection of the trees with the labor for all these activities providing employment for the poor. While there is a need to adjust such schemes to Cambodia, efforts to rehabilitate the environment would have a positive effect on rural livelihoods in the immediate term with wages providing needed cash and may also help to ensure the long term sustainability of the country's forests⁴³.

FUNDING

While there are sufficient examples where a labor based approach to employment could be applied, the issue of funding represents a serious challenge to the practicality of the scheme. Until now labor based schemes have been funded by a range of NGO's or International Financial Institutions. Yet, if the government is to rebuild infrastructure throughout the country on an ongoing basis, it has to have access to reliable financial sources. As noted above, an expansionary policy could be financed in part by public deficit; however, it is vital that the government mobilize domestic resources. Cambodia's record in this regard is disappointing. Recently, a residential tax was proposed, but quickly rejected. The tax, 0.05 percent on the assessed value of residential land, was to be paid on a yearly basis. With property prices increasing dramatically this could have provided much needed revenue⁴⁴. The scheme was to have been implemented in Phnom Penh and then in other urban centers, with the funds gathered to be used for development projects in the countryside⁴⁵. However, while the idea was accepted by the

⁴¹ Assist, International Labour Organisation, bulletin no 19 June 2005 pp 5-8

⁴² Poverty and the environment; turning the poor into agents of environmental regeneration. United Nations Development Project. Kirit S. Parikh. October 1998 pp 26-27

⁴³ In the case of Cambodia funds could be directed through local community forest groups. In 2002 there were approximately 57 community forest groups covering 83,000 hectares. For details about the products that come from the forests and their importance to local communities see, Product Use and Product Flow in Chumkiri District Kampot Province in Cambodia, in Economy and the Environment: Case Studies in Cambodia, ed Bruce McKenney, Economy and Environment Program, South East Asia Singapore 2002, pp 1-7.

⁴⁴ Property Prices. Development Skyrocket in City, Cambodia Daily 25.1.2005, William Shaw pg 13. In 2003/4 property prices rose 15 to 20 per cent every six months.

⁴⁵ PM New Taxes To Fund Countryside Projects, Cambodia Daily 6.12.2005, Yun Samean pg 17

Council of Ministers,⁴⁶ it was rejected by key lawmakers in the National Assembly due to a concern that it could ‘disadvantage civil servants’⁴⁷ and, finally, by Prime Minister Hun Sen, who said that it would be considered at an ‘appropriate time’⁴⁸.

While the short life of the tax reveals the difficulties of increasing public revenue the current discussion about taxation in Cambodia appears unrealistic. Public revenue is steady at over 8 percent of GDP; but while the government declares that they wish to broaden the tax base, revenue collected is expected to reach slightly over 9 percent by 2010⁴⁹. In the face of rising inequality, Finance Minister Keat Chonn has said that opportunities for the poor should be increased, but that taxation schemes that might reduce growth are not on the agenda⁵⁰. The World Bank noted the need to broaden the tax base further, yet specifically excluded the possibility of redistributing income because it is politically difficult⁵¹. All forms of taxation raise issues regarding possible incentive effects and, as shown above, are politically sensitive. But evidence suggests that for most countries redistribution in the form of current income, assets or growth increments will be necessary to achieve development goals and reduce poverty⁵².

Yet, debate about such choices is stifled by deference to market driven policies that emphasize growth, despite its disappointing results and the limited potential of such an approach towards job creation.

Throughout, the discussion about the expansion of public works has been confined to economic analysis and been dominated by concerns of cost effectiveness, productivity, and funding. These are legitimate concerns surrounding what would be a fundamental commitment by the government, but the arguments for the policy change cannot be confined to the narrow visions of economists who ignore that their policies exist within a broader context. Already there is an urban rural divide, with many people from the countryside preferring a marginal existence on the streets of Phnom Penh to life in the provinces without work⁵³. Yet those who continue to stay in the countryside are aware of how their richer counterparts live in the cities. At a recent focus group discussion, rural people commented that while it is wrong for urban centers to "consume most of the resources, they believe

⁴⁶ Council of ministers approves property tax, Cambodia Daily 3/4.12.2005, Kay Kimsong, pg 3

⁴⁷ Key Lawmakers Reluctant To Adopt Land Tax, Cambodia Daily 15.12.2005, Prak Chun Thul, pg 19

⁴⁸ Gov't Drops Plan To Tax Land in Capital Cambodia Daily 22. 12. 2005 Erik Wasson and Yun Samean, pp 1 and 2.

⁴⁹ National Strategic Development Plan Royal Government of Cambodia December 2005 pg 18

⁵⁰ Inequality Rising Impairing Growth; Panel Cambodia Daily 14.6.05 Erik Wasson, pg 16

⁵¹ World Bank report Halving Poverty by 2015, World Bank February 2006 pg 51

⁵² Poverty Reduction with Growth and Redistribution, Development and Change 33 (3) 2002 Hulya Dagdeviren Rolph van der Hoven and John Weekes pp 383-413

⁵³ For Some Living on Streets Preferable to Living in Provinces, Cambodia Daily 30.9.2005, Michael Cowden, Pin Sisovann, pg 21

there is little or nothing that they can do about it"⁵⁴. Failure to create jobs in rural Cambodia and the resultant migration will lead to an expansion of the informal economy, an increase in slum areas⁵⁵ and further stories about the desperation of those who have little choice⁵⁶.

CONCLUSION

Cambodia's level of unemployment is disturbingly high and there is little reason to believe that it will decline in the near future. The key areas of employment growth in the recent past benefit from considerable tax concessions, have a limited relationship with the domestic economy and their expansion is not assured; their success, according to the World Bank, is more a result of 'fortuitous circumstances' than design⁵⁷. In the countryside where the bulk of the population continues to struggle and earn a subsistence livelihood the situation is critical. Productivity is low, there is an ongoing need for improvements in infrastructure and demographic pressure adds to the number of those seeking work every year. In such a situation securing enough to survive takes precedence over thoughts of generating a surplus.

This paper has acknowledged the government's commitment to infrastructure development and its stated aim that it should use labor where possible but also sought to develop these themes with a focus on roads, irrigation and environmental regeneration. The country's recent experience with labor based programs confirms that the benefits cannot be confined only to the infrastructure, but also include the method of construction and the associated multiplier effects.

In contrast to the above, the current approach to development in Cambodia is characterized by a 'world as market place' economics that is unsuitable for the country and its people. It turns a blind eye to history and pursues exposure to the world economy at the expense of domestic development, regardless of the risks. Such a situation demands a fundamental rethinking of both policy and priority. Recent discussion about the possibility of raising tax and targeting those who have benefited the most from the country's economic growth and redistributing income were welcome. These were departures from the economic script that extols the virtues of liberalization and trade because the measures sought to put policy more in the context of the country and its most disadvantaged people. Unfortunately, the debate was brief and resulted in the abandonment of a proposal that could have been a start to

⁵⁴ Participatory Poverty Assessment: Cambodia, Asian Development Bank , 2001 pg 3

⁵⁵ Rural Poor Flock to Cities, Phnom Penh Post Vol 15 No 2 2006 Melinda Marshall pp 1 and 6

⁵⁶ Blood Drive Cambodia Daily 7/8. 12. 2002, Kate Woodsome pp 4,5 This story details how some youth are selling their blood to stay alive in Phnom Penh. Other stories, Teens Living on Streets turn to Theft For Survival , Cambodia Daily 30.8.2005, Pin Sisovann, Erin Donar pp 1and 2, reveal how some youth turn to petty crime to live.

⁵⁷ Cambodia Halving Poverty by 2015, World Bank February 2006 pg 57

addressing the widening inequalities that are so disturbing to a country still emerging from years of civil unrest⁵⁸. Ultimately, the ‘appropriate time’ for the tax and the attendant possibility of expanding infrastructure development has passed, at least for the immediate future. Yet as the pressure for solutions continues in the context of inequality and a massive rural exodus, it may re-merge as a possibility for political leaders prepared to follow through with policies that are driven by, rather than overlook, the realities of the Cambodia countryside.

⁵⁸ Hun Sen Says KR fueled by Class Warfare Cambodia Daily 20.7.2005, Michael Cowden, Pin Sisovann, pg 13. It is important to note that the inequality is acknowledged by the Prime Minister.

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**A STUDY OF FACTORS AFFECTING
FARMING HOUSEHOLD INCOMES:
A CASE STUDY OF SAMRONG COMMUNE,
KOMPONG CHAM PROVINCE, CAMBODIA**

Chea, Marong*

INTRODUCTION

Cambodia is one of the lowest-income countries in the world. Its gross domestic product (GDP) per capita is estimated at US\$357. In terms of social capacity for human development, Cambodia is in the lowest tier of the medium human development category and ranked 130th out of 173 nations, with its human development index estimated at 0.543 (UNDP, 2002). Rural households in Cambodia rely mostly on agriculture as the main source of income for their livelihoods, which is dominated by rice production. About 2.16 million hectares or about 90 percent of the total cropped area of 2.42 million ha is planted for rice. The country's average rice yield was estimated 1.97 tones per hectare (ha) in 2004, the lowest in Southeast Asia (MAFF, 2004). In addition to rice income, small-scale livestock raising, vegetable production and non-farming activities serve as supplementary sources of income for farming households.

In 2004, 91 percent of the country's poor lived in rural areas and mostly depend on agriculture for their livelihoods. Agriculture remains the primary occupation for 72 percent of heads of households and contributes 31 percent of Gross Domestic Product (World Bank, 2006). Recognizing the importance of agriculture, this sector has an important role to play in reducing poverty, increasing household income and improving the capacity for human development. Given the fact that rural household incomes are mainly generated from farming activities, increasing household income by focusing on rice cultivation and other income generation activities remains an important issue for all stakeholders. One of many ways to improve household incomes is to be aware of the characteristics of the rural households and constraints in order to seek the best possible solutions. To this end, this study aims at analyzing the factors affecting household income in Samrong commune, Kompong Cham province, Cambodia.

This study classifies the farming household into two categories, namely low-income household and high-income household. This classification intends to compare two groups of household with the aim to point out the similarities and differences. By doing so, it is expected to generate useful information in relation to each household group that can be used by relevant stakeholders working with farming households in order to promote income generation activities and improve rural livelihoods in the study area.

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RESEARCH OBJECTIVES

The specific objectives of this study are:

- To compare farm size, productivity, production cost, and profitability between low-income and high-income household; and
- To analyze the main factors (farm size, labor and capital) affecting rice output and the relationship between farm size and household income.

METHODOLOGY

Data Collection

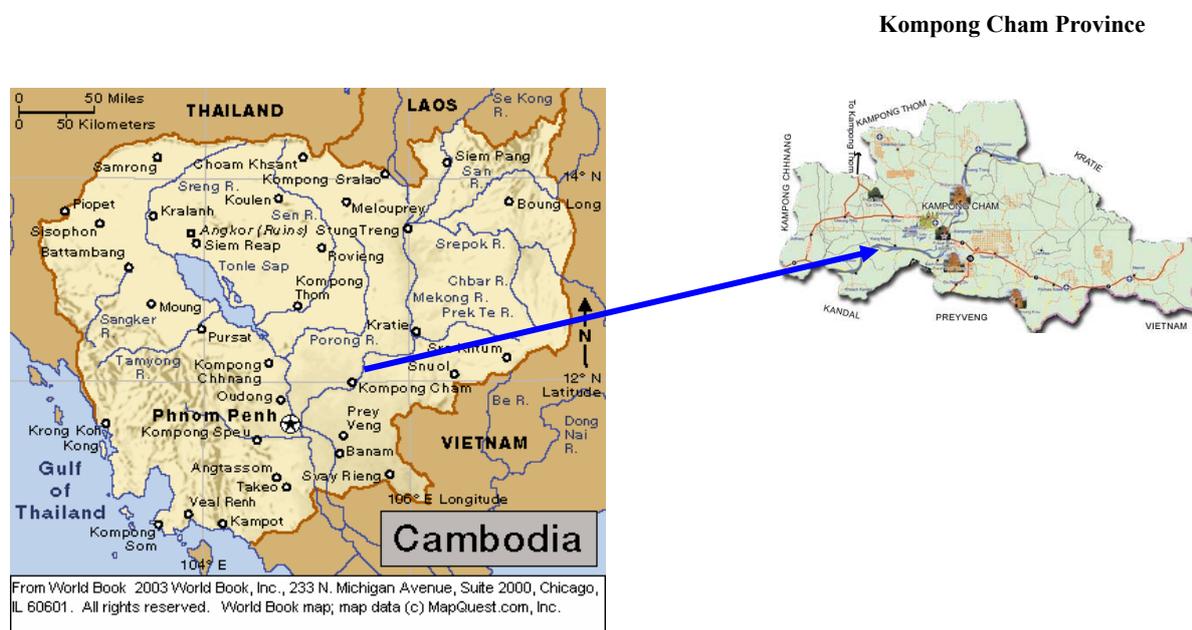
In order to achieve the objectives of this study, the survey questionnaires were produced based on the study. Primary data was gathered through face-to-face interviews carried out by the researcher with rural households in the target location. The secondary data was also incorporated into this study to supplement the questionnaires. It involved the collection of both published and unpublished materials related to the study. This information was obtained from government publications, past research, physical and non-verbal materials, national census and personal records of farmers or other relevant people.

Data Analysis

A statistical analysis system, Statpad, and Microsoft Excel were used to analyze the quantitative data. The raw data gathered from the survey was classified and presented in tables, charts and graphs by using comparative analysis and statistical analysis. These analyses include (i) comparative analysis to find the similarities and differences between low-income households and high-income households; (ii) cost function analysis to determine how much rice output should be produced and how large should the farm be to get maximum profit; (iii) Income statement analysis to give an indication of the relative profitability of a farming condition and the degree of flexibility the farm has in meeting expenses and t-test to test hypothesis; (iv) Production function analysis (Cobb-Douglas Production Function) to determine the main factor affecting rice output; (v) Simple regression analysis to show the relationship between total cultivated farm size per year and annual household income and to predict household income from cultivated farm size. To assist the readers to interpret the information in the tables and charts, descriptive analysis was also been taken into account.

Definition of Key Term in the Study

- *Low-Income Household* is defined as households whose annual household income is below the average household income (3.58 million Riel) of the sample size.
- *High-Income Household* is defined as households whose annual household income is above average household income (3.58 million Riel) of the sample size.

*Map of Study Area***Figure 1: Map of the Study Area**

Source: United Nations, 1995-1999, *Population Map for Windows Produced by UNDESA-UNFPA-VN/IOIT*.

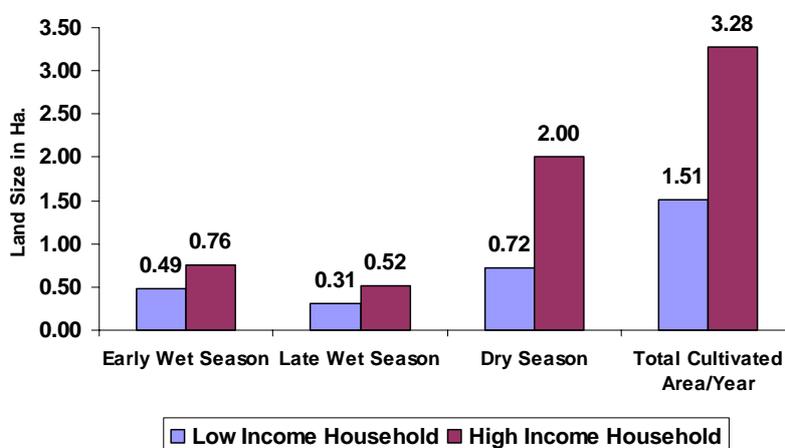
RESULTS AND DISCUSSION*Comparative Analysis**Comparison of Rice Cultivated Area*

Agricultural land is generally accepted that it is one of the most important assets for farming households. In rural area in Cambodia, it sometimes represents the wealth or status of the household. Households possessing large farmland can be viewed as better off farming households. On the other hand, households owning a small sized farm might be regarded as poor households.

The data in Figure 2 shows data on the comparison of rice cultivated area between low income household and high income household in early wet season, late wet season, dry season and total cultivated area during a one year period. In early wet season and late wet season, it can be seen that the rice cultivated area of high-income households was notably bigger than low-income households. The gap in terms of land size between low-income households and high-income households in wet season was not relatively small.

On the other hand, there was a big gap in terms of rice growing area between low-income households and high-income households during the dry season. Low-income households cultivated rice on 0.72 ha. while high-income households grew rice on 2 ha. of agricultural land. This means that high-income households could cultivate on large sized farms compared with low-income households.

Figure 2: Comparison of Rice Cultivated Area in Early Wet Season, Late Wet Season, Dry Season, and Total Cultivated Area per Year



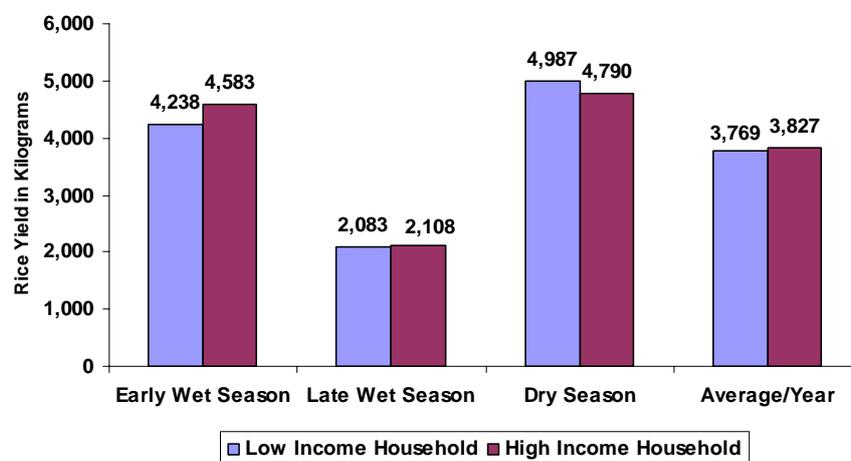
Source: *Field Survey, 2005*

In comparing the total cultivated area for the whole year, low-income households could grow rice on 1.51 ha, while high-income households could cultivate rice on 3.28 ha. per year. This number clearly shows that the total cultivated area of low-income households was less than half of the cultivated area of high-income households. Overall, high-income households cultivated rice on larger sized farms compared with low-income households during the three cropping periods, namely early wet season crop, late wet season crop and dry season crop. Therefore, it is safe to say that high-income households own large sized farms while low-income households possess small sized farms.

Comparison of Rice Productivity per Hectare

Figure 3 contains data comparing rice productivity per hectare between low-income households and high-income households in the early wet season, late wet season, dry season and average rice yield per year. In the early wet season rice cultivation, low-income households achieved 4.23 t/ha while high-income households got 4.58 t/ha. This implies that high-income households achieved slightly higher rice productivity per hectare compared to low-income households.

Figure 3: Comparison of Rice Productivity per Hectare in Early Wet Season, Late Wet Season, Dry Season and Average per Year



Source: *Field Survey, 2005*

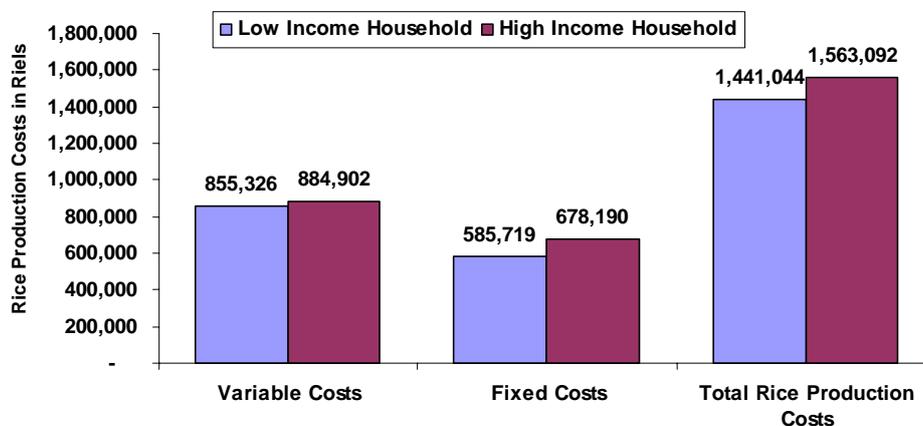
With respect to rice productivity per hectare in late wet season, the same figure also reveals that both households, low-income households and high-income households, achieved almost the same level of rice yield per hectare. Low-income households got 2.08 t/ha, and 2.1 t/ha was attained by high-income households. Accordingly, it is comparable in terms of rice productivity during this season.

By comparing rice productivity per hectare between low-income households and high-income household in dry season, unlike early wet season rice cultivation, low-income households achieved rice productivity (4.98 t/ha) higher than high income household (4.79 t/ha). This number is slightly different and it is comparable between the two groups of households. Over the whole year, comparison of rice productivity basis, low-income households attained 3.76 t/ha while 3.82 t/ha were achieved by high-income households. Rice productivity achieved by both households is very high or nearly double compared with the average national rice yield in Cambodia, which is only 1.9 t/ha. From the above comparative analysis, it can conclude that both households achieved the same level of rice productivity per hectare.

Comparison of Rice Production Costs per Hectare

Figure 4 below provides data on the comparison of average rice production costs per hectare in Riel (Cambodian currency) between low-income households and high-income households. The term cost of rice production here is classified into variable costs and fixed costs. Variable costs consist of hired costs and input costs. Hired costs are the cost paid out directly by households for hired labor or hired machinery, such as seed bed preparation, seedling, land preparation, transplanting, watering, and transportation. Similarly, input costs are the costs paid for agricultural inputs, such as seed, organic fertilizer (cow manure), chemical fertilizer, and pesticide. In contrast, fixed costs are the costs paid for land charge, depreciation of farming tools, and maintenance of farming equipments.

Figure 4: Comparison of Rice Production Costs per Hectare between Low-Income Households and High-Income Households



Source: *Field Survey, 2005*

By comparing the variable costs between low-income households and high-income households, it appears that high-income households spent (884,902 Riel per hectare) a little bit higher than low-income households (855,326 Riel per hectare). This expenditure is almost at the same level of expenses. On the other hand, concerning fixed costs, high-income households spent more than low-income households. However, the expenditure gap was not much different. The reason why high-income households paid more in fixed costs than low-income households was that high-income households generally own more durable assets, such as a hand tractor, water pump, other farming assets compared to low-income households. These durable assets are charged into depreciation cost. Accordingly, it leads to the situation where total fixed costs of high-income households are higher than total fixed costs of low-income households.

Considering the total rice production costs, low-income households paid 1,441,044 Riel in the production of rice per hectare, while high-income households spent 1,563,092 Riel in the production of rice per hectare. It is clear that high-income households invested more than low-income households in order to produce one hectare of rice. However, there is no significant difference in terms of expenditure.

Cost Concepts/Function for Rice Production

With increasing prices for purchase inputs, farming households often express concern for minimizing costs while trying to achieve maximum profit for farm business and determine how large should the farm be and how much output should be produced. The two basic questions of “how much output should be produced” and “how large should the farm be to get maximum profit” are always important to farming households. For this reason, it is crucial from a managerial viewpoint that the relationship between the production function, input prices, and the associated cost of production need to be clearly understood. These connections can be found in detail in Table 1. This table provides data on farm size, rice output, total variable cost, total fixed cost, total cost, average variable cost, average fixed cost, marginal cost and marginal revenue.

Since Marginal Cost describe how much each additional unit of output costs, a corresponding figure is needed which describes how much each additional unit output is worth in the market place? The value output is measured by its price on a per unit base. Marginal Revenue (MR) is calculated by the change in Total Revenue divided by the change in output. As shown in Figure 5, rice output price is of 515 Riel/Kg. The graph of Marginal Revenue for a typical farming household in perfectly competitive markets is a horizontal line. This indicates that the market price is not affected by the production of an individual household.

Table 1: Data Describing The Costs Associated With Various Levels Of Rice Production On 3.5 Hectares

Farm Size/ha	Rice Output/Kg	MPP	TVC	TFC	TC	Δ TC	AVC	AFC	ATC	MC	MR
0.5	2,269	-	557,648	947,931	1,505,579	-	246	418	664	-	-
1	4,807	2,538	1,118,862	947,931	2,066,793	561,213	233	197	430	221	515
1.5	6,895	2,088	1,745,135	947,931	2,693,066	626,273	253	137	391	300	515
2	10,296	3,401	2,292,821	947,931	3,240,752	547,686	223	92	315	161	515
2.5	12,701	2,404	2,591,586	947,931	3,539,517	298,764	204	75	279	124	515
3	15,150	2,449	3,397,233	947,931	4,345,164	805,648	224	63	287	329	515
3.5	17,482	2,332	4,610,675	947,931	5,558,606	1,213,442	264	54	318	520	515

Source: *Field Survey 2005*

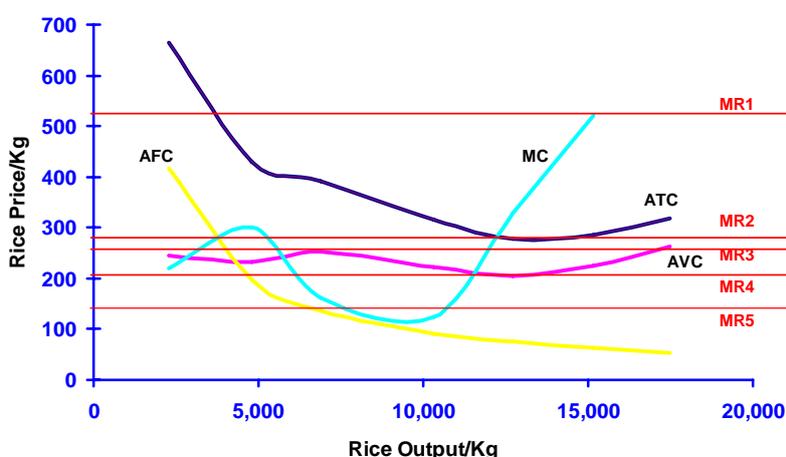
In this context, the decision is to continue increasing production as long as the Marginal Revenue is greater than the Marginal Costs (MC). The optimum point of rice output exists where the additional costs (MC) are just equal to the additional revenue (MR) gained from the last unit produced. This point can be found in Figure 5 graphically where the Marginal Revenue curve intersects Marginal Cost. Thus, the decision rule from the output side is that the profit maximizing level of output will occur where Marginal Cost equals Marginal Revenue.

Taking Figure 5 into account, rice Marginal Cost crosses Marginal Revenue at approximately 17,482 kg (around 3.5 hectares). If the expected price of rice is 515 Riel/Kg, 17,482 kg would be the profit maximizing level of rice production. When the optimal amount of output is calculated, there is no guarantee that this level will produce profits, only which is the best possible level of output given the prices and costs associated with a particular production function. This can be said that by producing at the optimal level of output one may be minimizing losses as opposed to maximizing profits. Further analysis, which is made possible by studying this problem from the output side, could indicate whether this optimal level of output does in fact result in profits or whether it is the best possible loss situation. A third possibility is to shut down if losses are excessive.

In order to gain further understanding into this problem and aid in analyzing profitability, it is necessary to calculate additional cost figures. These figures are the Average Total Cost (ATC), Average Fixed Cost (AFC), and Average Variable Cost (AVC). The detailed results of calculation are shown in Table 1. Figure 5 indicates typical Average Cost curves with a Marginal Cost and some Marginal Revenue curves superimposed upon them. By using these relationships one can determine

whether a production activity should be continued in the long run, operated only in the short run, or shut down production immediately. In order to decide which situation applies (see Figure 5), the MR's represents different prices for rice output. Examine this one by one, notice that MR5 (MR5 = 150 Riel/Kg) intersect MC at a point below AVC. When this occurs, farming households are not able to cover the variable costs of production. In such a case, farmers in the study area should shut down or stop producing rice. If marginal revenue intersects marginal cost below average variable cost, the more that is produced, the greater the loss. By shutting down, only fixed costs are forfeited.

Figure 5: Average Cost Curves to Determine the Profitability of Rice Production under Five Possible Output Prices.



MR4 (MR4 = 200 Riel/kg) intersects MC at the low point of the AVC curve so that all three curves come together at the same point. In this situation, the farmer is meeting the variable costs of rice production but has nothing to apply to fixed costs. One should be indifferent as to whether to produce or not since only variable costs are covered and the loss is equal to fixed cost whether production or shutdown take place.

In the event of MR3 equal approximately 260 Riel/kg, Marginal Cost is intersected above the low point of Average Variable Cost but below the Average Total Cost curve. When this occurs, the farmer is in a situation known as loss minimization. That is, all the variable costs are being covered and some contribution is being made to fixed costs but not all fixed costs are being covered. Hence, the farmer should produce in the short run (for the next production season) and hope that prices improve. However, should the price received be equal to price MR3, no profit will accrue but losses will be at a minimum. Shutdown in this case would result in a loss of fixed costs (greater than the loss involved with production).

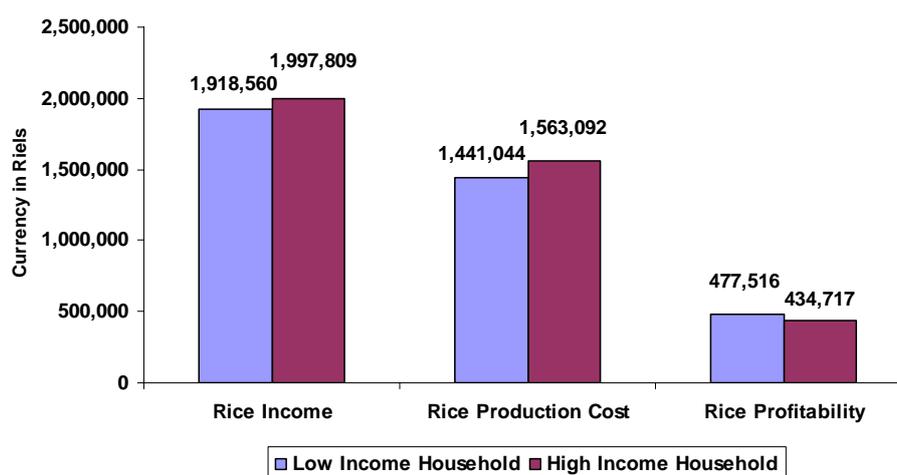
MR2 (MR2 = 285 Riel/kg) intersects Marginal Cost the point where Average Total Cost is at a minimum. In this case, the farmer is meeting all of the total costs of production and, therefore, making a normal profit. If the farmer is meeting the total costs of production, then each of these four factors of production will be receiving its fair return. If the total costs of production are being met, there is a fair return to each of the factors of production including management, that return is profit. When all costs are met, the farmer should continue producing in the long run.

Lastly, notice that MR1 ($MR1 > 295\text{Riel/kg}$) passes through Marginal Cost at a point above Average Total Cost. This point indicates that the farmer is not only earning revenue to cover all the variable and fixed costs of production but is receiving an amount over and above all costs. This latter is referred to as excess or economic profits. When this situation occurs, it should only be present for a short run period of time. As excess profits are available for any production activity, they cause entry by other farmers and entrepreneurs seeking to capture some of these profits. As more producers enter the industry, more of the product will be produced and all things being equal, a downward pressure on price is likely to occur.

Comparison of Rice Income, Production Costs and Profitability

The data in Figure 6 shows the comparison of rice income, production costs, and profitability between low-income households and high-income households per hectare. As can be seen from this figure, low-income households received slightly less rice income than high-income households. Low-income households received 1,918,560 Riel per hectare while high-income households generated 1,997,809 Riel per hectare. This amount of money is not much different and can be regarded as the same level of income.

Figure 6: Comparison of Rice Income, Production Costs and Profitability per Hectare



Source: *Field Survey, 2005*

On the production cost side, high-income households also paid more money than low-income households in order to produce one hectare of rice. High-income households spent 1,563,092 Riel/ha and low-income households paid 1,441,044 Riel/ha. High-income households' cost of rice production is slightly higher than low-income households. With regard to rice profitability per hectare, it can be seen that low-income households received more economic return/rice profitability than high-income households. Low-income households received 477,516 Riel/ha compared with high-income households, 434,717 Riel/ha. However, there was no significant difference in terms of economic return/rice profitability per hectare among the two groups of households.

The same figure also reveals that rice income, rice production costs and rice profitability per hectare were slightly different. However, rice income, rice production costs and rice profitability per hectare can be

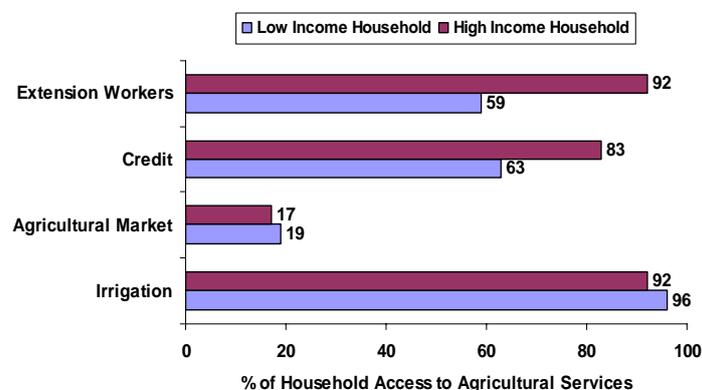
interpreted as at the same level and comparable between low-income households and high-income households. This result is also consistent with the result done by other researchers. Low-income households, who cultivate on small sized farms, seem to be more profitable in growing rice on a one hectare basis.

Comparison of Households' Accessibility to Agricultural Services

Access to the agricultural market, credit, rural infrastructure, and availability of professional services, such as agricultural extension, can have important impacts on household incomes and living standards by raising the productivity and efficiency of agricultural and other employment activities. Unfortunately, the ability of farming households to access such services is still limited.

The data in Figure 7 provides the comparison data between low-income households and high-income households' accessibility to agricultural services, such as market, credit, irrigation, and extension workers. As shown in the same figure, less than 20 percent of both households could access the agricultural market and there was no difference in terms of accessibility to the agricultural market. This situation presented a serious problem faced by low-income households and high-income households in selling their agricultural products, such as rice, vegetables, and livestock. It would also put households in a disadvantaged position in raising their income by selling agricultural products at a reasonable price.

Figure 7: Comparison of Households' Accessibility to Agricultural Services



Source: Field Survey, 2005

With regard to agricultural extension workers, who can help farmers in adopting new seed technologies, fertilizer applications, and cultivation practices, there was a significant difference in terms of accessibility among the two household groups. Around 92 percent of high-income households claimed they could access extension workers, while only 59 percent of low-income households could access this professional service. Interestingly, more than 90 percent of households could access irrigation water, which makes dry season rice cultivation possible.

In terms of accessibility to credit service, 83 percent of high-income households can access credit, while only 63 percent of low-income households can access credit. This number shows that credit accessibility of high-income households was remarkably higher than low-income households. The reason

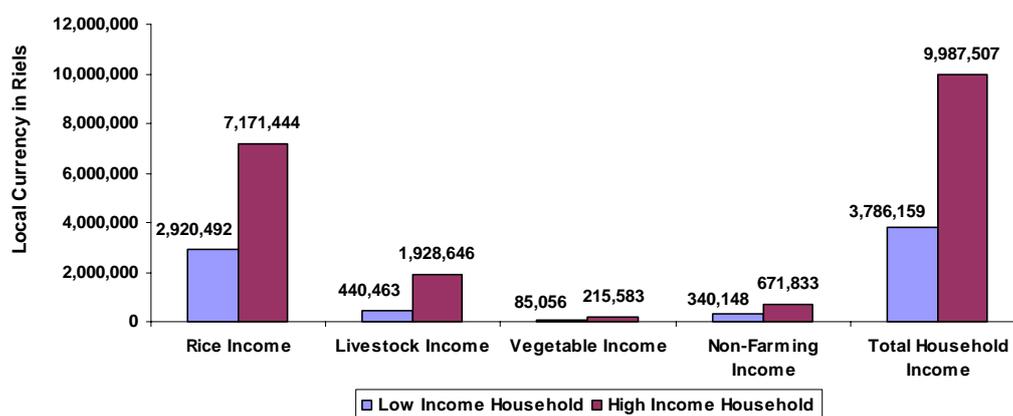
behind this could be linked to high-income households usually owning large sized farms, which is regarded as asset collateral in borrowing money from rural banks or other financial institutions.

Overall, it is apparent that high-income households are in a better position in terms of accessibility to agricultural services, especially credit services and extension workers. Since high-income households have more access to credit, it is also possible for high-income households to borrow money for capital investment in enlarging farm business activities. Furthermore, both households in the study area appear to be in a better position than other rural areas throughout the country in terms of accessibility to agricultural services, except accessibility to markets.

Comparison of Household Incomes from Multiple Sources

The data in Figure 8 shows the comparison of income between low-income households and high-income households from rice, livestock, vegetables, non-farming activities and total household income over the period of one year. Clearly, rice income is the primary source of income for both households, and livestock income is the secondary source of income. Livestock income is generated from selling cows, pigs, and chicken. However, selling cows is rare, while selling pig and chicken are commonly practiced by both farming households. In addition to rice and livestock income, low-income households and high-income households also received additional income from small scale vegetable growing and non-farming activities available to their own community. These two sources of income did not contribute much to the total annual household income.

Figure 8: Comparison of Household Income from Multiple Sources and Annual Household Income



Source: Field Survey, 2005

In comparing rice income between low-income households and high-income households, it can be seen that rice income is remarkably different among the two household groups. High-income households received more than double rice income compared with low-income households. Furthermore, there is a big gap in terms of livestock income between low-income households and high-income

households. Livestock income of low-income household was nearly 5 times lower than high-income households. This gap is very high that makes total low-income households significantly different.

Besides, high income household also received notably high income from vegetable income and non-farming income. This can be said that high income household generated significantly amount of money higher than low income household from all income sources. On the whole year basis, high-income households generated 9,987,507 Riel/year or US\$2,496/year. Conversely, low-income households generated only 3,786,159 Riel/year or US\$946 /year. This income gap is high, and it results in substantial inequality in income generation from multiple sources.

By comparing low-income households and high-income households with the national average income, it can be seen that the annual income of low-income households (US\$946) is lower than the national average income per household, US\$1,300. On the contrary, annual income of high-income households (US\$2,496) was remarkably higher than the national average income. This implies that the standard of living of high-income households is a little bit higher compared with average households in Cambodian rural society.

Comparison of Household Income Statement Analysis

Ratios calculated from the income statement give an indication of the relative profitability of a farming condition and the degree of flexibility the farm has in meeting expenses. The operating ratio indicates the proportion of the gross income allocated to the paying of operating expenses. Similarly, the fixed ratio indicates the proportion of gross income allocated to meeting fixed expenses. The gross ratio indicates the proportion of gross farm income needed to meet total expenses and is the sum of the fixed and operating ratios.

In examining these three ratios, the gross ratio is perhaps the most important one of the three ratios. If the gross ratio is greater than 1, the farm business is not covering the total expenses of operation. Values that are less than 1 indicate that the farm is generating a positive net farm income. The relationship between the fixed ratio and the operating ratio is also important. Farming households with relatively large fixed ratios and small operating ratios generally are more vulnerable to cash flow (also called liquidity) problems than are farms in which the reverse conditions hold true.

Table 2: Comparison of Household Income Statement Analysis

<i>Analysis Factor</i>	<i>How Calculated</i>	<i>Low Income Household Calculation</i>		<i>High Income Household Calculation</i>	
<i>Income Statement</i>					
1. Operating ratio	Total operating expenses	1,752,013	= 0.46	4,022,547	= 0.40
	Gross farm income	3,786,159		9,987,507	
2. Fixed ratio	Total fixed expenses	841,521	= 0.22	1,907,855	= 0.19
	Gross farm income	378,6159		9,987,507	
3. Gross ratio	Total expenses	2,593,535	= 0.68	5,930,402	= 0.59
	Gross farm income	3,786,159		9,987,507	

Source: *Field Survey*

The income situation for low-income households has a gross ratio of 0.68 (Table 2). This means that for every Riel (Cambodian currency) of gross income that the low-income households

generate, only 0.68 Riel was required to meet the explicit expenses of the operation. The operating ratio and fixed ratio were 0.46 and 0.22 respectively. For high-income household's condition, they have a gross ratio of 0.59 (Table 2). This means that for every Riel (Cambodian currency) of gross income that high-income households generated, only 0.59 Riel was needed to meet the explicit expenses of the operation. The operating ratio and fixed ratio were 0.40 and 0.19, respectively.

By comparing low-income households and high-income households ratios calculated from income statement, it can be seen that the gross ratio of low-income households (0.68) and high-income households (0.59) is less than 1. This implies that both farming households were generating a positive net farm income. However, high-income households appear to be in a better financial position than low-income households as its gross ratio is smaller than low-income households.

Table 3: T-Test For Gross Ratio Of Low Income Household And High Income Household

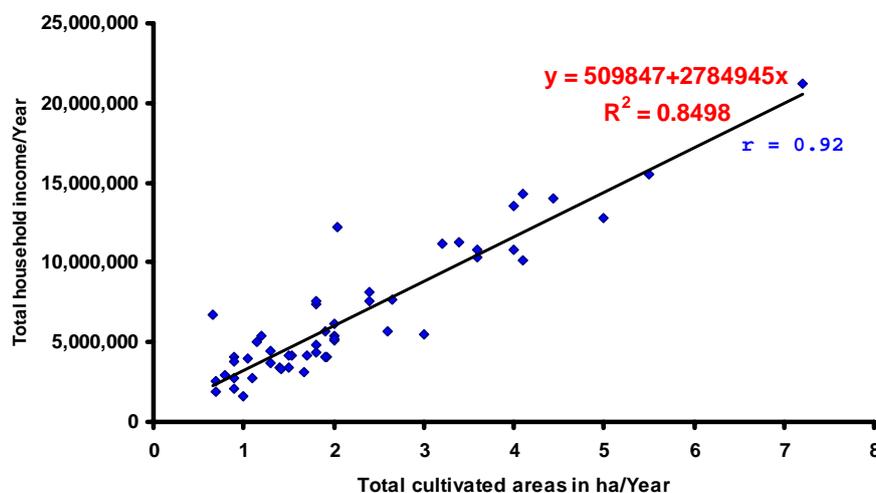
	<i>Gross Ratio of Low Income</i>	<i>Gross Ratio of High Income</i>
Mean	0.68	0.59
Variance	0.053899131	0.018258408
Observations	27	24
Df	49	
t Stat	2.35367617	
P(T<=t) two-tail	0.02264412	

To gain further understanding regarding the gross ratio of low-income households and high-income households, t-test analysis is applied. The result of an analysis reveals that the sample averages 0.68 and 0.59 are significantly different ($p < 0.05$). Accordingly, there is a significant difference in gross ratio between the two households in generating farm income. In other words, low-income households and high-income households gain their farming income differently.

Factor Affecting Household Income

Since one of the main objectives of this study is to find out the main factor affecting household incomes, linear regression analysis is used to identify and predict annual household incomes based upon total cultivated farm size per year. This method is predicting one variable from the other, using an estimated straight line that summarizes the relationship between the variables. By convention, the variable being predicted is denoted Y, and the variable that helps with the prediction is X.

In this Linear Regression, household income is the dependent variable, Y, and total farm size in ha. is the independent variable, X. The main reason to use farm size to predict household income is that more than 70 percent of household incomes generated from rice income and rice income are mostly determined by total cultivated farm size. By using linear regression analysis, the results of a, b, the correlation coefficient, and the coefficient of determination are presented in Figure 9 below.

Figure 9: Relationship between Farm Size and Household Income

As shown in Figure 9, this figure supplies information regarding the relationship between farm size and annual household income. By looking at the scatter plot in the figure above, there is a linear relationship between farm size and household income. In other words, as the cultivated farm size increased, annual household income also increased in the same direction.

Is increasing the farm size a good choice to increase household income? To answer this key question, it is worthwhile referring to Figure 9. Note that the correlation coefficient, r , is 0.92. Because the value of r is close to 1.00, this can be concluded that there is a strong positive relationship between total cultivated farm size and annual household income. Therefore, increased farm size is a good solution to increase household income. Next, is examined the coefficient of determination, $r^2 = 0.8498$. This value of r^2 implies that 85 percent of the variation in annual household income is explained by total cultivated land size.

Factors Affecting Rice Output

In an attempt to understand the production function and return to scale of rice output, Cobb-Douglas function is applied to identify the main contributor to rice output. As rice output is largely determined by the level of the farm size, labor, and capital to achieve a certain amount of rice output, these inputs are regarded as the three-variable in the production of rice output. In addition to these three variables, dummy variable, household category, is also incorporated in the regression model in order to gain more understanding between two household groups in rice production.

The relationship between output and input variables in Cobb-Douglas production function is nonlinear. However, if we log-transform four variables function, we obtain the following linear equation.

For production, four-variable function can be written as the below:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 X_4 + u$$

Where:

- Y = rice output
- X1 = farm size input ,
- X2 = labor input,
- X3 = capital input
- X4 = Dummy variable: 1 for low income household and 0, Otherwise (High income household)
- $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ are parameters and u is error term

From a purely statistical viewpoint in Table 4, the F-test is significant (8.14E-26 level), indicating this model is useful, and the estimated regression line fits the data quite well. The R Squared value of 0.929129 indicates that about 93 percent of variation in the (log of) rice output is explained by the log of farm size, labor, and capital. This means about 7 percent of the variability in rice output is not explained and could be due to other factors such as education, experience, age and credit, etc.

**Table 4: Regression Statistics
for Production Function**

0.929129	R squared
0.19605	Standard error of estimate
51	Number of observations
150.7658	F statistic
8.14E-26	P value

As can be seen in the coefficient in Table 5, the output elasticities of farm size, labor, capital and household are 0.385, 0.382, 0.143 and -0.07 respectively. In other words, in this study, holding other inputs constant, a 1 percent increase in farm size input led on the average to about 0.38 percent increase in the rice output. Similarly, holding other inputs constant, a 1 percent increase in the labor input led on the average to about a 0.38 percent increase in the rice output.

In applying the same method, holding other inputs constant, a 1 percent increase in the capital input led on the average to about a 0.14 percent increase in the rice output. The regression coefficient for households, -0.07, indicates that the expected rice output difference between low-income and high-income households with the same level of farm size, labor and capital is 0.07 percent or 7 kg, which rice output of low-income households is lower than high-income households. The coefficient for households is not significant, and it is not even close.

Table 5: Multiple Regression Results Using the Log of Farm Size, Labor and Capital

	Coeff	StdErr	T	P	Significant?
Constant	4.742766	0.782362	6.062113	2.34E-07	Yes (p<0.001)
Farm Size	0.385197	0.105394	3.654835	0.000658	Yes (p<0.001)
Labor	0.382239	0.08757	4.364973	7.14E-05	Yes (p<0.001)
Capital	0.143179	0.05877	2.436279	0.01877	Yes (p<0.05)
Household	-0.07011	0.07813	-0.8973	0.374233	No (p>0.05)

The prediction equation is:

$$\text{Rice Output} = 4.742 + 0.385 \text{ Farm Size} + 0.382 \text{ Labor} + 0.143 \text{ Capital} - 0.070 \text{ Household}$$

By adding the three output elasticities (Farm size + Labor + Capital), the result is $(0.385 + 0.382 + 0.143) = 0.90$, which gives the value of the returns to scale parameter. As is evident, rice output in the study area was characterized by decreasing return to scale. In other words, it can be said that an increase all resources (farm size, labor, and capital) by 10 percent will add 9 percent to total rice output.

CONCLUSION

One can find both similarities and differences between low-income households and high-income households. Concerning similarities, both households achieved almost the same level of rice productivity and profitability/economic return per hectare, and the production cost per hectare is also at the same amount of expenditure. Low-income households and high-income households were generating a positive net farm income and facing a problem in selling agricultural products to the market.

Concerning the differences, high-income households cultivated on large sized farms compared with low-income households. Large sized farms means large quantity of rice yield. Large quantity of rice yield translated directly into high rice income for high-income households. High-income households generated a great deal of income from livestock raising activity while low-income households received little income from this income source. Compared to low-income households, high-income households had better access to extension workers and credit service, allowing them to get more capital investment in enlarging farm business. There is a significant difference between the two household groups in generating net farm income.

Another interesting result is found when answering the two basic questions of how much output should be produced and how large should the farm be to get maximum profit. Rice Marginal Cost crosses Marginal Revenue at approximately 17,482 kg (around 3.5 hectares). If the expected price of rice is 515 Riel/Kg, 17,482 kg would be the profit maximizing level of rice production. There is no guarantee that this level will produce profit, only that is the best possible level of output given the prices and costs associated with a particular production function. By producing at the optimal level of output losses maybe minimized as opposed to maximizing profits.

Rice output in the study area was characterized by decreasing return to scale. An increase all resources (farm size, labor, and capital) by 10 percent will add approximately 9 percent to total rice

output. Farm size is the main factor affecting rice output, and labor input ranks as the second factor in producing rice output, while capital input contributes little to produce rice output. Also, there is no significant difference between the two household groups in producing rice output.

Increasing cultivated farm size would result in substantially increasing rice output. Then, it is likely to translate directly into higher household income. Also, there is a linear or positive relationship between farm size and household income. Accordingly, increased farm size is a good solution to increase household income. Whenever it is possible, households should pay special attention on livestock raising activity, which could contribute significantly to annual household income and try to improve access to agricultural markets.

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OPTIMIZING RURAL INFRASTRUCTURE DESIGN IN DEVELOPING COUNTRIES

Heng, Salpiseth*

INTRODUCTION

Despite a good rate of national growth in many developing countries in the past decades, poverty in these countries is still largely a rural phenomenon where the majority of the population lives. These rural residents are not integrated into the mainstream of national life. They barely participate in the market economy and they have little hope for the future.

Poor infrastructure improvement is one of the factors of their low quality of life. Rural transport networks in most developing countries are underdeveloped and of poor quality. Approximately 900 million rural residents in the developing world do not have access to yearly roads and about one third of these people use only non-motorized transport (Lebo and Schelling, 2001). The accessibility and affordability of services for rural people is related to weak communications and poor transport infrastructure. There is a significant correlation between poverty and remoteness. It is argued that rural roads are a key to raising living standards in poor rural areas (Gannon and Liu, 1997). As agricultural output from rural areas is still a very significant component of the national economy in developing nations, the rural transport systems require as much attention from transport planners as does inter-urban transport (Tolley and Turton, 1995). From another angle, it is clearly mentioned by Howe and Richards (1984) that providing farmers adequate access to social services, such as medical and health services and advice, proper nutritional care for the young and education facilities, would determine to a large extent the improvement of social and economic welfare of the rural population. These are also important determinants to ensure the continued self-sustaining momentum of rural development efforts (Odoki *et al*, 2001).

There is evidence that because of poor geographical accessibility, basic public services do not reach the majority of the population in these nations. Arguments have also been made that by reducing isolation, having better roads and optimal facility locations reduce vulnerability and dampen income

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variability. It is hard to disagree with the proposition that enhancing accessibility to various public facilities is important for the economic survival and the welfare of rural communities.

Apart from limited investment funds to build rural roads and public facilities, the lack of proper planning of these rural infrastructures is also a major problem. Hence, a research on planning of rural roads and public facility locations in a comprehensive integrated manner targeting optimized budget allocations has been carried out in this paper.

Furthermore, transportation network design and facility location theory have been extensively studied in the past, almost entirely independently of each other. This is unfavorable because the very definition of optimal locations of facilities, both private and public in order to serve residents, is constrained by the structure of the designed transportation network. When the network is designed improperly, residents receive extremely poor services even when facilities are located optimally. While evidence shows there is significant interaction of the network with facility locations, it is meaningful to determine the network design and facility locations simultaneously (Daskin and Owen, 1999; Melkote and Daskin, 2001). It would assist decision makers in developing countries on how to make a choice effectively under limited fund constraints to build schools, expand hospitals, or improve road links (Daskin and Owen, 1999).

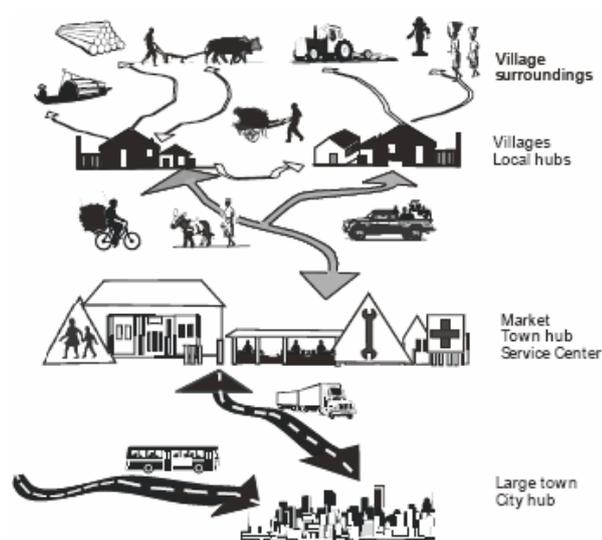
Therefore, it is meaningful to investigate an integrated model where rural road networks are optimally designed considering existing and new multi-public facility locations. In this study, existing rural road networks and new multi-public facility locations are to be optimally designed simultaneously to achieve minimum total cost comprising construction and operation cost spent by government/local authority and rural residents, respectively. With a different solution approach, several options of road surface (e.g. bituminous, laterite/gravel, and earth) and multi-type public facilities (e.g. health centers, primary schools, and rural markets) are considered in the studied model. Existing public facility locations and permanent roads are also taken into account throughout this research. In order to prove its applicability and validity, the proposed model is to be simulated with a real rural road network followed by sensitivity analyses considering financial and spatial constraints.

The remainder of the paper is organized as follows: Section 2 illustrates the model definition and assumption to support the formulation of the integrated model. In Section 3, model formulations, the core of this paper, are demonstrated. Section 4 describes the study area to be challenged with the formulated model. Section 5 considers the application and validation of the proposed model. The sensitivity analyses followed by computational results are also reported in this section. Finally, the conclusion and future directions are provided in Section 6.

MODEL DEFINITION AND ASSUMPTIONS

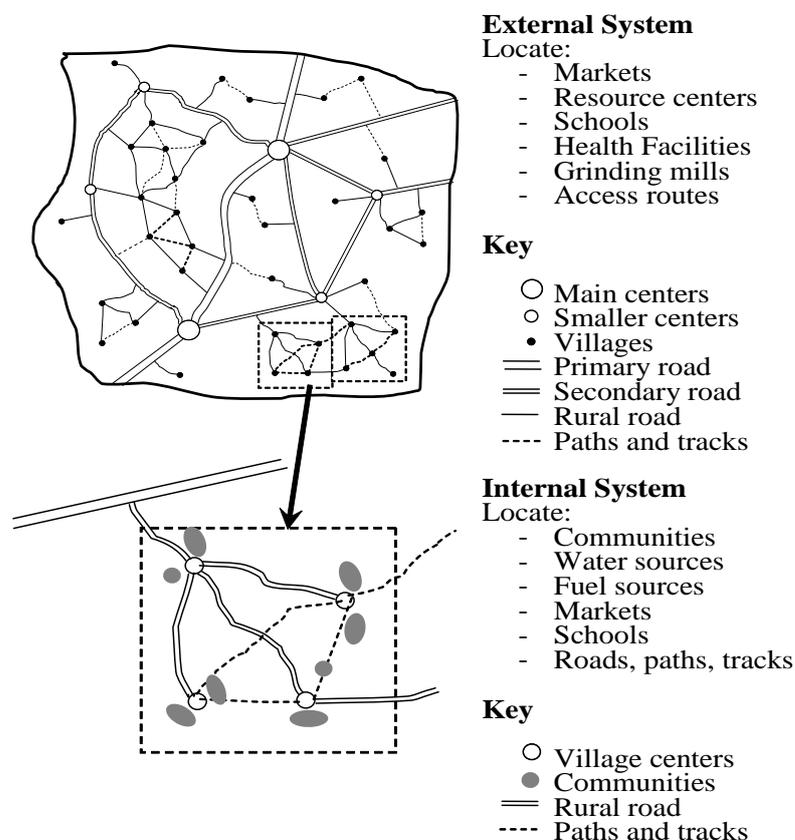
Many reviews on merits of rural roads described above clearly proved that rural transport infrastructure is vital for rural livelihoods. In Figure 1, the rural road network is the lowest level of road network that connects the rural population, and therefore the majority of the poor, to their farms, local markets, and social services, such as schools and health centers, potentially increasing their real income and improving their quality of life. This road network was developed from cart tracks which were originally footpaths (Howe and Richards, 1984).

Figure 1: A Rural Transport System



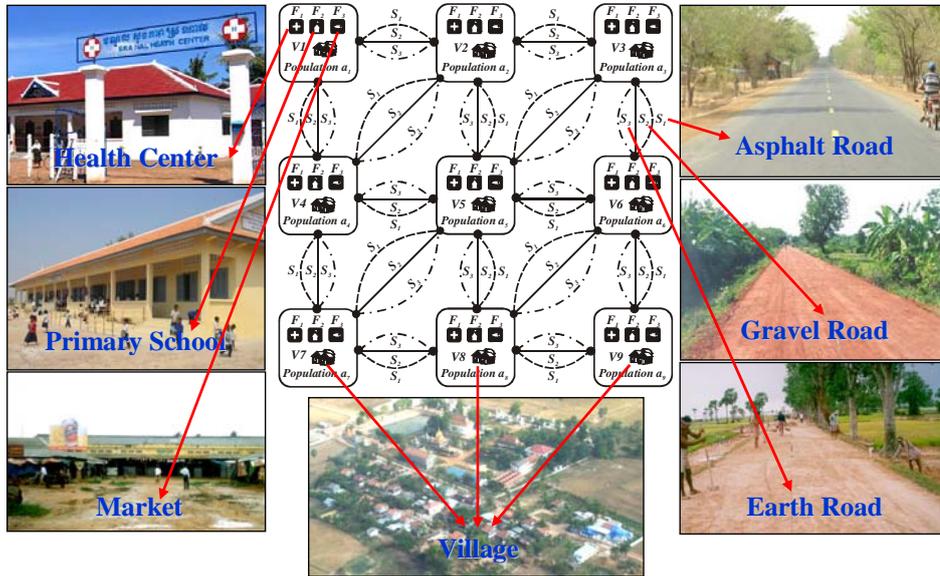
Source: *International Focus Group on Rural Road Engineering*

The rural road network forms the basic network within a rural area and serves the main local traffic. It links up district centers to villages. It needs to be improved with sufficient capacity and good quality in order to enhance rural accessibility. The factors affecting rural access are interactive and cannot be considered in isolation. An integrated system approach is therefore needed for effective accessibility planning in which all the relevant factors and their interactions are properly taken into account. To plan a rural road network, a hierarchal system needs to be developed as it is necessary to define the internal systems which are the subject of the accessibility planning and the external system that influences them (Figure 2).

Figure 2: Integrated System for Rural Road Planning

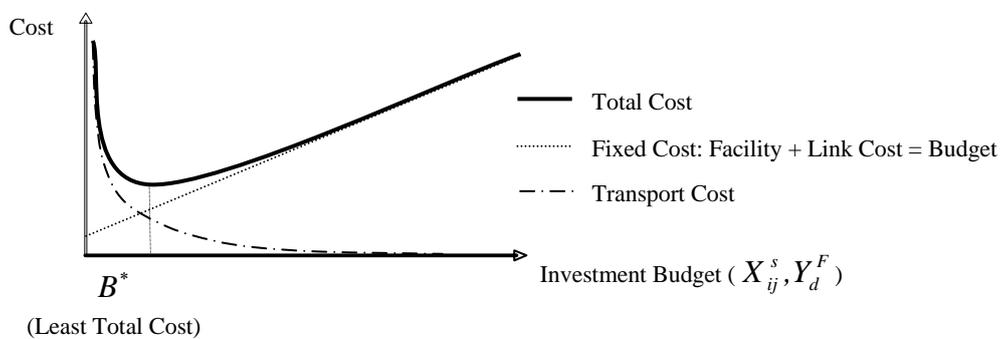
The internal system should cover an appropriate geographical area encompassing interlinked villages and match the aims of the planning study. The external system should cover all routes, major rural centers, and facilities to which the internal system needs to access and people could benefit from. It is clear that the network design problem for rural road network in developing nations is somewhat different from that for developed countries. The networks in developing countries are being planned around existing roads and very few of the rural road links may already exist. Figure 3 illustrates a rural road network comprising village nodes connected to each other by road links. Road links with dotted and continuous lines are existing tracks or roads in poor condition which can be upgraded to all-weather roads without land acquisition; and are considered as candidate links for improvement with options of road surface (earth, gravel or asphalt). Each village nodes are taken into account as candidate sites for adding more new public facilities (health centers, primary schools and rural markets). The model aims to achieve least total cost which is a concept developed for utility planning that is being applied to transport. The total cost comprises all costs associated with construction and operation of a road network over its entire life including all money spent by producers (government) and consumers (rural residents). The least total cost calculation refers to the trade-offs that government and residents make between use of their financial resources (Figure 4).

Figure 3: Components of Integrated Model of Rural Road Network Design and Rural Public Facility Allocation



Necessary assumptions made throughout this study are stated as follows: 1) Congestion and the effect of traffic volume have not been considered as traffic flows are low in the rural areas of developing countries. 2) All villages are connected to the network regardless of their sizes. 3) Facilities may only be located at the village nodes. 4) The network is a resident-to-server system in which the residents themselves are travel to the facilities to be served. 5) Residents would choose the closest facilities. 6) The facility interaction and the attractiveness among facilities are not considered. 7) All candidate links are to be connected, at least constructed with the cheapest level (earth road). 8) Same unit travel costs for each road surface are applied to each rural resident’s travel costs.

Figure 4: Tradeoff between Costs and Investment Budget



MODEL FORMULATION

A planning agency, such as the government, is assumed to be responsible for designing rural infrastructure including public facilities allocation and road improvement to support the economic survival and welfare of rural residents. By assuming the residents to be on a number of village nodes of a given road network, the network is considered as a directed graph $G = (N, L)$ where N and L are sets of village nodes and road links respectively. The notations used throughout the mathematical formulation are: S is set of road surface options ($S = (s_1, s_2, s_3)$ for asphalt, gravel and earth respectively). F is set of facility types ($F = (F_1, F_2, F_3)$ for health centers, primary schools and rural markets respectively). O, D are sets of demand and supply nodes respectively ($O, D \subseteq N$). K_{od} is set of paths connecting OD pair od . d_{ij} is link distance from the node i to node j . C_r^{od} is travel cost per unit flow on path r connecting OD pair od . C_{ij}^s is travel cost per unit flow on link (i, j) , where $C_{ij}^s = d_{ij} \cdot c_{ij}^s$. c_{ij}^s is travel cost per unit flow and distance of traveling over surface type s on link (i, j) . a_o^F is demand size at demand nodes o for facility F . q_{od}^F is trip rate between OD pair od where $q_{od}^F = y_{od}^F \cdot a_o^F$. D_{max}^F is maximum total travel distance for each resident to get services from facility type F . B is an available investment budget. EY_d^F is existing facility capacity at supply nodes d . FC_d^F is capacity of one new facility F or minimum size of one new facility F to be allocated at any supply node d . α_d^F is coefficient of allocation cost of facility type F at each supply node d . CC_{ij}^s is cost of improving link (i, j) with surface type s . $\delta_{ij,r}^{od}$ equals 1 if link (i, j) is on path r between OD pair od , 0 otherwise. β^F is maximum percentage of total number of new facilities F to total number of existing facilities F . The decision variables in this model are: $X_{ij}^s = 1$ if a link (i, j) is built with surface type s , 0 otherwise; Y_d^F is numbers of new facilities F built at supply nodes d , where $Y_d^F \in \mathbb{Z}$. Link flow variable x_{ij}^s on link (i, j) with surface s defined by X_{ij}^s and Y_d^F is introduced to the model to calculate the total transportation cost. Additionally, in order to solve the mathematical

formulation of the integrated model, other two variables are also used: y_{od}^F is fraction of demand for facility F at node o assigned to a facility F at node d where $0 \leq y_{od}^F \leq 1$; $f_r^{F,od}$ is flow of demand for facility F on path r connecting OD pair od .

It is vital to recognize that there is no unique optimum network. Having defined a specific objective and a set of constraints then a model may generate a strictly mathematical optimum. The goal of this study is to investigate the fundamental question of public resource allocation to attain minimum total cost. Where should be locate public facilities? What size? Which road link should be upgraded with high quality? Between spending on link improvement and allocating more public facilities, which one is the most cost-effective investment? If public facility allocation is more cost-effective than link improvement, which facility, for instance, among health centers, primary schools and rural markets, is the most cost-effective one?

The objective function of the integrated model aims to optimize the total cost as follows:

$$\text{Minimize} \quad \sum_{s=1}^3 \sum_{(i,j) \in L} C_{ij}^s \cdot x_{ij}^s + \sum_{F=1}^3 \sum_{d \in D} \alpha_d^F \cdot FC_d^F \cdot Y_d^F + \sum_{s=1}^3 \sum_{(i,j) \in L, i < j} CC_{ij}^s \cdot X_{ij}^s$$

However, as budget constraint is very important in this study, we should consider different scenarios of budget design problem. With an investment budget constraint, we design the infrastructure by keeping total transportation costs to a minimum. The summation of link and facility construction costs subjected to a budget is added as a constraint. This would make the complex mathematical formulation become easier to be solved as choosing a good formulation for a mixed-integer optimization model can drastically reduce its solution time.

The Capacitated Facility Location/Network Design Problem (CFLNDP) which seeks to minimize total transportation costs of the population subject to budget and spatial constraints should be reformulated as follows:

$$\text{Minimize} \quad \sum_{s=1}^3 \sum_{(i,j) \in L} C_{ij}^s \cdot x_{ij}^s \tag{1}$$

$$\text{Subject to} \quad \sum_{r \in K_{od}} f_r^{F,od} = q_{od}^F = y_{od}^F \cdot a_o^F \quad \forall (o,d) \in O,D, \forall F \in F \tag{2}$$

$$\sum_{s=1}^3 X_{ij}^s = \sum_{F=1}^3 \sum_{(o,d) \in O,D} \sum_{r \in K_{od}} f_r^{F,od} \delta_{ij,r}^{od} \quad \forall (i,j) \in L \quad (3)$$

$$\sum_{F=1}^3 \sum_{d \in D} \alpha_d^F \cdot FC_d^F \cdot Y_d^F + \sum_{s=1}^3 \sum_{(i,j) \in L, i < j} CC_{ij}^s \cdot X_{ij}^s \leq B \quad (4)$$

$$\sum_{o \in O} a_o^F \cdot y_{od}^F - (FC_d^F \cdot Y_d^F + EY_d^F) \leq 0 \quad \forall d \in D, \forall F \in F \quad (5)$$

$$\sum_{d \in D} FC_d^F \cdot Y_d^F - \beta^F \cdot \sum_{d \in D} EY_d^F \leq 0 \quad \forall F \in F \quad (6)$$

$$x_{ij}^s \leq X_{ij}^s \cdot \sum_{F=1}^3 \sum_{o \in O} a_o^F \quad \forall (i,j) \in L, \forall s \in S \quad (7)$$

$$X_{ij}^s = X_{ji}^s \quad \forall (i,j), (j,i) \in L, \forall s \in S \quad (8)$$

$$\sum_{s=1}^3 X_{ij}^s = 1 \quad \forall (i,j) \in L \quad (9)$$

$$\sum_{d \in D} y_{od}^F = 1 \quad \forall o \in O, \forall F \in F \quad (10)$$

$$y_{od}^F \leq y_{dd}^F \quad \forall o, d \in O, D, \forall F \in F \quad (11)$$

$$0 \leq y_{od}^F \leq 1 \quad \forall o, d \in O, D, \forall F \in F \quad (12)$$

$$y_{od}^F \geq 0; \quad X_{ij}^s, X_{ji}^s \in \{0,1\}; \quad Y_d^F \in \{0,1,2,\dots,n\}; \quad x_{ij}^s \geq 0; \quad f_r^{F,od} \geq 0$$

$$\text{WHERE} \quad \sum_{(i,j) \in L} \delta_{ij,r}^{od} \cdot d_{ij} \leq D_{max}^F; \quad \forall (i,j) \in L, \quad \forall i, j \in N,$$

$$\forall o, d \in O, D \subseteq N, \forall s \in S, \forall F \in F, \forall r \in K_{od} \quad (13)$$

Equation (2) and (3) describe flow conservation. Eq. (4) indicates that the total expenditures (facilities and links construction cost) is constrained to an investment budget. The term of link construction expenditure is to be spent to build only one link either (i, j) or (j, i) on which both flows $i \rightarrow j$ and

$j \rightarrow i$ can appear. Eq. (5) restricts total demand assigned to a facility not exceed the capacity of the facility. Eq. (6) limits maximum total number of new facilities to be allocated. Eq. (7) ensures that flow on link can occur only if the link is constructed. Constraints (8) and (9) define that one link in both directions $i \rightarrow j$ and $j \rightarrow i$ is to be paved with only one type of surface. These constraints also guarantee all links are to be connected, at least built with the cheapest surface option (earth road). Eq. (10) states that summation of all fractions of demand for facility F at any node o assigned to all facility F at node d equal unity. Eq. (11) eliminates the possibility of cross haulage by restricting assignments to communities which assign to themselves: $y_{od}^F + \sum_{k=1, k \neq d}^n y_{dk}^F \leq 1$. If demand at village o is fully assigned to a central facility in village d ($y_{od}^F = 1$), then village d cannot reassign the people to village k ($y_{dk}^F \leq 0$ for the people to village k) $\Rightarrow y_{od}^F \leq y_{dd}^F$. Eq. (12) is constraint for demand assignment variables. Finally, (13) are integrality and non-negative constraints. Maximum traveling distance for residents to get services from each facility is considered in the model. D_{max}^F is a factor to impose restriction on the path flow variable $f_r^{F,od}$ which affects the decision variable of customer assignment y_{od}^F . It means the total travel distance is a barrier influencing the decision making of residents whether to travel to acquire services from a facility type F at a certain location. This results in a constraint to facility decision variables Y_d^F where the facility should be located. In planning to improve access through location of a facility, a catchment area needs to be defined. A desirable upper limit for travel distance (travel time) from any village to facility center should not be exceeded (Rahman and Smith, 1999 and 2000). For instance because of targeting at optimizing the total cost in this model, it may bias the location of facility to the populated areas which would penalize other isolated ones with low density. Therefore, since individual travel distance (travel time) influences their welfare and in order to avoid high inequality in accessibility to public services, it is essential to consider the upper limit of travel distance of each citizen in the integrated model corresponding to each type of facilities.

STUDY AREA

In order to prove the applicability and validity of the formulated model, the integrated model is to be tested on rural road network in Puok District of Cambodia by using real parameters.

Figure 5: Map of Cambodia Location

CAMBODIA

Cambodia, a developing country with a size of 181,035 km², is located in Southeast Asia, on the Indochina peninsula. It is bordered on the north and west by Thailand and Lao People's Democratic Republic and on the east and southeast by Vietnam. The country is bounded on the southwest by the Gulf of Thailand (Figure 5). Comparing with its neighbors, Cambodia is a geographically compact country administratively composed of 20 provinces, 4 municipalities, 185 districts, 1,621 communes and 13,703 villages. About 85 percent of Cambodia's 14 million people in 2005, and more than 90 percent of the poor, live in rural areas with an annual population growth of 2 percent. Cambodia's poverty is rooted in its large agricultural sector, which has low productivity and low growth, but provides livelihoods to the vast majority of the country's population. Cambodia's economy recorded high annual GDP growth of 7 percent and 5.1 percent of GDP growth per capita in 2005. Nevertheless, the impact on the proportion of the population living in poverty seems to have been small. The latest World Bank's poverty assessment based on Cambodia Socio-Economic Surveys (CSES) conducted in 2003/2004 shows that 34.7 percent of Cambodia's population lived below the national poverty line in 2004. Clearly mentioned in Cambodia Millennium Development Goal 2005, the country needs to focus on poverty reduction in rural less accessible areas as the surveys show that the proportion of the people

living below the poverty line account for 45.6 percent compared with 28 percent for the urban and accessible areas (Ministry of Planning, 2005; World Development Indicators, 2006). This would reflect on inequality and disparity between urban and rural sectors.

Moreover, three decades of civil war have damaged the entire population and its physical infrastructure. Particularly, rural infrastructure in Cambodia has deteriorated because of the long periods of civil war and instability. Economic development and improvement in living standards in rural Cambodia are seriously hindered by the poor state of roads and access and economic infrastructure. Inadequate transport infrastructure imposes higher travel costs and delays, raising the costs of marketing goods or obtaining inputs, and limiting access to facility-based health and education services. According to the Ministry of Public Work and Transport, the total Cambodia Road Network covers about 40,000 km of paved and unpaved roads, consisting of 4,802 km of national roads (both primary and secondary), 6,705 km of provincial roads and 28,000 km of tertiary or rural roads. The 28,000 km of rural roads defined as the roads with low traffic volumes, low geometric and construction standards, and passing through rural areas are in poor condition. These roads serve as feeders, linking villages with one another as well as with the nearest provincial roads, national highway and market centers or towns. Although there have been significant investments in rural road improvements through government efforts, mostly using donor funds, maintenance and coverage are major challenges.

The legacy of conflict is seen most noticeably in the depleted physical and human capital of the nation. Public facilities such as hospitals and schools were destroyed and have had to be rebuilt. And, although, a considerable number of schools and health facilities have been built since 1993, there are still too few classrooms and hospital beds for the needs of the population. Stated in the recent Cambodia Millennium Development Goal report, most people particularly the poor still have much less access to public services.

Having efficient and adequate rural marketing system, a precondition for agricultural diversification in Cambodia, would provide better prices to producers and the availability of competitively priced products to consumers. Poor market locations and quality causing inadequate access to markets remain a serious problem even if better market information becomes available to farmers. The average distance to the nearest markets in rural areas, about 13 km, is much longer than in Phnom Penh and other urban areas, which are only 7 km and 4 km respectively (socio-economic survey 1997). So the real deficiency appears to be in the smaller rural markets that serve the rural population more directly. These markets are usually administered, serviced and maintained by local authorities. Proper planning of the smaller rural markets seeking to increase the capacity of markets would be necessary and of significant benefit to farmers. Most of the rural markets are “local primary markets”

servicing rural residents' needs whereas the markets in district/provincial towns serve mainly a retail function. Different from main markets, which have been upgraded to a reasonable standard, facilities in rural markets are very limited, usually with no main market sheds and no water supply or latrines. Due to limited stall space, market activities spill out on to the adjacent streets and fresh produce is often exposed to the weather, resulting in high produce losses.

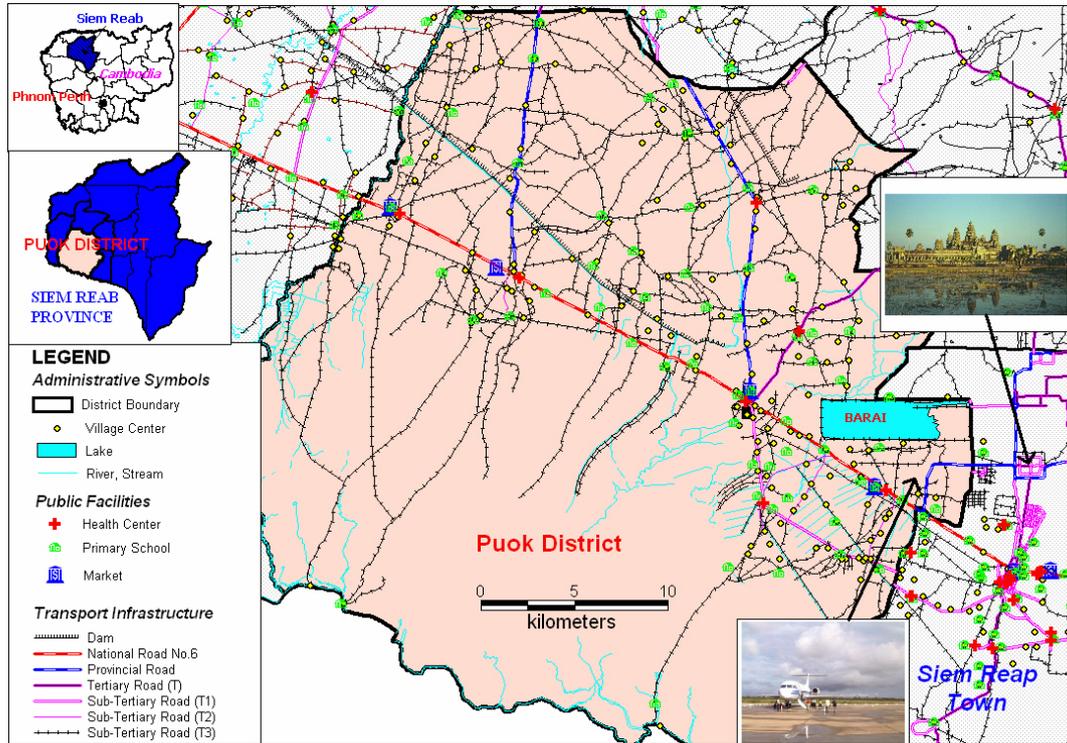
In addition to the issues facing the rural marketing network, health centers providing basic medical treatment are often not located effectively. According to the socio-economic survey 1997 by the Ministry of Planning, the average distance to the nearest health centers for the people living in rural areas is about 12 km, whereas only 4 km and 7 km for health centers in Phnom Penh and other urban areas, respectively.

Inequity in accessing basic education in Cambodia has been acknowledged as a significant limitation on the ability of the work force to develop the skills needed to reduce poverty nationwide. The Ministry of Education has identified that the incompleteness of primary education imposes a restriction on transitioning to secondary education. To solve this problem, there is a guideline stating that every school should have at least three serviceable classrooms, including selective use of double-shifts and multi-grade classes. A desirable upper limit of 3 km for every primary age pupil to school has been proposed to ensure that all children have easy access without incurring transport costs safely.

PUOK DISTRICT

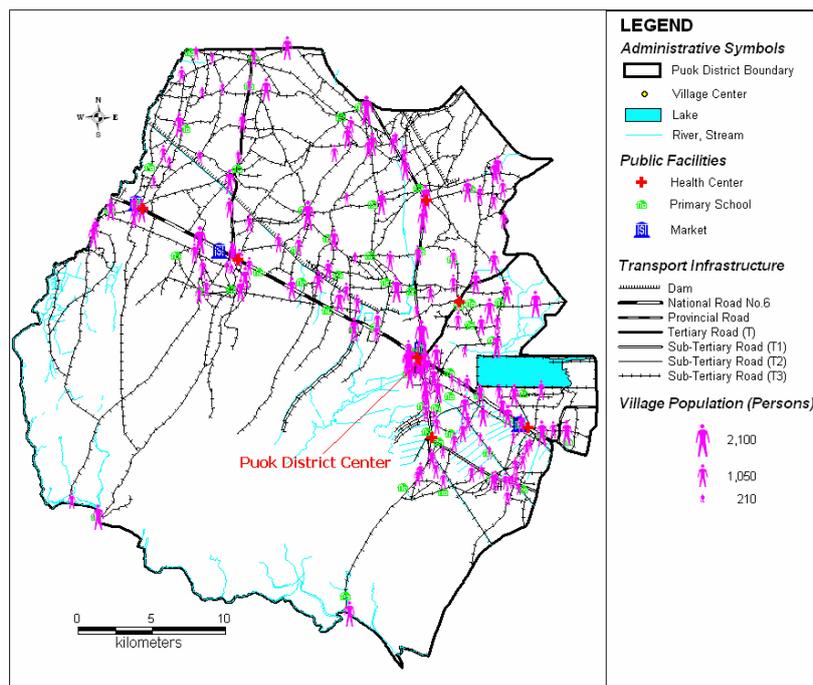
Puok district with nearly 130,000 inhabitants in 2005 and where its center is located about 15 km from Angkor Wat Temple, has the most residents among the twelve districts in Siem Reap province (Figure 6). Covering an approximate area of 1,090 km², there are 16 communes and 154 villages in Puok district. As shown in Figure 6, there are 61 primary schools, 7 health centers and 1 district and 3 commune markets distributed within the district.

Figure 6: Road Network and Existing Public Facilities in Puok District



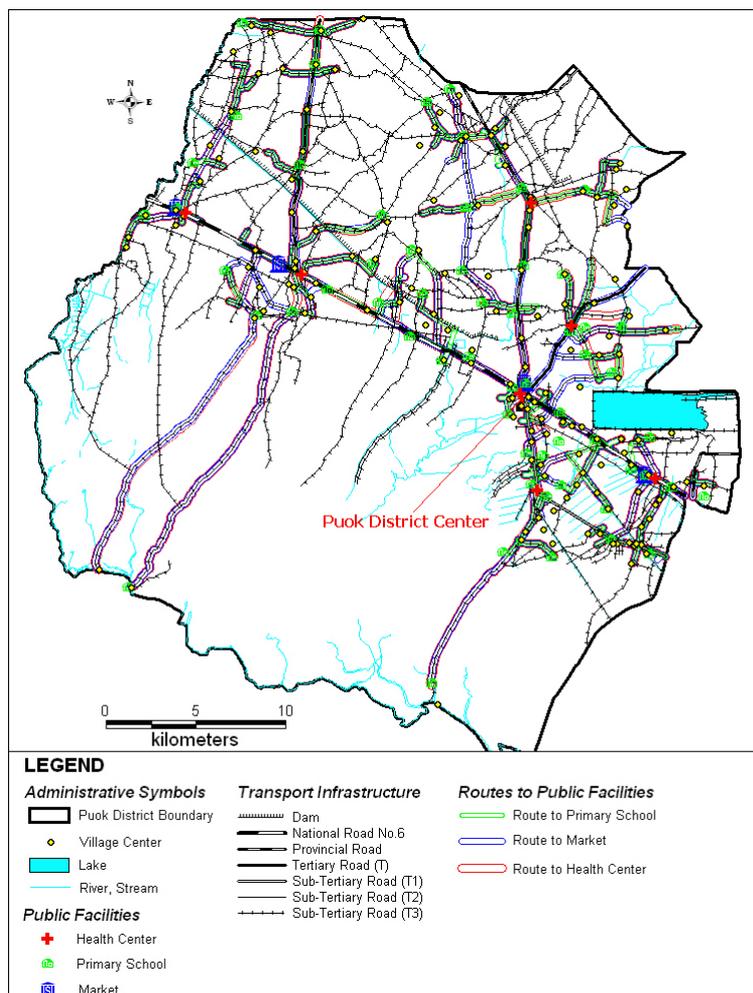
In Figure 7, population distribution in each village in the district would reflect on size of villager's demands for public facilities.

Figure 7: Population Distribution at each Village in Puok District



In Puok district, traveling outside the village takes a long time even if villagers own a bicycle or motorbike. This is due to the poor quality of roads, especially in the wet season. Except national roads, approximately 88 percent of the total road, mostly rural roads, are only dry-weather roads. Figure 8 demonstrates several routes taken by Puok residents to reach public facilities. These routes are mostly national and provincial roads. This would harm the living condition of Puok residents, especially ones living far from main roads during the rainy season, due to isolation from public services. Because of the bad road condition, rural families face a considerable transport burden by spending more time on traveling in the wet season and some areas are even isolated because of impassable roads. According to the Accessibility Action Plan of Puok district in 2004, Pupils spend about 21 mins and US\$0.14 to reach the nearest primary school. Puok inhabitants have to travel on average approximately 30 mins and it costs about US\$0.40 to reach the nearest health center during the rainy season. The density of markets in the district is low and the average distance to markets for residents is long.

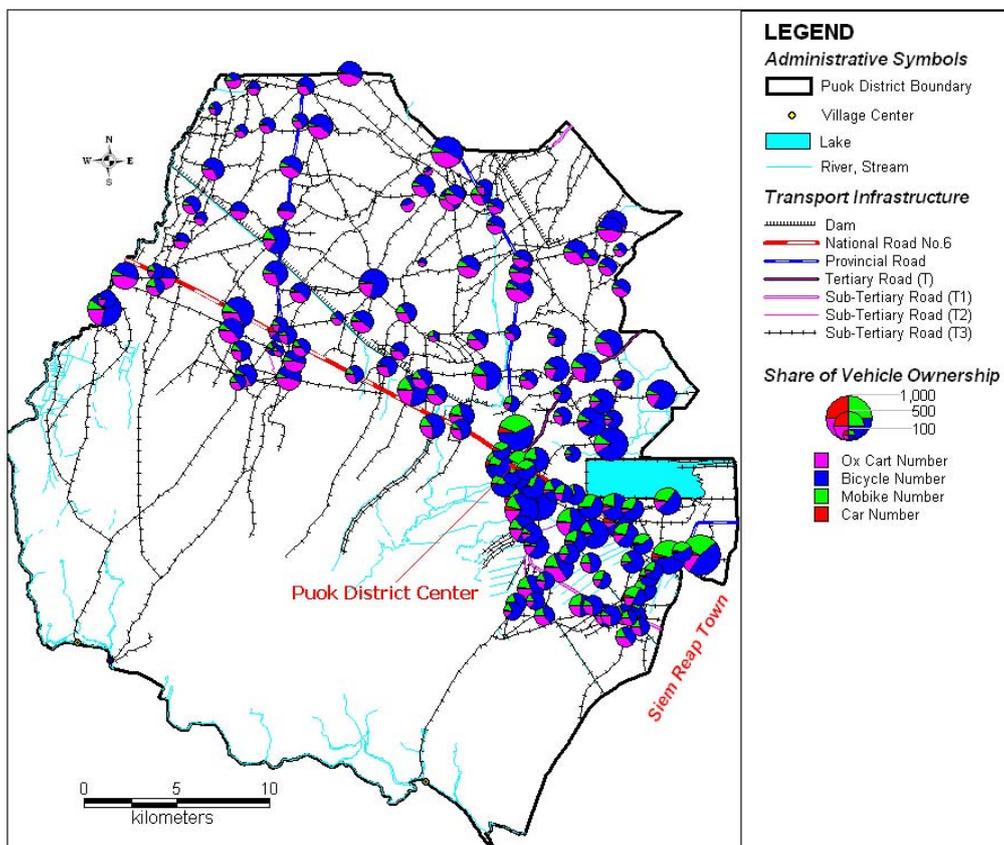
Figure 8: Actual Routes Taken by Local Residents to Public Facilities in Puok District



Rural residents visit the nearest local market with an average travel time of 45 mins and travel cost of US\$0.60. Inadequate transportation and public facilities, especially in the remote areas of Puok district, have serious impacts on the lives and welfare of the majority of the population in the district.

In addition to poor transport infrastructure within the district, the lack of motorized transport makes the Puok residents, especially the poor, more isolated from public facilities. It is clearly seen that non-motorized transport means, bicycle and ox-cart, are mostly used by Puok residents, particularly by the people living far from the district center and national road. As shown in Figure 9, the closer the village is to the district center and Siem Reap Town, the more motorized vehicles, mostly motorbikes, owned by residents in the village increases. Poor geographical accessibility and adequate supply of facility disconnect most Puok people who are living far from the district center and national road, from opportunities to improve their quality of life. Providing better access to public facilities would in turn increase economic opportunities for Puok residents to capture the profits from the tourism growth in Siem Reap town by supplying the huge demands of their agricultural products and labors. Poverty reduction would be therefore achieved through lowering transport costs by improving better transport infrastructure and facility locations.

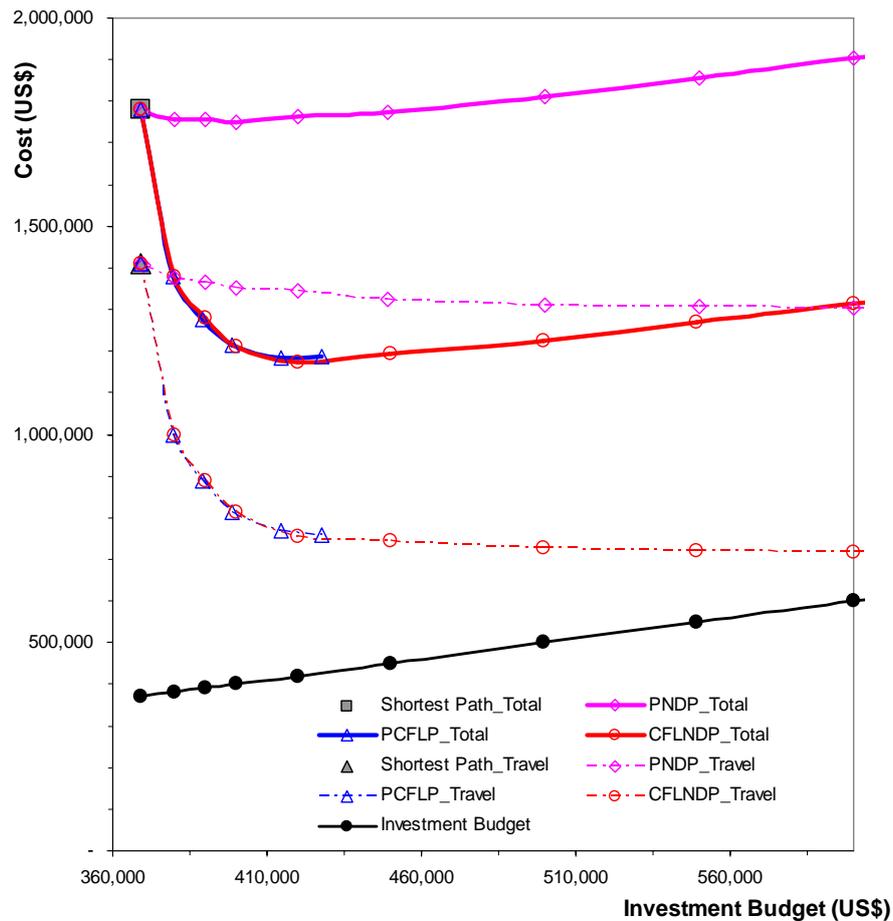
Figure 9: Share of Vehicle Ownership in Puok District



MODEL APPLICATION AND VALIDATION

The proposed model in this paper is to incorporate facility locations in the decision-making process involved in the design of a rural road network.

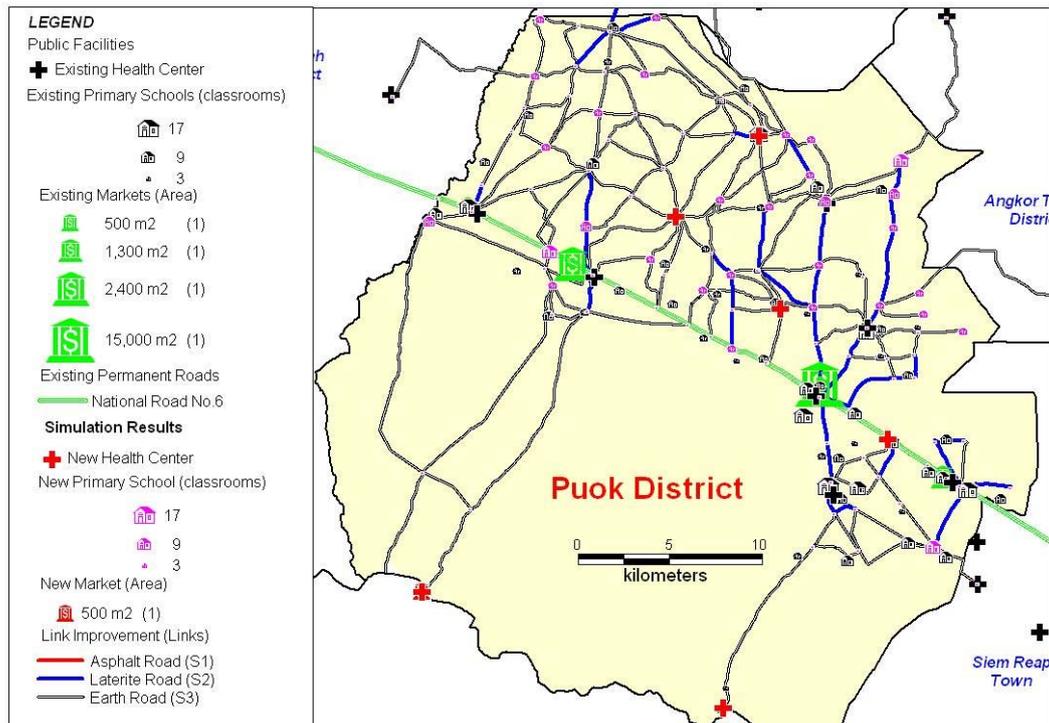
Figure 10: Comparison with other Models



The model is to be simulated with the rural road network of Puok district. There are totally 181 links (about 627 km). 14 links (54 km) are good-condition national roads with two-lane asphalt surface. 14 links (50 km) and 153 links (523 km) are provincial roads and rural roads respectively which are considered as candidate links for improvement in this study. The time period for the analysis is 15 years post-construction, i.e. 2005 through 2020. Uncertainties concerning the path of social and economic development would make projections over longer period hazardous. During the projected period, an annual population growth of 2 percent is adopted. All costs are discounted using a discount rate of 12 percent. This value is commonly used for infrastructure projects by the World Bank and other development agencies and is widely accepted as representing the social discount rate in Cambodia.

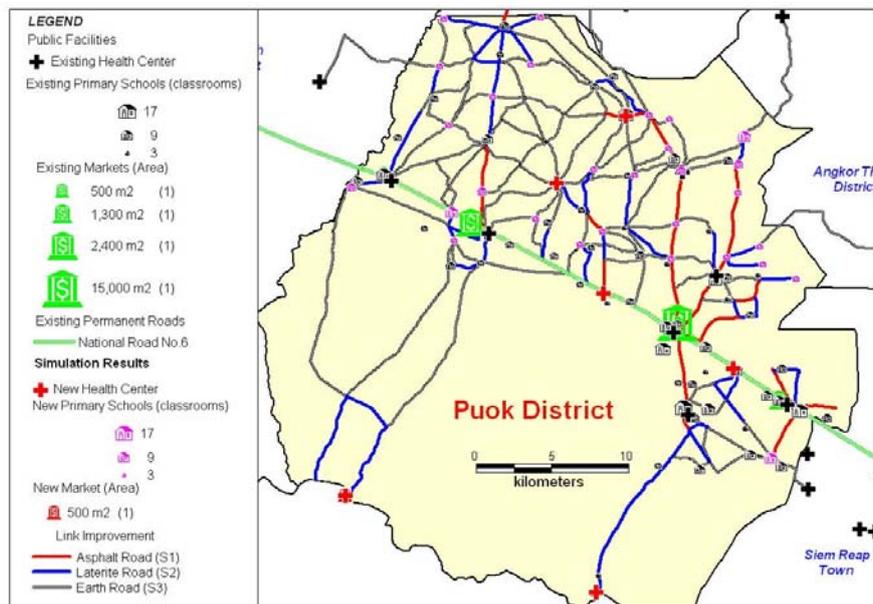
The result of this study shows that the integrated models of facility location and network design can be solved to optimality despite its complex formulation. The tradeoff between expenditures and investment budgets in Figure 10 illustrates that the integrated model (CFLNDP) is superior to other classic models as its total and travel costs are lower than the costs given by the classic models.

Figure 11: An Optimal Network for Budget = US\$480,000



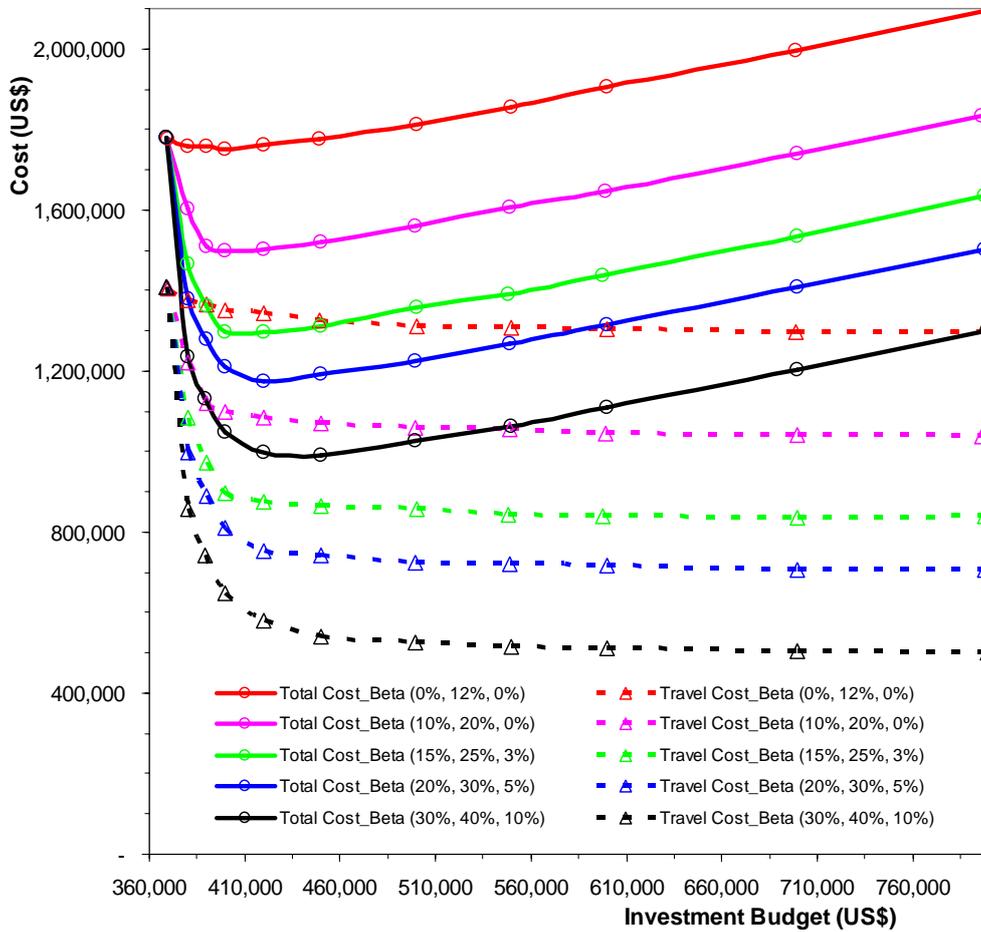
Moreover, in order to observe the model behavior, sensitivity analyses considering financial and spatial constraints are made throughout the study. The three constraints included in the analyses are budget constraints, restriction on maximum numbers of new allocated facilities (β^F) and limitation on maximum travel distances (D_{max}^F). Different budget sizes are to be simulated with the model. Figure 11 and 12 illustrate an optimized Puok network for an annual budget of US\$480,000 and US\$600,000 respectively. These Figures explain that the optimal network configurations change at different budget levels.

Figure 12: An Optimal Network for Budget = US\$600,000



Although budget for public infrastructure investment is sometimes available, public land and human resources availability may restrict number of new facility to be allocated. In the model formulation, this constraint is defined by equation 6:
$$\sum_{d \in D} FC_d^F \cdot Y_d^F - \beta^F \cdot \sum_{d \in D} EY_d^F \leq 0$$
 where β^F representing percentage of new public facilities to be allocated (e.g. health centers, primary schools, markets). The value of β^F is influenced by many factors. The maximum number of new allocated facilities may also depend on national policy. For instance, the government may give high priority to improve basic education and health care service rather than investing in building more local markets. In addition, lack of health care personnel (such as physicians and nurses), especially in developing countries, would impose a restriction on the allocation of a new health center. It may not be possible to allocated new classrooms for primary schools if there is no teacher available. Furthermore, designing local markets depend on many criteria. The annual turnover growth of agricultural products would answer to the needs of a new market location as these markets play a key role in improving agricultural marketing (Tracey-White, 2003). The investment in market facility also depends on the market users' needs (communities, producers and traders). Therefore, allocating new markets or improving existing market size may be determined by potential supply and demand for agricultural products and goods affected by local population and income growth.

Figure 13: Comparison among β^F Scenarios



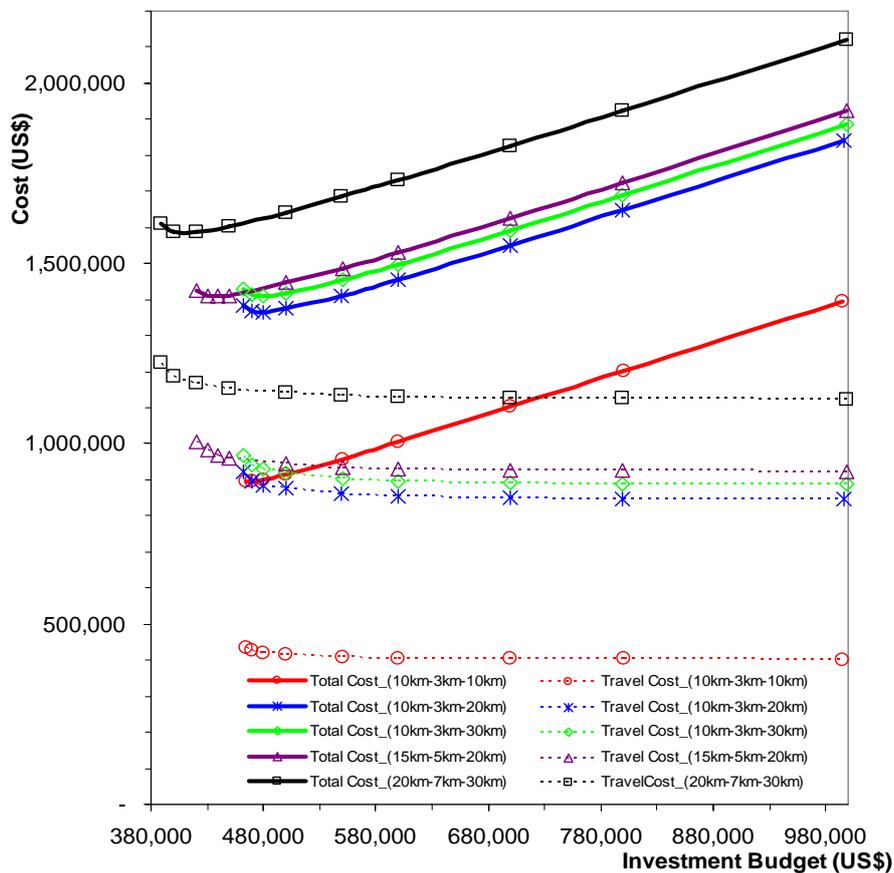
The result from this study shows that when the unit facility cost is low, the more the increase in the maximum number of new allocated facilities (β^F), the lower optimal total cost is obtained (Figure 13). This can be interpreted that the integrated model tends to be Pure Facility Location Problem while available budget for link improvement is decreasing.

The transportation constraint circumscribes behavior by limiting the distances an individual can travel to reach each facility type. The value of an opportunity to an individual would decrease with distance because the amount of time that can be spent at the location decreases, and the monetary travel cost also increases. This constraint was introduced to the integrated model by restricting the path flow variables $f_r^{F,od} \geq 0$ WHERE $\sum_{(i,j) \in L} \delta_{ij,r}^{od} \cdot d_{ij} \leq D_{max}^F$. The network is to be designed for the specified maximum travel distance from a health centers, primary schools and markets. Then this would require allocating more new facilities. Clearly this constraint would contrast with the land use, policy, human resource, and economic constraints above. Hence, there are many options for decision makers to

choose from. For example, either plan the new primary schools in the areas or relax the maximum allowed distances from primary schools. The transport planner can choose any options. Although the second option may reduce the expected education level in the area, it may be the only solution due to a lack of public land or teachers.

Figure 14 demonstrates a comparison among travel distance options considering minimum number of new allocated facilities. The travel and total costs decrease when the distance constraint is tightened. The result implies that when more new facilities are needed to satisfy the constraint, link improvement becomes less beneficial. On other words, the road link upgrading with high quality level would contribute slightly to minimize the total cost unless the number of new allocated facilities is restricted.

Figure 14: Comparison among Travel Distance Options



The sensitivity analyses show that many rural road links of Puok network are not likely cost-effective to be upgraded with high engineered standards. The results from this research study are same as what is stated by Howe and Richards (1984): “Where poverty reduces the local demand for mechanized transport to nearly zero and where there are few animals to draw wheeled vehicles, the best-engineered road in the world will have little more merit than a footpath. But if rural productivity

is high enough to generate effective household demand for truck and bus transport, then the effect of transport cost reductions may be colossal.” In case there is a significant growth in motorized transport used in the district resulted from economic development such as increasing in agricultural productivity, many links should be upgraded to a higher quality.

Another important remark is that the model is in favor to build many small-scale facilities such as small-size school classrooms at different village nodes rather than constructing big-scaled ones at any village nodes. These findings are also parallel to what is explained by Howe and Richards (1984): *“Lower mobility costs should increase enrolment. However, there is little doubt that throughout rural areas of the developing world children walk to school. Better roads may be immaterial if passenger transport is too costly. Thus more schools, even if small (and usually larger schools are better equipped), maybe more useful than more roads.”*

CONCLUSION

In developing countries, among the development of agriculture, industry, electricity power and above all, the provision of an adequate rural transportation system are ones of the basic needs. Rural infrastructures, including road networks and public facilities, are recognized as necessary ingredients for rural development. In this paper, we have studied the problem of designing an optimal rural public infrastructure to provide better services to rural residents. Throughout sensitivity analyses, an effective process for optimizing the resource allocation to public infrastructures improvement is identified. Having defined a specific objective and a set of constraints, the formulated model can be solved to optimality by searching for an optimal combination value of the decision variables (link upgrading and facility allocation). The model demonstrates its applicability in a typical rural network of Cambodia. In rural areas with low population density in developing countries, investment in many small-size facilities distributed among villages along with provision of a good basic earth road seems to be the most cost-effective approach. Improving rural road with high quality standards would not be more beneficial unless there is a high rural productivity.

The proposed model coping with the design of rural infrastructure is expected to be a useful tool to invest the restricted public resources efficiently to achieve economic goals in the developing nations such as Cambodia. However, the model is not intended to replace management decisions but rather to provide information to aid decision-making. The model is going to provide the decision makers with useful information of the rural infrastructure investment to explore the validity and effectiveness of capital allocation. Moreover, it is necessary to determine realistic constraints (e.g.

maximum total number of new facilities) and appropriate parameters (e.g. unit facility cost) for real model application.

The computational experiments lead to the main conclusion that the optimal budget depends on relative cost of link improvement and facility location when the optimal configuration of the road network is determined endogenously. The sensitivity analyses clearly revealed that links improvement with superior levels is likely not to affect the value of the objective function unless the improved link benefit is much bigger than its cost. Potential benefit of link improvement would include reducing transport costs and lower facility investments.

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THE GARMENT INDUSTRY IN CAMBODIA:
ITS ROLE IN POVERTY REDUCTION
*THROUGH EXPORT-ORIENTED DEVELOPMENT**

Yamagata, Tatsufumi[†]

INTRODUCTION

The garment industry has been the main engine of the Cambodian economy since the mid-1990s. Garments are the country's biggest export making up about three-quarters of total exports, and the industry is a symbol of the country's dynamism in the world economy. The industry is also the main non-agricultural formal sector creating employment opportunities for the poor. The greater part of the workforce is women, less educated, that have migrated from rural areas. Thus, the garment industry is seen as contributing to poverty reduction in Cambodia by providing employment opportunities with higher wages for the poor who would otherwise be engaged in low-wage economic activities in rural areas.

There was lively discussion about the survival of Cambodia's garment industry prior to the final phase out of the Multi-Fiber Arrangement (MFA) on 1 January 2005 which was expected to greatly intensify competition in the international garment market. One of the most influential forecasts was that of a WTO discussion paper (Nordås [2004]), which predicted that that only China and India would gain from the MFA phase out and that Cambodia and other smaller garment suppliers would lose out. Fortunately, there was no immediate collapse of the industry in Cambodia. Garment exports to the United

* This is a report of the main results from a field survey of the export-oriented garment industry in Cambodia. The survey was conducted in 2003 by the Institute of Developing Economies (IDE) in cooperation with LIDEE Khmer, the Council for the Development of Cambodia (CDC), the Cambodia Investment Board (CIB), and the Garment Manufacturers Association in Cambodia (GMAC). The author would like to give special acknowledgement to His Excellency Suon Sithy (CIB Secretary General) and Ray Chew (the former manager of GMAC) for providing their complete cooperation. The field survey was led and supervised by Sau Sisovanna and Hing Thoraxy. The team leader was Phauk Samrech. Dav Ansan, Heng Bunsong, Mak Huch, Preap Manel, Seng Piseth, and Krouch Say were excellent assistants. Saint Lundy directed data processing, and Shina Matsuura (an IDE Research Fellow) also participated in the field survey. This research project could not have been completed without the cooperation of all these people. The dataset collected for this paper is available at <http://www.ide.go.jp/English/Publish/Dp/Abstract/062.html>. Finally, the author is grateful to Naoko Amakawa, Naomi Hatsukano, Satoru Kobayashi, Yukiko Sakanashi and participants of seminars at the Cambodian Economic Association, the Economic Institute of Cambodia and the IDE for their useful comments on the Japanese version of this paper.

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States grew throughout 2005, while those to EU declined only slightly. However, the prospects for the industry in Cambodia are not certain and the future trend in garment exports needs to be watched.

Despite its importance and predominance as the leading modern and internationalized industrial sector in Cambodia, there has been little research done on the garment industry at the firm level, while research on garment workers has attracted the most attention (Engquist [2001], Forder [1999], Hall [1999]). Bargawi [2005], Hach, Huot and Boreak [2001], Knappe [2002], and Konishi [2003] have analyzed the structure and features of production in the industry by surveying some factories. However, the coverage of the sample firms in these research works has been limited; therefore they do not provide a comprehensive picture of the structure of garment factories based on a substantial sample size.

This paper is based on a firm survey conducted from August to October 2003 covering 164 export-oriented garment-manufacturing firms. The sample size represented 84 percent of the total number of members firms in the Garment Manufacturers Association in Cambodia (GMAC), which is the sole industrial association of export-oriented garment manufacturers in Cambodia. Although the total membership of GMAC is 196 firms, this figure includes those that have closed down, but remained registered members. Therefore, the data set covers most of the export-oriented garment-manufacturing firms operating in 2003. Thus, this data set can provide comprehensive statistics on Cambodia's export-oriented garment industry which have been derived from the information of individual firms not available in the existing literature. With this data set the impact of the garment industry's development on poverty reduction in Cambodia can analyze more thoroughly by examining such factors as: worker remuneration based on sex, job category and experience; female workers as a share of the labor force; the frequency of promotion; the required level of education; and hours worked. Moreover, the prospects for the industry can also be examined by investigating firm profitability; the characteristics of managers; sources of capital; and the scale of firms.

The main conclusions of this study confirm the substantial impact that employment in the garment industry has had on poverty reduction in Cambodia. Firstly, female workers, especially in certain job categories, make up the predominant share of the labor force, and workers earn wages that are far higher than the poverty line. Secondly, barriers to employment and promotions up to a certain level of job categories are not high in terms of educational attainment and experience. Thus, employment in the garment industry is a wonderful job opportunity for rural women who otherwise would be engaged in low-wage economic activities.

Another finding concerned the profitability of the export-oriented garment firms. The profitability of a typical firm in the sample was high, although the variation in profits-to-sales ratio was also great. This high average profitability could help the industry to survive the intensified competition that has come with the end of the MFA.

The remaining sections of paper are as follows. Section 2 looks at the institutional background of the garment industry in Cambodia. Import restrictions imposed by the United States and Canada were critical determinants of the quantity of garment exports from Cambodia, while labor standards supported by the United States and the International Labour Organisation (ILO) dictated wage and working conditions. Section 3 forms the core of this paper, presenting the statistical results derived from the field survey. The final section summarizes the main findings and provides some interpretations of them.

DEVELOPMENT OF THE GARMENT INDUSTRY IN CAMBODIA

The textile and apparel industries have led industrialization in the early stages of development in many countries of the world. In general, competition in the international market has been intense, and it has not been rare for latecomers to emerge and often replace the countries where the average wage rate has become too high to be competitive. Most developed countries which have lost competitiveness have imposed quantitative restrictions on the trade in textiles and clothing since the 1950s, although there has been progress in trade liberalization as a whole. The Multi-Fiber Arrangement governed the trade in textiles and clothing from 1974 to 1994. This arrangement was superseded in 1995 by the Agreement on Textiles and Clothing (ATC) under the administration of the World Trade Organization (WTO). The ATC stipulated that all quantitative restrictions on the trade in textiles and clothing were to be phased out, and would be abolished completely by 1 January 2005.

Table 1: Exports of Knit and Woven Garments to the United States

Rank	Origin	Amount (Million US\$)			Rate of Change (%)	
		2003	2004	2005	2003-04	2004-05
	All Countries	62,911	66,875	70,807	6.30	5.88
1	China	8,690	10,723	16,808	23.39	56.75
2	Mexico	7,098	6,845	6,230	-3.56	-8.98
3	Hong Kong	3,732	3,878	3,523	3.93	-9.16
4	India	2,056	2,277	3,058	10.74	34.29
5	Indonesia	2,155	2,402	2,882	11.47	19.99
8	Bangladesh	1,759	1,872	2,268	6.45	21.15
13	Cambodia	1,229	1,418	1,702	15.42	20.06

Source: U.S. Department of Commerce, Bureau of Census.

Note: Knit and woven garments are defined as commodities with HS codes of 61 and 62.

There was serious concern that low income countries, such as Bangladesh and Cambodia, which relied heavily on the garment industry, would suffer from the intense competition expected to be triggered by the complete liberalization of trade in textiles and clothing from the beginning of 2005. The most cited study, published as a discussion paper by the WTO (Nordås [2004]), predicted that China would expand its exports and India would follow, and that the other relatively small exporters would suffer seriously from the competition of these two giants. However, it turned out that some garment-exporting Least Developed Countries (LDCs), such as Bangladesh, Cambodia and Haiti, fared very well throughout the year 2005. Tables 1 and 2 show the trends in garment exports to the United States and EU from the five largest garment exporters and the two leading exporters among the LDCs, Bangladesh and Cambodia. As Nordås [2004] correctly expected, China and India expanded garment exports to the US and EU, the world's two largest markets. However, unlike Nordås' expectation, Bangladesh and Cambodia also increased their exports to the United States during 2005 by more than 20 percent. Though their garment exports to the EU declined between 2004 and 2005, the drops were not significant; and the growth in the same figures by more than 30 percent between 2003 and 2004 surpassed the decline in 2005 (Table 2). As a whole, the sum of garment exports to the two largest markets grew by 2.54 percent for Bangladesh and

by 11.06 percent for Cambodia in 2005. Since the US and EU are going to be imposing new restrictions on textile and garment imports from China for at least a couple of years, exports from that country will slow down, making room for the remaining garment exporters to increase growth. Thus, the prospects for Cambodia to continue expanding its garment exports are encouraging.

Table 2: Exports of Knit and Woven Garments to the EU

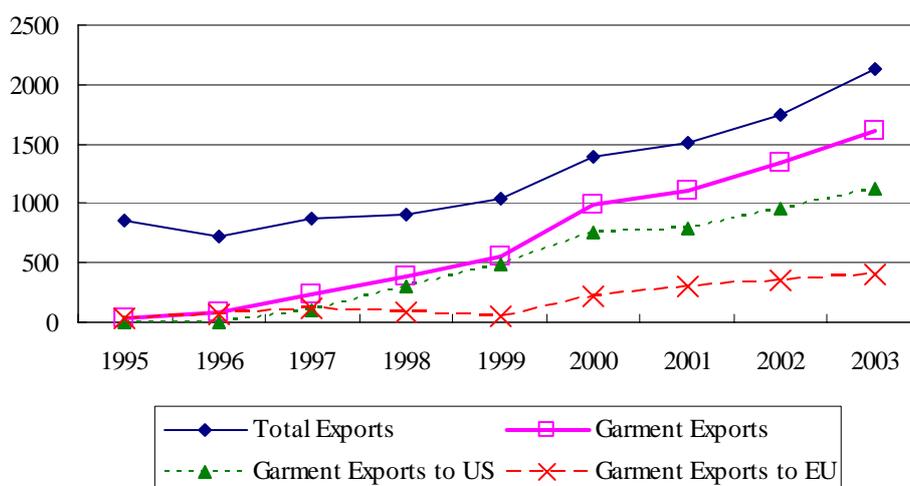
Rank	Origin	Amount (Million US\$)			Rate of Change (%)	
		2003	2004	2005	2003-04	2004-05
	All Countries	56,918	65,552	69,642	15.17	6.24
1	China	10,913	13,714	20,334	25.66	48.27
2	Turkey	8,112	9,348	9,790	15.24	4.72
3	Bangladesh	3,471	4,578	4,346	31.90	-5.08
4	Romania	4,124	4,572	4,285	10.87	-6.28
5	India	2,599	3,020	3,988	16.23	32.02
19	Cambodia	475	643	587	35.27	-8.77

Source: Eurostat.

Note: The same as for Table 1.

Although Cambodia did not become a member of the WTO until October 2004, its garment exports to the United States had been increasing dramatically since the Asian economic crisis which started in 1997 (see Figure 1). Thoraxy [2003] showed that this was due to the large-scale inflow of foreign direct investment into the country's export-oriented garment industry. With the surge in garment imports from Cambodia, the United States started negotiations with the Cambodian government. The two countries concluded a trade agreement on textiles and apparel in 1999, which set down quantitative restrictions on exports of textiles and garments from Cambodia to the United States.

Figure 1: Growth of Garment Exports (million US dollar)



Sources: (1995-2001) Hach and Acharya [2002], Table 3.4, p. 19; (2002-2003) Sothea and ach [2004].

In the agreement import ceilings, *i.e.* quotas were assigned item by item, and were conditional on Cambodia meeting decent labor standards in its garment producing factories. The agreement stipulated that quotas allocated to factories with low labor standards would be withdrawn. The local office of the ILO was assigned to carry out surprise inspections of all export-oriented garment factories to detect those violating the stipulated labor standards (ILO [2001, 2002a, b, c, 2003a, b]). As a result, the agreement was rigorously enforced.

One of the issues the ILO inspections focused on was compliance with regulations on minimum wages. Table 3 shows the regulations according to the status of workers. They stipulate that regular workers are entitled to earn the equivalent of or more than US\$45 per month. As will be explained in the next section, this wage rate is considerably higher than that earned by entry-level workers employed in typical garment factories in Bangladesh, another garment exporter among the LDCs. Cambodia's minimum wage regulations are strictly enforced through monitoring by the ILO, and the minimum wage rate is binding for garment factories in the country.

Table 3: Monthly Minimum Wage by Status of Worker (US dollars)

	Apprentice worker	Probation worker	Regular worker	Casual worker
Contract period	3 months at most	2 months at most	No requirement	No requirement
Minimum wage	30	40	45	45

Source: ILO [2001, 2002a, b, c, 2003a, b].

Most of the labor standards which must be in accordance with ILO inspections originated in the Labor Code of the State of Cambodia enacted in 1992, and the Kingdom of Cambodia Labor Code which superseded the former in 1997. However, despite the wide coverage of ILO inspections, there are still many factories which do not satisfy the labor standards (Hall [1999]).

STATISTICAL PROFILE OF THE GARMENT INDUSTRY IN CAMBODIA

Because the United States and Canada imposed quotas on most textile and apparel items imported from Cambodia until 1 January 2005, export-oriented garment factories had a strong incentive to belong to the Garment Manufacturers Association in Cambodia (GMAC) where membership was a *de facto* condition to receive quotas for exporting to the United States. Thus being a member of GMAC became synonymous with being an export-oriented garment firm. As of August 2003 the number of GMAC member firms was 196, although some of them had closed down without notifying GMAC. Therefore, the actual number of export-oriented firms operating in 2003 was less than 196.

All member firms are requested by GMAC to notify the number of workers and amount of capital. Table 4 provides statistical figures on the number of workers in each GMAC member firm. It can be seen that the average number of workers is large and that the standard deviation is also great. The figure for the average is 903, while the median is 559. The range between the minimum number of workers, 18, and the maximum, 9500, is enormous and the standard deviation is a large 1098. These figures are more impressive when compared with the same variables of a corresponding industrial association in Bangladesh. The corresponding figures for the Bangladesh Garment Manufacturers and

Exporters Association (BGMEA), which is the largest industrial association for export-oriented garment production in Bangladesh, are juxtaposed with those for Cambodia in Table 4. Bangladesh garment exports are roughly four times greater in US dollar terms than those of Cambodia, which is reflected in the large number of member firms in the BGMEA compared with that for GMAC: 3115 members for the former compared with 196 for the latter.. However, the average number of workers in BGMEA member firms, 399, is less than half of the 903 average for GMAC members, while the standard deviation in the number of workers for the former is far smaller than that for the latter. In other words, there are many small firms exporting garments in Bangladesh, while a small number of large factories are engaged in export-oriented garment production in Cambodia.

Table 4: Number of Firms and Workers in the Export-oriented Garment-producing Industry in Cambodia and Bangladesh

	Cambodia	Bangladesh
Number of firms	196	3,115
Number of workers: Mean	903	399
Number of workers: Median	559	313
Number of workers: Maximum	9,500	7,600
Number of workers: Minimum	18	18
Number of workers: Standard Deviation	1,098	373

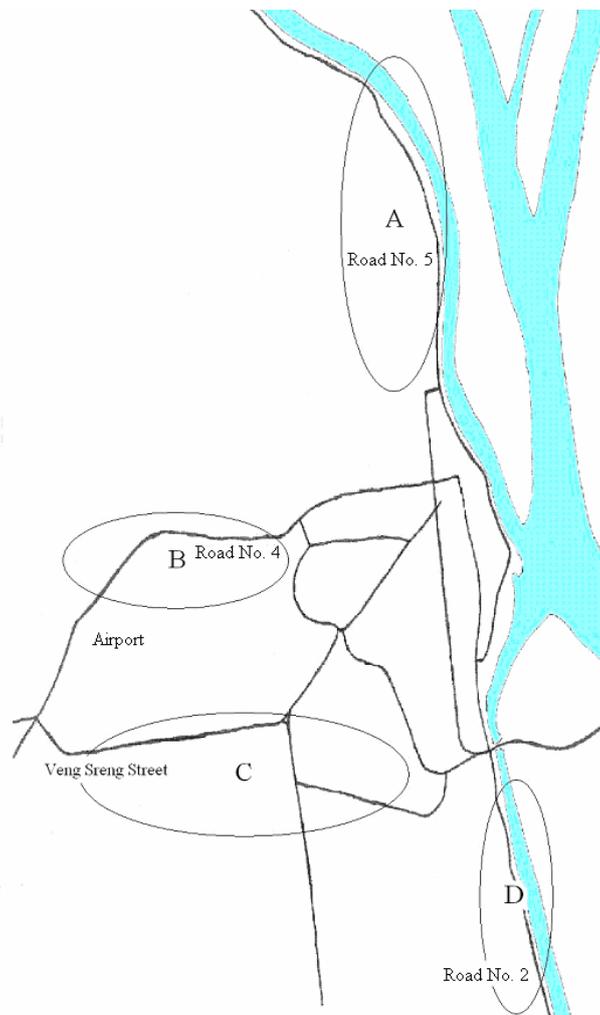
Note: *The figures are based on the firm membership lists of: the Garment Manufacturers Association in Cambodia (GMAC) and the Bangladesh Garment Manufacturers and Exporters Association (BGMEA). GMAC is the sole industrial association of export-oriented garment manufacturers in Cambodia, while the BGMEA is the largest association of garment manufacturers and exporters in Bangladesh. That country also has another association, the Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA), which consists of around 600 member firms for knitwear. Some firms are members of both the BGMEA and BKMEA. The mean, median, maximum, minimum and standard deviation shown above are derived from data on 194 firms in Cambodia and 2891 in Bangladesh which provided data on the size of their workforce..*

Source: *GMAC, data as of August 2003; BGMEA [2003].*

It is interesting that Cambodia and Bangladesh, two rising stars among the LDC garment exporters, exhibit quite dissimilar features as shown in Table 4. It would be worthwhile, therefore, to scrutinize details of the garment producing firms in Cambodia, which are not available from the data collected by GMAC. This study will examine aspects of production, employment, capital accumulation and management in order to shed light on the prospects for the garment industry and its impact on poverty reduction in Cambodia. No other studies to date have provided information on the above-mentioned aspects of the industry using a reasonably substantial number of sample firms. GMAC collects data on only a small number of variables, and the collected figures are not often updated. Moreover, though there are some in-depth studies highlighting a small number of firms, such as Hach, Huot and Boreak [2001], Knappe [2002], and Konishi [2003], those using a large number of samples are few. A survey on the investment climate in Cambodia conducted by the World Bank was used in Batra, Kaufmann and Stone [2003]. This seems to be the only study with interviews conducted at a number of firms using a structured questionnaire. However, since this study covered many industries, the questionnaire used for the survey was not designed to focus on garment production.

The present study is based on a field survey conducted by the Institute of Developing Economies in cooperation with the LIDEE Khmer, a research-oriented NGO in Cambodia. To the author’s knowledge this is the first survey focusing specifically on the production and management of the garment industry in Cambodia using a sizable sample of firms and a structured questionnaire.¹ The field survey was conducted between August and October 2003, which was after a general election. Fortunately, there was no disturbance due to the post-election turmoil. With the cooperation of the Council for the Development of Cambodia (CDC), the Cambodia Investment Board (CIB) and GMAC, the survey team attempted to visit all the firms listed by the CDC and GMAC. As a result, 164 questionnaires were collected and confirmed to be valid. The sample size represented 70.1 percent of all firms registered with GMAC. Since some firms had closed down by the time of the field survey, the actual coverage was higher than 70.1 percent. All flow variables were as of fiscal year 2002, *i.e.* January - December 2002, while all stock variables were as of the end of December 2002. The following sections present the results from analyses of the data collected above.

Figure 2: Areas in Phnom Penh and Its Vicinity Where Garment Factories Are Concentrated



¹ The questionnaire is attached as Appendix 2.

Firm Locations

The lists of firms maintained by the CDC and GMAC show that most of the export-oriented garments producing firms are located in Phnom Penh Municipality and Kandal Province (Table 5). Firms located in other areas, such as Krong Preach Shihanouk, account for no more than 10 percent of the total. There are four sub-regions in the Phnom Penh Municipality-Kandal Province area where export-oriented garment producing firms concentrate. These are: the area along Road No. 5, the Toukok area and along Road No. 4, the Steung Meanchey area and along Veng Sreng Street, and the area along Road No. 2. Almost an equal number of firms are located in each of the four sub-regions. (Table 5; see Figure 2 for the exact locations of the four sub-regions.) Table 5 shows that survey samples were collected almost proportional to the distribution of GMAC member firms.

Table 5: Geographical Distribution of Export-oriented Garment-producing Firms

Province	Symbol	Location	All GMAC members	Sample Size
Phnom Penh and Kandal	A	Road No. 5	51	41
	B	Toukok and Road No. 4	53	38
	C	Steung Meanchey and Veng Sreng Street	55	44
	D	Road No. 2 (Phnom Penh and Kandal)	52	34
Sihanoukville			8	7
Kompong Cham			3	0
Kompong Spue			1	0
Not recorded			11	-
Total			234	164

Management

One aspect of the management of export-oriented garment producing firms in Cambodia that was thoroughly reflected in the field survey is that most of the top managers are foreign nationals. The questionnaire asked interviewees to answer who “the (real) most influential decision-maker” is in order to identify the top manager, whatever her/his actual position is. Then, attributes of the decision-maker were asked.

Table 6: Geographical Origin of Top Managers

Country/Region	Number of firms	%
Cambodia	13	7.93
China	50	30.49
Taiwan	35	21.34
Hong Kong	25	15.24
South Korea	12	7.32
Singapore	6	3.66
Malaysia	5	3.05
United States	4	2.44
Other	14	8.53
Total	164	100.00

Table 6 shows the distribution of top managers by their geographical origin, while Table 7 shows their ethnic identity. The greatest numbers of top managers had Chinese nationality. Thirty percent of top managers came from mainland China, while 15 percent and 21 percent were from Hong Kong and Taiwan, respectively. Those from South Korea, Singapore, Malaysia and the United States follow in that order. Only 8 percent of top managers were of Cambodian nationality. By ethnic identity, around 77 percent of top managers answered that they were Chinese whatever their geographical origins. These statistics demonstrate that ethnic Chinese manage the export-oriented garment industry in Cambodia.

Table 7: Ethnic Identity of Top Managers

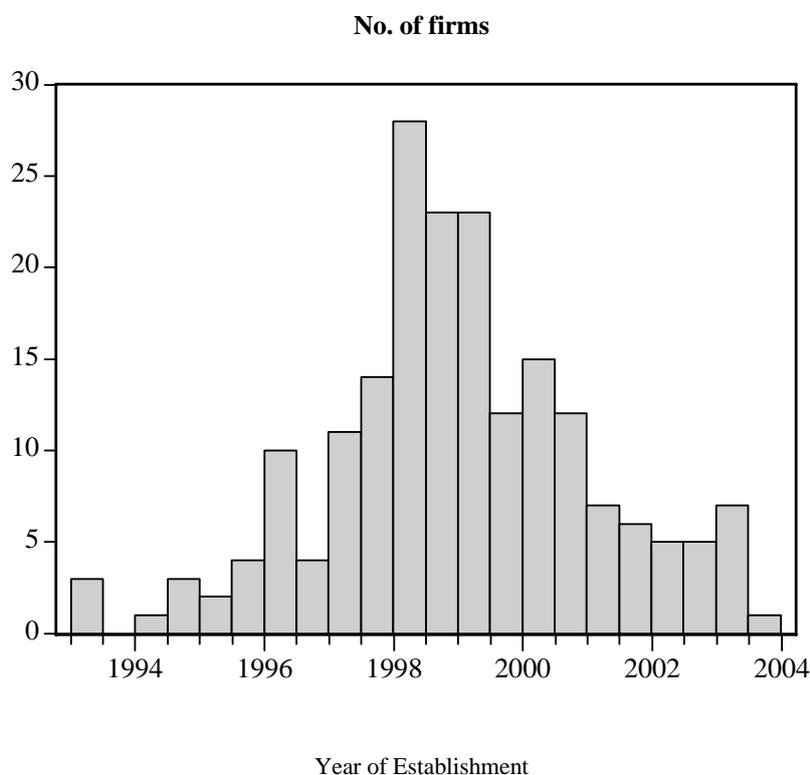
	Number of firms	%
Cambodian	13	7.93
Chinese	126	76.83
Korean	12	7.32
Malaysian	5	3.05
Other	8	4.87
Total	164	100.0

Note: Information was derived from the answers to question 5.5 of the questionnaire. “Taiwanese” and “Hong Kong” identities were provided by respondents. The provided category in the questionnaire was “Chinese.” with no further subcategory breakdown.

More than 90 percent of top managers had attained education beyond high school (Table 8). More than a quarter had obtained a master’s degree including MBA. Regarding work experience, more than a quarter of these top managers had worked for other textile-related firms, but the majority of them had not worked for any other firms before. Their average age, which happened to be equal to the median, was 47.0 years old with 4.7 years service for the current firm on average (Table 9). Their average duration of working in the garment business was 14.6 years.

Table 8: Educational Attainment and Work Experience of Top Managers

Education	Number of firms	%	Work Experience	Number of firms	%
High school	11	9.4	None	92	57.1
Vocational school	43	36.8	Previously employed in other textile firms	44	27.3
textiles-related	11	9.4	Previously employed in non-textile firms	8	5.0
engineering	6	5.1	Government official	8	5.0
College	12	10.3	Other	9	5.6
University (B.A.)	19	16.2	Subtotal	161	100.0
Master's	32	27.4			
MBA	15	12.8			
Subtotal	117	100.0			
No answer	47		No answer	3	
Total	164		Total	164	

Figure 3: Distribution of Firms by Year of Establishment

Source: GMAC.

The average length of business operations for the surveyed firms was a short 4.7 years, reflecting the fact that the majority of firms currently in operation were established only in recent years. Figure 3 shows the distribution of firms registered with GMAC by their year of establishment. The

figure is based on data collected by GMAC. About 85 percent of currently operating firms started business after 1997, while the peak year for setting up operations was 1998.

Table 9: Age and Work Experience of Top Managers

	Age	Tenure in the firm	Years worked in garment business
Mean	47.0	4.7	14.6
Median	47.0	4.0	13.0
Maximum	72	20	42
Minimum	28	0	0
Standard deviation	9.6	3.0	9.3

According to many interviewees, the reason for starting operations around that time was because neighboring countries had suffered severe economic stagnation brought on by the Asian economic crisis that broke out in 1997. Cambodia was less affected by the crisis, so many multinationals engaged in the garment business shifted their production sites to the country. This development is all the more impressive when the political situation in Cambodia at that time is taken into account. In 1997 there was a coup d'état which caused not only serious political turmoil but also property damage to some of the garment factories. One factory owner in an interview said that all the sewing machines in his factory were stolen or destroyed during the disturbances. Despite such circumstances, however, a great amount of capital flowed into Cambodia's garment industry.

Table 10: Status of Firms

Status	Number of firms	Number of subcontracting firms
Holding company	9	1
Subsidiary	93	74
Independent	62	44
Total	164	119

The majority of firms said they were subsidiaries with 73 percent of them working as subcontractors (Table 10). Most impressively, more than 90 percent of the firms stated that they had not borrowed any money from outside. Table 11 shows that 148 of the surveyed firms answered that their ratio of capital to assets was 100 percent.²

² It should be noted that those answers were likely not based on their balance sheets, and that the respondents gave rough figures of their ratios; therefore the values should be taken as estimates. However, the answers were given by responsible managers (see Table A2 in Appendix 1 for the positions held by interviewees in the sample firms); therefore the figures given are considered to be more or less true.

Table 11: Distribution of Firms by Ratio of Capital to Assets

Ratio	Number of firms	%
25-49%	2	1.2
50-74%	4	2.5
75-99%	7	4.3
100%	148	91.9
Subtotal	161	100.0
No answer	3	
Total	164	

Table 12 provides a general overview of the ownership of export-oriented garment producing firms. It shows that the majority of firms are 100 percent foreign-owned. One hundred twenty-five firms confirmed that they were 100 percent owned by foreigners, and 7 firms said they were joint ventures with Cambodians. Only 14 firms were owned wholly by Cambodians. The table shows clearly that Chinese capital has contributed the most substantially to Cambodia's export-oriented garment industry. Thoraxy [2003] endorses the importance of foreign direct investment for the industry.

Table 12: Distribution of Firms by Source of Capital

	100% foreign capital	Joint venture with Cambodian	Total	%
Hong Kong	40	3	43	32.6
Taiwan	31	0	31	23.5
China	19	1	20	15.2
Joint ventures set up with capital from Hong Kong, Taiwan, China and other foreign countries	4	1	5	3.8
Korea	8	1	9	6.8
Singapore	3	0	3	2.3
Europe and United States	7	0	7	5.3
Southeast Asia (Indonesia, the Philippines, and Thailand)	3	0	3	2.3
No answer	10	1	11	8.3
Subtotal	125	7	132	100.0
Only Cambodia			14	
No answer			18	
Total			164	

Production

A main feature of the export-oriented garment industry in Cambodia is that most firms do not produce fabrics and instead specialize in making garments from imported fabrics. Table 13 shows that 87.4 percent of the sample firms engaged in only sewing fabrics and making final products. This feature contrast with Bangladesh, another outstanding garment exporter among the LDCs. Bakht *et al.* [2006] point out that the majority of knitwear producing factories in Bangladesh are vertically integrated and undertake the weaving of fabrics and the making of garments from the fabrics knitted in-house. In Bangladesh vertical integration was promoted by strictly applying the rule of origin set down in the Generalized System of Preferences (GSP) offered by the EU. In other words, in order to receive a preferential tariff exemption from the EU in accordance with the GSP, Bangladesh began encouraging vertical integration from the middle of the 1990s. Although a similar system has been applied to Cambodia as an LDC and knitwear is a major category of garment export, Cambodia has not responded as Bangladesh has.

Table 13: Distribution of Firms by Production Process

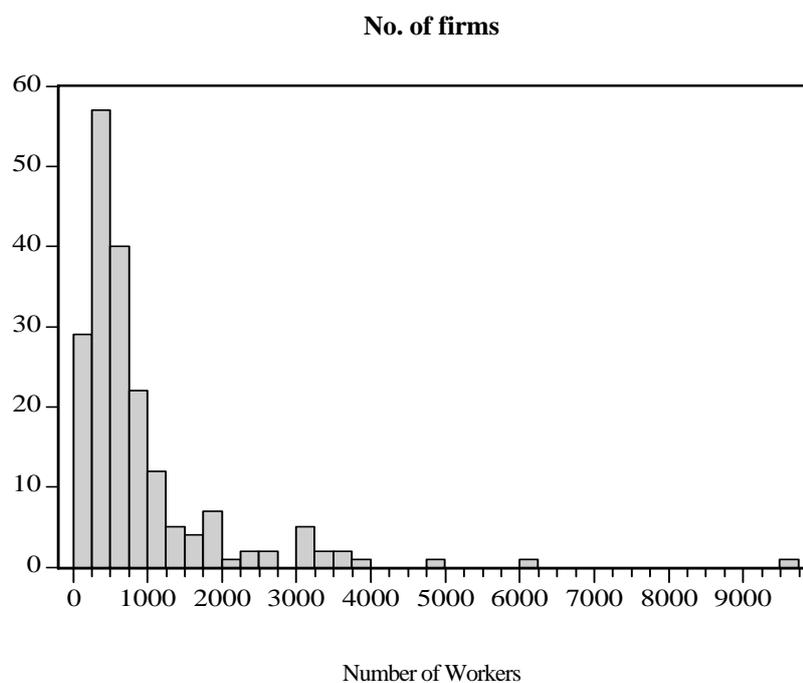
Process 1	Process 2	Number of firms	%
Sewing	-	139	87.4
	Knitting fabrics	4	2.5
Knitting sweaters or socks	-	7	4.4
	Dyeing	2	1.3
Knitting fabrics		3	1.9
Dyeing only		1	0.6
Other		3	1.9
Subtotal		159	100.0
No answer		5	
Total		164	

Regarding the size of export-oriented garment producing firms, the distribution is polarized between a small number of large firms and a large number of small firms. Table 14 shows the distribution of sample firms in terms of their amount of sales. The size distribution by the number of workers is also available in the data held by GMAC, which is shown in Table 4 and Figure 4. The skewness of the size distribution is evident in Figure 4.

Table 14: Distribution of Firms by Value of Sales

Sales (Million US dollars)	Number of firms	%
1	20	13.7
5	58	39.7
10	38	26.0
20	14	9.6
30	3	2.1
40	2	1.4
50	5	3.4
100	4	2.7
150	0	0.0
200	1	0.7
250	1	0.7
Subtotal	146	100.0
No answer	18	
Total	164	

Regarding the intensity of operation, in 2002 the majority of firms operated for 10 hours per day on average running one shift (Table 15), the 10 hours consisting of 8 hours of regular work time and 2 hours of overtime. Only 17 firms ran multiple shifts. Since the statutory overtime wage rate is set at twice the regular wage, and since this regulation is relatively strictly enforced in Cambodia, firms are likely to avoid a night shift and to reduce working hours.

Figure 4: Distribution of Firms by Number of Workers

Source: GMAC.

Finally, the industry exhibits high profitability as a whole. Figure 5 shows the distribution of sample firms by their ratio of profits to sales³. It shows that the majority of the sample firms exhibit positive profits, and that a typical firm generates profits as high as 20-30 percent of sales⁴. On the other hand, a high variation in the ratio can also be observed. There are a considerable number of sample firms that exhibit negative profits. Moreover, the standard deviation of the ratio is 35.58 points. Therefore the coefficient of variation exceeds unity. A similar profile of high profitability and wide diversity is shared with the export-oriented garment industry in Bangladesh (Bakht *et al.* [2006]).

Table 15: Distribution of Firms by Operating Hours and Shifts

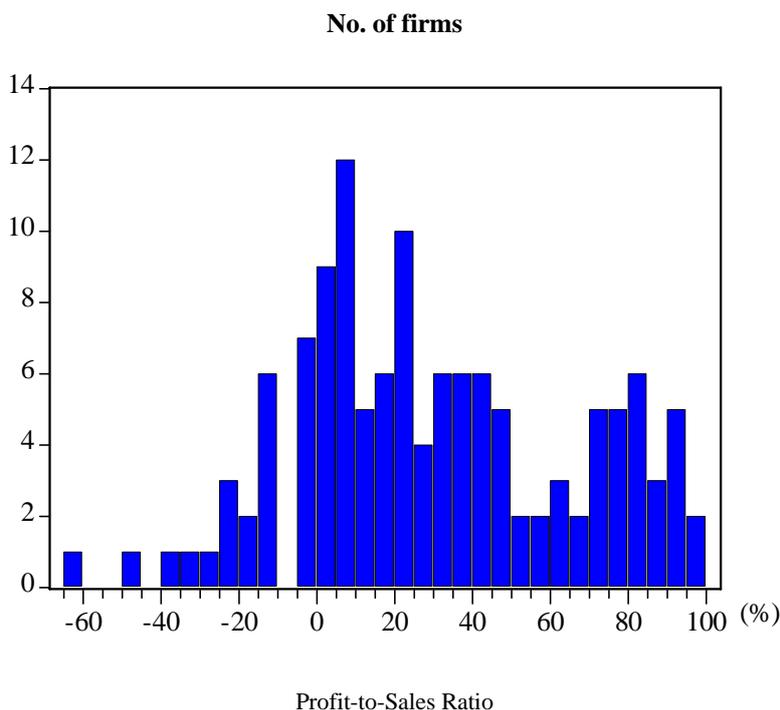
# of hours \ # of shifts	1	2	3	Total
8	43	0	0	43
9	1	0	0	1
10	89	0	0	89
11	1	0	0	1
15	0	2	0	2
16	0	8	0	8
17	0	1	0	1
18	0	1	0	1
20	0	1	0	1
24	0	0	4	4
Total	134	13	4	151

Note: There were firms that did not answer, so the total number of firms is less than 164.

³ Profits are defined as sales minus costs for materials and energy, costs for other intermediate inputs, wages and salaries, insurance payments, interest on loans, and rent for buildings and land. Costs for machinery and taxes are not taken into account. In this sense, the profits as defined in this paper should be regarded as “gross profits before taxes.” Any questions on tax payments are so touchy to the garment producing firms that they were not included in the questionnaire.

⁴ Precisely speaking, the mean and median of the profits-to-sales ratio are 30.2 percent and 24.9 percent, respectively. The sample size for this diagram was reduced to 127 firms due to the elimination of samples with insufficient information (18 firms) and negative value added (19 firms).

Figure 5: Distribution of Firms by Profits-to-Sales Ratio



Note: The sample size for this diagram was reduced to 127 firms due to the elimination of samples with insufficient information (18 firms) and with negative value added (19 firms). The mean and median of the profits-to-sales ratio are 30.20 percent and 24.90 percent, respectively. The standard deviation is 35.58

Employment and Wages

Table 16 shows the number of workers employed by production section, job category, work experience and sex. The sample firms employed 147,000 women and 21,000 men. As mentioned above, the export-oriented garment producing firms in Cambodia tend toward specializing in the final making process of wearing apparel. The composition of the workforce reflects this tendency with 87.6 percent of the total workforce in the sample firms allocated to the garment section where garments were made from imported fabrics or sweaters and socks were knitted from imported yarn. There were relatively fewer workers engaged in other production sections such as knitting, weaving, dying and finishing fabrics. The median length of work experience for workers ranged from one to five years according to the factory managers of the sample firms.

**Table 16: Total Number of Workers Employed at the Sample Firms
by Section, Job Category, Work Experience and Sex**

	Experience Category	<1 year		1-5 years		6 years<		Total	
		Male	Female	Male	Female	Male	Female	Male	Female
Administration Section	Managers/Executives	27	11	281	137	96	40	404	188
	Other Officers	44	113	765	1,156	111	110	920	1,379
Garment Section	Engineers	18	6	337	62	24	1	379	69
	Supervisors	25	242	663	2,683	132	563	820	3,488
	Quality Controllers	43	1,002	365	6,039	20	589	428	7,630
	Operators	795	11,726	11,107	86,889	373	12,697	12,275	111,312
	Helpers	285	1,806	1,117	5,411	312	1,575	1,714	8,792
Other Production	Engineers	3	0	27	6	1	0	31	6
	Supervisors	6	3	137	364	21	107	164	474
	Quality Controllers	4	93	96	1,366	7	30	107	1,489
	Operators	370	1,302	2,345	9,611	274	787	2,989	11,700
	Helpers	4	121	360	380	21	37	385	538
Total		1,624	16,425	17,600	114,104	1,392	16,536	20,616	147,065

An important feature of the export-oriented garment industry in Cambodia is the very high ratio of female workers. Table 17 shows the ratio of women by production section and job category; 87.7 percent of the total workforce in the sample firms is female. The ratio was particularly high in the garment section. Engineers were more likely to be male than female, as were executives and managerial staff. This high reliance on female labor in Cambodia's export-oriented garment industry is the same as it was for the garment industry in other Southeast Asian countries two and three decades earlier (Pang [1988]). The development of the industry empowers women economically by providing them with large-scale employment opportunities that also pay a markedly high wage rate (as will be discussed below). This has been confirmed by some studies on rural households in Cambodia (Amakawa [2004] and Kobayashi [2004]). One caveat concerns the high number of women supervisor. To a certain extent this was due to the immigration of Chinese female supervisors from subsidiaries located in other countries. According to interviewees at some firms, many supervisors were Chinese women who had long term experience in the garment industry before coming to Cambodia. Therefore, the large number of female supervisors does not necessarily mean that there is much scope for Cambodian female operators and quality controllers to be readily promoted to supervisors.

Table 17: Ratio of Female Workers

	Category	Ratio (%)
Administration Section	Managers/Executives	31.8
	Other Officers	60.0
Garment Section (Sewing and knitting sweaters/socks)	Engineers	15.4
	Supervisors	81.0
	Quality Controllers	94.7
	Operators	90.1
	Helpers	83.7
Other Production Sections (weaving fabrics, dyeing, and finishing)	Engineers	16.2
	Supervisors	74.3
	Quality Controllers	93.3
	Operators	79.7
	Helpers	58.3
Total		87.7

In general, garment workers in Cambodia earn relatively high wages. The average earnings are far higher than those of garment workers in Bangladesh where per capita income is higher than in Cambodia. In 2004 the per capita gross national income in Bangladesh was US\$440, while in Cambodia it was US\$320 (World Bank [2005]). But the garment workers in the latter are better paid. The wage rate for an entry level garment worker is around twice as higher in Cambodia than in Bangladesh, as will be pointed out below.

Table 18 shows the monthly wage profile in US dollars⁵ as constructed from interviews with managers in garment factories in Cambodia. Each cell under the male and female categories contains three figures: the first is the mean of the monthly earnings averaged among firms employing the concerned category of employees; the second is the median of the monthly earnings among the firms; and the third figure in parentheses is the number of firms employing the concerned category of employees. One of the focal categories is “helpers in the garment section with less than one-year experience,” which is the job category for entry level workers. As Table 3 indicates, US\$45 is the monthly minimum wage for regular workers, and most of the firms answered that they pay that amount. Thus the mean and median of the wage for entry level workers are both US\$45.⁶ This contrasts with the equivalent of US\$21-23 that UNIDO [forthcoming] reports was the average monthly earnings in 2003 for a garment-section helper in Bangladesh with less than one year experience.⁷

⁵ US dollars are widely circulated in Cambodia, and as mentioned above the minimum wages are also defined in US dollars. Therefore, all interviewees provided figures of wage rates in terms of US dollars.

⁶ Readers may wonder whether the managers exaggerated the amount of wages paid. But casual observations confirmed the amount was true in the case of the garment industry in Cambodia.

⁷ Bakht *et al.* [2006] also confirm the same level of monthly earnings for helpers with less than one-year experience in the knitwear industry in Bangladesh in 2001.

Table 18: Monthly Wage by Section, Job Category, Work Experience and Sex

	Experience Category	<1 year		1-5 years		6 years<	
		Male	Female	Male	Female	Male	Female
Administration Section	Managers/Executives	605	383	770	473	738	493
		500	200	400	300	474	300
		(15)	(7)	(73)	(32)	(22)	(12)
	Other Officers	127	134	149	138	150	167
		120	120	140	120	120	145
		(21)	(38)	(128)	(136)	(18)	(16)
Garment Section (Sewing and knitting sweaters/ socks)	Engineers	173	328	185	189	331	75
		120	328	125	185	150	75
		(9)	(2)	(42)	(12)	(7)	(1)
	Supervisors	142	101	127	117	238	208
		73	65	100	90	225	200
		(10)	(20)	(83)	(120)	(14)	(21)
	Quality Controllers	57	70	93	87	248	138
		50	48	70	70	240	110
		(7)	(26)	(54)	(122)	(6)	(14)
	Operators	54	51	59	57	67	59
		45	45	50	48	65	45
		(39)	(66)	(97)	(141)	(11)	(22)
Helpers	45	46	51	50	48	51	
	45	45	45	45	50	45	
	(13)	(30)	(54)	(94)	(3)	(8)	
Other Production Sections (knitting fabrics, dyeing, and finishing)	Engineers	203	-	256	143	200	-
		229	-	250	100	200	-
		(3)	(0)	(13)	(3)	(1)	(0)
	Supervisors	271	177	117	124	236	96
		270	225	80	90	250	85
		(4)	(3)	(42)	(51)	(8)	(5)
	Quality Controllers	90	72	109	78	172	146
		90	50	80	73	130	100
		(2)	(7)	(23)	(54)	(3)	(4)
	Operators	54	53	58	58	74	73
		45	45	50	50	70	70
		(17)	(23)	(69)	(73)	(8)	(9)
Helpers	50	56	52	54	56	54	
	48	50	45	48	50	50	
	(4)	(6)	(33)	(36)	(4)	(5)	

Note: The first figure in each cell is the mean of monthly wage

Monthly earnings equal to US\$45 for an entry level worker is very high relative to the standard of living in Cambodia. In fact, this amount of earnings is far above the estimated poverty line for Cambodia. The food poverty line in 1999 for Phnom Penh was US\$0.45 per day and was US\$0.35 for the country's rural areas; the overall poverty line for Phnom Penh and the rural areas was US\$ 0.63 and was US\$0.46 per day, respectively⁸ (Council for Social Development [2002]). Multiplied by 30 days, the food and overall poverty lines per month for Phnom Penh in 1999 was US\$13.50 and US\$18.90, respectively. Thus, monthly earnings of US\$45 for a garment section helper are more than three times higher than the food poverty line for Phnom Penh. The greatness of this wage still remains even when taking into account the number of a worker's dependent family members. According to the Population Census of Cambodia, the country's dependency ratio was 86.1 percent in 1999. This meant that one person between the ages of 15 and 64 fed on average 0.861 persons of younger and/or older age. In other words, one economically active person fed roughly one dependent family member on average. Clearly US\$ 45 is far greater than the amount of income needed for two persons to live above the overall poverty line in Phnom Penh. Therefore, employment as an entry level worker in the export-oriented garment industry is poverty reducing.

Another interesting feature of the wage structure in the garment industry in Cambodia is that the difference in earnings between operators and helpers is not great. For example, the average monthly earnings of a male operator in the garment section with less than one year of experience is US\$54 which is only 20 percent higher than the earnings of a helper with the same length of experience. This moderate wage difference between helper and operator contrasts with that in the garment industry of Bangladesh. Bakht *et al.* [2006] and UNIDO [forthcoming] point out that a helper with less than one-year experience earns the equivalent of US\$21-23 while an operator with the same length of experience receives US\$32-35, a wage difference of 40-65 percent. Thus, the wage rate increases less when promoted from helper to operator in Cambodia than in Bangladesh. For workers categorized as "other officers" in Table 18, which designates office employees below the level of manager, the level of earnings for such employees in both Cambodia and Bangladesh is nearly the same. Finally, it is evident from Table 18 that there is very little increase in earnings for helpers and operators from length of experience unless they are promoted to higher job categories. In other words, the rate of return for job-specific accumulated experience is low for garment section helpers and operators.

⁸ These estimates are based on Cambodia's Social Economic Survey 1999. The food poverty line is the amount of expenditure for "2,100 calories of energy per day with a small allowance for non-food items such as shelter, and clothing" (Council for Social Development [2002], p. 31). The overall poverty line incorporates additional basic needs.

Table 19: Job Categories and the Minimum Education Level Required by Firms

Education Level	Supervisors	Quality controllers	Operators	Helpers
No requirement	108 (65.9)	119 (72.6)	139 (84.8)	144 (87.8)
Primary	6 (3.7)	8 (4.9)	14 (8.5)	13 (7.9)
Lower secondary	21 (12.8)	19 (11.6)	10 (6.1)	7 (4.3)
Higher secondary	26 (15.9)	17 (10.4)	1 (0.6)	0 (0.0)
Bachelor's or higher	3 (1.8)	1 (0.6)	0 (0.0)	0 (0.0)
Total	164 (100.0)	164 (100.0)	164 (100.0)	164 (100.0)

Note: Figures in parentheses are the percentage of the total number of sample firms.

Entry barriers in terms of educational attainment for people seeking employment in the garment industry are not high. The employers do not expect a high level of education for factory-floor garment workers. Table 19 indicates that most firms do not set any educational level requirements for helpers and operators. Table 20 shows that the average level of education for these categories is primary schooling.⁹ Although more than half of the sample firms stated that for supervisors and quality controllers, the average level was lower secondary schooling. One caveat that came out in the interviews was that many of the firms required job applicants to take a written examination prepared by the firm, and, it seems that some of the firms scrutinize the ability of potential workers directly from the results of their company-made examination rather than from educational attainment.

⁹ Hach, Huot and Boreak [2001] also pointed out the low level of education characterizing garment workers in Cambodia. They stated that the level of education of more than 60 percent of their sampled workers was only primary schooling (*ibid.*, p. 52).

Table 20: Education Level by Job Category

Education Level	Supervisors	Quality controllers	Operators	Helpers
Primary	16 (9.8)	31 (19.0)	131 (80.4)	138 (87.9)
Lower secondary	89 (54.6)	95 (58.3)	28 (17.2)	17 (10.8)
Higher secondary	49 (30.1)	34 (20.9)	4 (2.5)	2 (1.3)
Bachelor's or higher	9 (5.5)	3 (1.8)	0 (0.0)	0 (0.0)
Sub total	163 (100.0)	163 (100.0)	163 (100.0)	157 (100.0)
No answer	1	1	1	7
Total	164	164	164	164

Note: Figures in parentheses are the percentage of the total number of sample firms.

Finally, according to the interviews, the average duration for a helper to become an operator was 10.1 months; the median was 6 months (Table 21). This implies that managers of export-oriented garment factories anticipate that a typical worker hired as a helper is likely to be promoted to operator within a year after her/his joining the company. Thus, promotion from helper to operator does not seem to be so difficult.

Table 21: Number of Months for a Helper to be Promoted to Operator

Mean	Median	Standard Deviation
10.1	6	14.1

Note: The sample size for this variable was 89 firms.

In sum, a female worker in Cambodia can get a job in a garment factory paying a high wage rate even without a high level of educational attainment. Then, after she gets a job as a helper, she is likely to be promoted to an operator within one year. In this way an ordinary female worker in Cambodia can increase her earnings through employment in the garment industry and can raise herself and members of her family out of poverty.

Investment Climate

The investment climate in Cambodia is generally seen as unfavorable because of inconsistently enforced taxes and regulations, immature financial market, political instability, corruption, crime and poor infrastructure (Batra, Kaufmann, and Stone [2003], World Bank [2004]).

Table 22: Interviewees Opinion about Paying Speed Money

	Do you think speed money to government officers is inevitable in order to procure materials smoothly?	Do you think the average level of speed money has increased for these five years?
Yes	146	54
No	18	110
Total	164	164

Table 22 reveals how serious the problem of governance is in Cambodia. Of 164 questionnaire responses, 146 answered that the payment of so-called “speed money” to government officials was unavoidable in order to expedite and smooth the procurement of materials. In effect, almost 90 percent of respondents considered that bribery was necessary whether or not the respondent herself/himself paid speed money. Moreover, around a third of respondents thought that the average amount of speed money had increased between 1999 and 2003. Table 23 shows the range in the amount of speed money paid per container that respondents regarded as necessary in order to process imported fabrics through customs.¹⁰ While 43 respondents out of the 164 stated that no extra money was necessary for the purpose, the remaining respondents stated that payments of speed money were necessary. The average amount paid was US\$171.4, while the largest amount a respondent claimed to have paid was US\$1,500.

Table 23: Distribution of Firms by the Amount of Speed Money Paid per Container to Expedite the Importing of Fabrics

Amount (US\$)	Number of firms	Amount (US\$)	Number of firms
0	43	301-400	6
1-100	27	401-500	3
101-200	40	501-600	3
201-300	38	601 or more	4

Note: The mean, median, maximum and standard deviation of the amount of speed money paid are 171.4, 150, 1500 and 191.4. The sample size was 164 firms.

The government has endeavored to carry out export-promotion policies. These policies have been ones adopted by most developing countries, such as tax deductions on export earnings and tariff exemptions on imported machinery. Two thirds of the sample firms said they took advantage of the tax deductions for exports, while more than 85 percent of them said they received tariff exemptions on imported machinery.

¹⁰ According to one respondent, the size of the most typical container is 40 feet long and able to hold eight to ten tons of fabrics.

Table 24: Utilization of Tax and Tariff Advantages for Export-Oriented Firms

	Tax deductions on export earnings	Tariff exemptions on imported machinery
Firms utilizing	107	142
Firms not utilizing	57	22
Total	164	164

In general, the investment climate in Cambodia has not been particularly favorable even though the country has attracted foreign direct investment into the garment industry. The country's physical and institutional infrastructure is poorly developed. Problems of governance still create serious challenges in many areas of development activities. Moreover, export promotion policies for the garment industry, the country's most important manufacturing sector, are not impressive. If these impediments and shortcoming are improved, Cambodia will attract more investment from abroad.

CONCLUDING REMARKS

This paper has presented basic statistical information on a large number of firms operating in Cambodia's export-oriented garment industry in order to examine the industry's contribution to poverty reduction and the features of the industry that have enabled it to remain internationally competitive in garment production since the end of the MFA.

The industry contributes to poverty reduction in Cambodia by providing employment for the poor at markedly high wages. The wage rate for entry level workers is largely in compliance with the statutory minimum wage. Female workers are employed far more than males in the main job categories. Moreover, a high level of education is not required for worker to be employed, and promotions from the entry-level job category of helper to the next category of operator are not very difficult. Thus, employment in the industry offers wide scope for the poor to substantially increase their earnings.

The industry is also competitive in exporting to the two main world markets, the United States and EU. It survived liberalization of the market after the MFA was phase out at the beginning of 2005. The competitiveness of the industry at present is confirmed by the data collected in 2003 for this paper. The profitability of a typical firm is high, although the variation in the profits-to-sales ratio is also great. This high average profitability might be a factor for the industry's ability to cope with the intensified competition after the MFA phase out. The great variation in profitability is also consistent with the serious concerns that people involved in the export-oriented garment business had about the prospects of the industry before total liberalization in January 2005.

The development of Cambodia's export-oriented garment industry as a labor-intensive industry that is contributing to poverty reduction is much like that of Bangladesh and the development of its export-oriented garment industry (Bakht *et al.* [2006] and UNIDO [forthcoming]). This pattern of poverty reduction led by the development of a labor intensive industry was pursued earlier by neighboring East Asian countries (Amjad [1981], Pang [1988]). However, there is a significant difference between the two patterns. Bangladesh and Cambodia are realizing the development of their

industry without any strong government industrial promotion policies, whereas the earlier countries experienced a great deal of government promotion and intervention in industrial development (Amsden [1989], Komiya, Okuno and Suzumura [1988], Wade [1990], World Bank [1993]). The pattern of poverty reduction through industrialization in Bangladesh and Cambodia is new and impressive in the sense that a part of the East Asian pattern of development is being reproduced without strong government promotion. It indicates that even without this promotion, competitiveness of labor-intensive industries on the strength of low wages (by international standards even though high by domestic standards) can be powerful enough to overcome impediments cause by deficient infrastructure and weak governance.

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APPENDIX 1

SAMPLING METHOD

The Institute of Developing Economies conducted a survey of export-oriented garment producers in Cambodia from August to October 2003 in cooperation with LIDEE Khmer (Ligue des Etudiants Khmers de l'Etranger), a research-oriented Cambodian NGO. The Council for the Development of Cambodia (CDC), the Cambodia Investment Board (CIB) and the Garment Manufacturers Association in Cambodia (GMAC) also cooperated fully with the project. Although conducted right after a general election, the survey work suffered no serious disruption due to political disturbances.

The survey team made every effort to visit all the firms listed by GMAC and all the firms registered by the CDC as garment manufacturers. The number of firms successfully interviewed is displayed in Table A1. About 30 percent of the firms listed by the CDC or GMAC were not part of the final sample group, either because they had closed down before the survey or they did not answer the questionnaire.

**Table A1: Total Number of Listed Firms and
the Number in the Survey Sample**

	Total	Sample
Firms listed by the CDC	221	159
Firms listed by GMAC, but not listed by the CDC	10	2
Firms listed by neither, but found during the survey	3	3
Total	234	164

Since export-oriented garment factories are concentrated in Phnom Penh and Kandal Province encompassing Phnom Penh, the survey was undertaken mainly in these two areas. Seven firms out of eight GMAC member firms located in Sihanoukville were also interviewed, although four GMAC members located in Kompong Cham and Kompong Spue were not visited. On the whole, the overall geographical distribution of the GMAC member firms was well represented in the survey sample, as shown in Table 5.

Table A2: Job Positions of Interviewees

Positions	Number of firms	%
General Managers	58	35.4
Chiefs of Administrative Section	30	18.3
Shipping Managers	18	11.0
Assistants to the General Manager	18	11.0
Other managers	40	24.4
Total	164	100.0

Whenever possible the interviews were conducted using either the English or Khmer version of the questionnaire. The English version is shown in Appendix 2. Interviews were sought primarily with the general manager of a firm as long as she/he was agreeable to the interview. Where it was not agreeable, or where the general manager spoke neither Khmer nor English, as with some of the Chinese general managers, then the survey team interviewed the firm's administration section chief, shipping manger, assistant to the general manager or other person in a managerial position. In all of these latter cases, the people had been directed by the general manager to handle our interviews, and the answers given by these subordinates were with the approval of the general manager.

The dataset is available at <http://www.ide.go.jp/English/Publish/Dp/Abstract/062.html>.

APPENDIX 2
QUESTIONNAIRE INSTITUTE
OF DEVELOPING ECONOMIES

3-2-2 Wakaba, Mihama-ku, Chiba-shi, 261-8545, Japan
and LIDEE Khmer 428, Street 271, Phnom Penh, Cambodia

The purpose of this survey is to better understand the current situation of garment producing firms and to promote garment production in Cambodia. Information of your company will be treated as strictly confidential and the information you provide will be used for research only. Neither your nor your company's name will be used in any document prepared based on this survey. This questionnaire is supposed to be filled by a single factory. If your company has multiple factories, please fill in separate answer sheets for other factories.

Schedule No. /_/_/_/_/

1. BASIC INFORMATION

Name of the Company _____

Legal Status of the Company _____

Codes: 1 = Sole Proprietorship; 2 = Partnership; 3 = Private Limited Company; and 4 = Public Limited Company

ADDRESS

Office: _____

Factory: _____

Telephone

Fax

Office: _____ Office: _____

Factory: _____ Factory: _____

E-Mail _____

Contact Person: Name _____ Designation _____

(It is ideal that the contact person fills this questionnaire.)

2. HISTORY OF THE COMPANY

2.1. Year of establishment of the company _____

2.2. Year in which operation started _____

3. COMPANY CHARACTERISTICS

3.1. Independent Holding Company Subsidiary

Name of the Group (if applicable) _____

3.2. Subcontractor (CMT) Yes No

4. SOURCES OF FINANCE

4.1. What was the ratio of equity to debt of your company by December 2002? (adds to 100%) Equity _____% (100%=family____%; other domestic____%; foreign _____% [country _____])
Debt _____%

4.2. What were the sources of debt of your company by December 2002? (adds to 100%)
Financial Institutions _____%, Informal _____%, Others _____%

4.3. In which month does your company's fiscal year begin? month _____

5. MANAGEMENT

5.1. Who is the real most influential decision-maker on business of your company?
Name _____ Designation _____ Age ____ (in Years);
Academic Qualification (Exam Passed) _____ Previous Occupation _____;

Code: 1: Same company in lifetime; 2: employee in other textile firm;

3: employee in other non-textile firm; 4: government officer;

5: others (specify _____)

5.2. How long has s/he been involved in your company? _____ years

5.3. How long has s/he been involved in garment industry? _____ years

5.4. What is her/his nationality? _____

5.5. What is her/his ethnic origin? _____

5.6. Are there any foreigners whose ethnic origin is not Cambodia permanently stationed in your company? Yes No

5.7. Whom are the foreigners in charge of negotiation with for your company?

(Multiple check is OK)

Government local companies 100% foreign-owned companies in Cambodia

Joint Ventures with foreign companies Companies located abroad

6. PRODUCTION

6.1. Which production process does your company undertake? Circle the number of the applicable item(s).

1. Knitting Fabrics; 2. Knitting Sweaters/Socks; 3. Dyeing;

4. Sewing (T-shirts, Polo-shirts, Woven Shirts, Blouses, etc.)

5. Other (specify) _____

6.2. Production Level (FY2002)

6.2.1. Knitting Fabrics

Types of Fabrics	Fabrics Produced		Yarn Used		
	Quantity (kg)	Price (US\$/kg)	Country of Origin	Quantity (kg)	Price (US\$/kg)

Fabrics Type. 1: Single Jersey; 2: Rib; 3: Fleece; 4: Pique; 5: Lacoste; 6: Interlock; 7: Others

6.2.2. Dyeing

Fabrics Dyed		Fabrics Used			Dye Used		
Quantity (kg)	Price (US\$/kg)	Country of Origin	Quantity (kg)	Price (US\$/kg)	Country of Origin	Quantity (kg)	Price (US\$/kg)

6.2.3. Knit and Woven Garments

Types of Garments	Goods Produced		Material Used			
	Dozens	Price per Dozen	Main Material (yarn or fabrics)	Quantity (kg)	Country of Origin	Price (US\$/kg)

Types of Garments

Knit Garments: 01 T-shirts; 02 Other Shirts; 03 Sweaters; 04 Trousers and Slacks; 05 Ladies' Tops; 07 Dress; 08 Nightwear and Pajama; 09 Underwear; 10 Socks; 11 Other Knit Garments;

Woven Garments: 12 Men's Shirts; 12 Blouses; 14 Trousers and Slacks; 15 Skirts; 16 Dress; 17 Nightwear and Pajama; 18 Underwear; 19 Suit-type Coat; 20 Other Woven Garments.

6.3. Service Delivery: What kinds of companies deliver the following services to your company? Material procurement: (trading company; buying house) [...] [...] [...]

Sales intermediation: (trading company; buying house) _____

Transportation: [...] [...] [...]

Subcontracting out (sewing process): [...] [...] [...]

Legal consultancy [...] [...] [...] Accounting [...] [...] [...]

Banking [...] [...] [...]

Codes: 1. local companies; 2. 100% foreign-owned companies in Cambodia; 3. Joint Ventures with foreign companies; 4. Companies located abroad.

7. MARKET

Where did your company supply garments for 2002?

Types of Garments	Sold		
	To Which Country	Quantity	Total Value Amount

Types of Garments: See legends in the section 6.2.

8. EQUIPMENT

Type and Number of Equipment: What kind of and how many knitting machines did your company have at the end of December 2002? Please fill the following table for all machines in operation by their type and vintage.

No.	Type	Numbers	Country Made	Year Made	Year Bought	Purchase Price	Operation Rate (%)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Code: Sewing machines: 01=Straight lockstitch; 02=Over lock; 03=Others;

Knitting machines: 11=Circular Knitting; 12=Flat Knitting; 13=Socks Knitting; 14=Linking,

15= Others,

Other machines: 21=Generator; 22= Dyeing; 23=Printing; 24=Fabrics Finishing; 25= others

9. EMPLOYMENT, WAGE LEVEL AND WORKING CONDITIONS

9.1. Employment: How many workers of the following categories were employed on average in FY2002? (the number of part-time employees in parentheses)

(.....persons)

	Experience Designation	less than 1 year		1-5 years		6 years +		Total	
		male	female	male	female	male	female	male	female
Administration Section	Managerial/Executive								
	Other Officers								
Garment Section (Sewing and knitting sweaters/socks)	Engineer								
	Supervisor								
	Quality Controller								
	Operator								
	Helper								
Other Production Sections (knitting fabrics, dying, and finishing)	Engineer								
	Supervisor								
	Quality Controller								
	Operator								
	Helper								

9.2. Change in Employment: How many workers have increased/decreased for last three years? + / -- _____ persons

9.3. Wage Level: What were the average monthly wage rates of the following categories of workers in FY2002?

(US\$.)

	Experience Designation	less than 1 year		1-5 years		6 years +		Average	
		male	female	male	female	male	female	male	female
Administration Section	Managerial/Executive								
	Other Officers								
Garment Section (Sewing and knitting sweaters/socks)	Engineer								
	Supervisor								
	Quality Controller								
	Operator								
	Helper								
Other Production Sections (knitting fabrics, dying, and finishing)	Engineer								
	Supervisor								
	Quality Controller								
	Operator								
	Helper								

9.4. Incentive Payment in Wage:

Performance Bonus Yes (Share in total remuneration ___ %) No

Attendance Bonus Yes (Share in total remuneration ___ %) No

9.5. Change in Wage: By how much percentage has the wage for a first-year helper changed for last three years? + / -- _____%

9.6. Working Days: How many days in FY2002 did your company operate? _____ days

9.7. Working Hours: How long did a typical worker work in each shift (including overtime) on average in FY2002?

(hours)

	Shift A	Shift B	Shift C
Knitting section (e.g. fabrics, Sweater, Socks)			
Sewing Section (Other knit and woven garments)			
Dyeing Section			

10. SKILL OF WORKERS

10.1. Educational Requirements: Is there any educational requirement for employees in you company?

Supervisor ___ Quality controller ___ Operator ___ Helper ___

Code: 0. No requirement; 1.Primary; 2. Lower secondary; 3. Higher secondary; 4. Bachelor or higher

10.2. What is the average educational level?

Supervisor ___ Quality controller ___ Operator ___ Helper ___

Code: 1.Primary; 2. Lower secondary; 3. Higher secondary; 4. Bachelor or higher

10.3. Training: Does your company have any training scheme for employees?

Formal in-house training How often? _____ times/year; How long? ___ days

Formal outside training How often? _____ times/year; How long? ___ days

No formal training scheme

10.4. Promotion:

How many current supervisors in the sewing section were sewing-machine-operators before they became supervisors? ___ persons

How long does it take for a helper to be promoted to a sewing-machine-operator on average? ___ months

11. PROBLEMS IN BUSINESS

11.1. Delay in Delivery: How many times have you experienced delay in material delivery for last three months? _____ times

11.2. Delay in Payment: On average, how many days does it take to collect payment for your sales? _____ days

11.3. Blackout: How many days did your company experience an electric power failure in working hours for three months? _____ days

11.4. Problems in enforcement of contracts: Suppose a contract between your company and other legal entities is broken. Then, who will be in charge of settling the problem on behalf of your firm? _____

Codes: 1. manager: foreigner; 2. manager: Khmer; 3. agent: foreigner; 4. agent: Khmer

11.5. Government:

11.5.1. Who will be in charge of negotiation with the government on the issues like licenses, taxes, quotas, etc.? _____

Codes: 1. staff: foreigner; 2. staff: Khmer; 3. staff foreigner and Khmer

4. Agent: foreigner; 5. agent: Khmer, 6. agent foreigner and Khmer

11.5.2. How many days does your company spend to petition the government to secure complete export documentation? _____ days

11.5.3. Do you think speed money to government officers is inevitable in order to procure materials smoothly? Yes No

11.5.4. How much speed money do you think is reasonable as speed money when a garment producing company imports a container of fabrics from abroad? _____ US\$

11.5.5. Do you think the average level of speed money has increased for these five years? Yes No

12. POLICY RELATED ISSUES

12.1. Was the advance income tax deduction on export earnings applied to your company during FY2002? Yes No

12.2. Was tariff exemption on imports of capital machinery for export-oriented sector applied to your company during FY2002? Yes No

12.3. Were any preferential interest rate to export oriented sectors applied for loans granted to your company during FY2002? Yes No

13. PROSPECTS AFTER MFA FADE OUT

13.1. Do you feel any influences due to MFA fade out after 2004 right now?

Yes No; If yes, what is that?

Drop in orders; Withdrawal of foreign partners; M&A; Others

13.2. Do you have any plans at this moment to cope with MFA fade out?

Yes No; If yes, what is that?

Dispose of equipment; Lay-off workers; M&A; Increase in sales in domestic market;

Increase in investment abroad; Others _____

14. FLOW DATA FOR 2002

Items	Value (US\$)
A: Gross Value of Output	
B: Industrial Costs	
B1: Costs of Materials (yarn, fabrics, etc.)	
B2: Costs of Fuel and Electricity (production)	
B3: Wage and Salary for workers	
C: Non-industrial Costs	
C1: Utilities (water/telephones)	
C2: Transportation	
C3: Office Supplies and Facilities	
C4: Insurance Payment	
C5: Interests	
C6: Rent	
C7: Others	

Name of the Field Investigator _____ Date /_/_/_/_/_/_/_/_/