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Baseline Survey for Socio-economic Impact Assessment: Greater Mekong Sub-region Transmission Project



HING Vutha, SAING Chan Hang and KHIENG Sothy

Working Paper Series No. 70

August 2012

A CDRI Publication

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ISBN-10: 99950-52-65-2

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Layout and Cover Design: Oum Chantha

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Acronyms and Abbreviations

ADB	Asian Development Bank
ATT	Average Treatment on the Treated
CBMS	Community-based Poverty Monitoring System
CSES	Cambodia Socioeconomic Survey
EAC	Electricity Authority of Cambodia
EDC	Electricité du Cambodge
GMS	Greater Mekong Sub-region
GMS-SF	Greater Mekong Sub-region Strategic Framework
GWh	Gigawatt-hour
HH	Household
kV	Kilovolt (1,000 volts)
kWh	Kilowatt-hour
MFI	Microfinance Institutions
MW	Megawatt
NGO	Non-Governmental Organisation
PMO	Project Management Office
PSM	Propensity Score Matching
REE	Rural Electricity Enterprises
RETA	Regional Technical Assistance
SPSS	Statistical Package for Social Sciences
USD	United States Dollar

ACKNOWLEDGEMENTS

This report represents a new piece of work in the area of programme evaluation conducted by a CDRI study team which received general supervision from Dr Hossein Jalilian, director of research, and financial support from Asian Development Bank (ADB). The authors and CDRI would like to express their genuine gratitude to ADB for its generous support to this project.

The authors would like to thank Dr Khan Murshid, RETA team leader, for general technical guidance and advice, and Dr Jim Knowles and Dr Asadul Islam, RETA technical advisors, for their valuable intellectual assistance in propensity score matching technique. The authors are grateful to Dr Tong Kimsun, programme coordinator for his useful ideas and comments on the concept and application of propensity score matching, and to Dr Rebecca F. Catalla, research advisor, for her contribution especially in the inception phase of the research.

The authors would also like to extend special thanks and appreciation to Mr Chhim Man, head of PMO1 at Électricité Du Cambodge (EDC), Mr Yasuhiko Hino, resident engineer for the transmission project, Mr Ouk Nida, senior project implementation officer at ADB and Mr Bun Veasna, infrastructure operations officer at the World Bank for their provision of valuable information during the consultation meetings with the research team.

Last but not least, the authors received very useful assistance in field work preparation from Ms Pon Dorina, and in data processing and data management from Mr Ker Bopha; their valuable contributions are gratefully acknowledged.

ABSTRACT

This research project represents the first baseline socioeconomic survey that CDRI has conducted for the Greater Mekong Sub-region Transmission Project of Asian Development Bank. The study was designed to develop a set of comprehensive baseline demographic, social and economic as well as energy consumption indicators for the project. The tools for data collection were village and household surveys in 27 villages, of which 17 villages are potentially project beneficiaries (treatment group) and 10 are non-beneficiaries (control group). It then used propensity score matching method to predict the probability of household participation (propensity score) in the two groups.

From the matching operation, it produces favourable results for consumption, male adults' study time, and family and children's teaching time, while total income differences of households in the two groups, and income from sources such as crops, common property resources, labour wage and remittance remain statistically significant, albeit reduced. This indicates that after controlling for household and village characteristics, households in the control and treatment groups have similar consumption behaviour, total spending and time allocation for reading and teaching at home. Although the matching operation could not produce better results in terms of household income from different sources, the median bias of the matching operation has been reduced substantially.

The propensity score matching analysis enables us to see if good matches for the treatment households can be found in the comparison sub-sample, and to consider the possibility of dropping some of the comparison households (those with highly different characteristics) from any follow-up survey. After matching, 35 households, which were off-support, were dropped creating the new sample of 709 reduced from 744. For follow-up evaluation study, the research team should refer to after-match sample villages as the study site and it is hoped that the survey costs could be reduced.

INTRODUCTION

1.1 Background

Following the recommendation from the midterm review of the GMS Strategic Framework 2002-2012 (GMS-SF) for the need to establish a system for monitoring and quantifying the poverty impact of GMS projects and programme¹, the Asian Development Bank (ADB) initiated a regional study to assess the socioeconomic effects of the Greater Mekong Sub-regional projects in Cambodia, Laos, Thailand, Vietnam, and Yunnan province of China. The study aims at (i) evaluating the socioeconomic effects of selected GMS projects that are ongoing or have been completed, with a view to providing quantitative estimates where feasible; (ii) constructing data sets with more comprehensive socioeconomic indicators to aid enhanced monitoring and evaluation of outcomes and impacts in subsequent years; and (iii) drawing key policy implications and lessons that could inform the design, implementation, monitoring, and evaluation of sub-regional projects in the GMS (ADB 2008b).

For the Cambodia part of the assessment, ADB has engaged the services of the Cambodia Development Research Institute (CDRI) to undertake a detailed assessment of the following projects and project components: (i) the GMS Communicable Disease Control Project; (ii) the GMS Transmission Project; and (iii) the GMS Southern Coastal Corridor Project.

This report presents the study details and results for the GMS Transmission Project. This project was approved in 2003 and was expected to be completed in 2008. At the time of the conduct of this study, the project was not wholly finished due to some technical difficulties and delay in resettlement. The high voltage transmission line component is complete with a considerable amount of energy being supplied to Phnom Penh, while the bulk supply component remains at the stage of selecting beneficiary villages.

Given the progress status of the project implementation, ADB's technical advisors and the research team agreed in the First Regional Technical Workshop on 22-23 October 2009 in Phnom Penh, Cambodia, to conduct a baseline survey instead of an impact evaluation study. The change prompted the research team to redesign the methodology framework and strategy for a baseline survey.

1.2. Overview of GMS Transmission Project

Project Objectives

The Greater Mekong Sub-region Transmission Project was approved in 2003 for Cambodia to develop its energy sector in response to insufficient supply and limited coverage of electricity in the country. The project has two main objectives. The first is to promote trade and economic growth in the sub-region through the provision of sustainable and reliable electricity at affordable prices to users in Phnom Penh and along the transmission line. This will be achieved by facilitating the import of up to 1,490 gigawatt-hours (GWh) of electricity

¹ ADB (2007), *Mid-Term Review of the Greater Mekong Subregion Strategic Framework (2002–2012)*, Manila (pages 14, 38 and 40)

per year with the construction of a 200 megawatt (MW) capacity high-voltage transmission line from the Vietnamese border to Phnom Penh. The second is to enhance accessibility to power by the poor by promoting a pro-poor policy environment in the sector. This will be achieved through making a 5-ampere connection available to low-use consumers in villages along the transmission line.

Project Components

The project area consists of Takeo and Kampong Speu provinces and the municipality of Phnom Penh and it has two components: infrastructure and bulk supply distribution.

The infrastructure component consists of a high-voltage transmission system comprising a 220 kV double-circuit transmission line connecting to 115 kV lines that will provide the final connection into Phnom Penh. The 109 km 220 kV transmission line runs in a southerly direction from Phnom Penh to the border, within 250 metres of the Phnom Penh-Kampot railway line to Takeo for 59 km and within 2 km of national road No. 2 from Takeo to the border for 50 km. Substations are constructed at west Phnom Penh (connection of the 220 kV line to the 115 kV line) and at Takeo to provide a 22 kV supply to the surrounding areas and to villages along the transmission line route.

The bulk supply distribution component will provide electricity to the villages located within 1 km to both sides of the right-of-way by connecting each village with a 22 kV supply using a single-wire earth-return system. The 22 kV system will run north and south from the Takeo substation and south from the West Phnom Penh substation, and will thus serve the entire transmission line route. The 22 kV system will be operated by Electricité du Cambodge (EDC), which will supply bulk power to a convenient point in each village. Points of distribution to end-users will be constructed and operated by Rural Electricity Enterprises (REE), which will be selected and licensed in accordance with the procedures of the Electricity Authority of Cambodia (EAC).

Project Benefits and Beneficiaries

The GMS transmission project is expected to make electricity more reliable, more affordable and more accessible, especially to the poor. The transmission line component is expected to earn an economic net present value of about USD201.3 million for Cambodia and USD17.9 million for neighbouring Vietnam. In Cambodia, main beneficiaries include EDC, greater Phnom Penh's population, and approximately 14,200 households in Takeo, 5,700 of which are below the poverty line.

Rural Electricity Enterprises (REE) is also expected to gain from this multi-million dollar project by being involved in providing electricity to rural households in small towns and villages along with potentially expanded and improved services. Additionally and indirectly, the project will benefit the population at large through economic growth. According to the economic analysis conducted prior to the implementation of the project, it is estimated that the net economic benefit of the project to Cambodia's poor population will be over USD31.00 million. The bulk supply component is expected to considerably bring down the currently high tariff while improving EDC's services (e.g. wider service coverage, user-friendly billing and improved customer services).

1.3. About the Baseline Survey

Objectives

The overall objective of this baseline survey is to construct a set of comprehensive baseline demographic, social and economic indicators in both beneficiary and non-beneficiary villages for the GMS Transmission Project. These indicators will become an accessible database for the future socioeconomic impact assessment study.

Framework for Baseline Survey

The literature on the economics of energy widely agrees on the significance and contribution of electrification in fostering economic development and improving quality of life. Electricity is needed for (i) *household use*, such as lighting, heating, cooking and other appliances; (ii) *for agricultural use*, such as irrigation and post-harvest processing; and (iii) *for commercial use* such as processing, milling and mechanical energy and process heating. Electricity is also an input to water supply, communications, commerce, health, education and transportation.

At industry level, electrification has stimulated more productive and efficient enterprise by enhancing: (i) complementary infrastructure—such as roads, transport, markets, banks, and adult literacy; (ii) stock of equipment and micro enterprise tools; and (iii) hours of operation (WB 2008a). Electrified communities had a significantly higher number of facilities—post office, restaurant, market, roads, transport, water, school, and health—than the non-electrified communities and a significantly higher percentage of households operating a micro enterprise as their primary or secondary occupation.

At household level, which is the focus of this study, electrification has been claimed to greatly improve the quality of life through positive association with health and education outcomes (Cecelski 2002). Electrification contributes to health improvement through a number of channels including improvements to health facilities, better health from cleaner air as households reduce use of polluting fuels for cooking and lighting, and improved health knowledge through increased access to media such as television and radio. On education benefits, electrification was found to increase the reading time of both adults and children in the household. Children in households with electricity have higher education levels than those without electricity. The main channels through which electrification may affect education are: improving the quality of schools, either through the provision of electricity-dependent equipment or increasing teacher quantity and quality, and time allocation at home, with increased study time.

In line with the Terms of Reference and the general conceptual framework on electrification, this study takes ‘households’ as measurement units to generate baseline social-economic indicator. The impact indicators for the evaluation are classified into three broad categories: demographic, economic and social indicators.

- **Demographic Indicators:** The likely impact of transmission project on demography would be household characteristics, dependency ratio and migration.
- **Economic Indicators:** the transmission project is likely to affect households’ economic status and well-being through income (sources, income’s share of electricity), employment, expenditure, asset ownership, saving and credit. These variables will be measurable indicators for our observation.

- ***Social Indicators:*** the transmission project is likely to affect social status through education and health factors. Electric lighting replaces other fuels and change time use of household members. This will improve indoor air quality and increase study time for children. As a result, education of households' children i.e. year of schooling, attendance, study hours at night, drop out can be improved. On health factor, electricity will increase access to media (TV, radio). This will raise knowledge on crucial public health issues and on health care practices and behavior. The impacts would be improvement in health, nutrition and fertility. The measurable indicators for social impacts include education (year of schooling, attendance, study hours, drop out rate), and health (knowledge on public health issues, health practice and behavior).
- ***Energy Indicators:*** They include energy consumption and expenditure, source of energy, source of electricity, duration of electrification, and willingness to connect and pay for electricity.

METHODOLOGY

The analytical approach outlined below is designed to investigate key characteristics and energy consumption behaviour of households (treatment group) which are potentially most likely to be connected to the grid and located one kilometre along both sides of the transmission line from the Vietnamese border to the capital city, Phnom Penh, passing through Takeo and Kampong Speu provinces, and of households (control group) located in Takeo province and least likely² to be connected to the transmission grid.

The primary aim of the design is to draw up baseline information on households in both treatment and control groups where the transmission line has recently been completed, though electricity has not yet started to flow to households along the grid (according to interview with the EDC officer in charge of ADB project implementation in October 2009). Given resource constraints, the study put all available resources towards analysing one measurement unit, namely the household, using data derived from the household survey. This said, the characteristics and the development of commercial and industrial units in all economic sectors are not investigated in this study.

2.1. Sampling Design

Selecting a truly representative sample for analysis is the backbone of every survey. In this study, several critical challenges arose during the sampling design, one of which was non-availability of information on the names of villages located along the transmission grid. However, two groups of households were identified for the survey. The treatment group consisted of households in the project location (one kilometre on both sides of the grid), while the control group consisted of households living outside the project area and were least likely to be connected to the transmission grid.

Treatment group: As reported in the ADB proposed loan R254-03, approximately 120 villages along the corridor grid are assumed to be within the area pending electrification. Consultations with Electricité du Cambodge (EDC) officers in charge of the project and clarification from the Electricity Authority of Cambodia revealed that a list of these villages has never been produced which made random sampling for the treatment villages impossible. Given the difficulties and time constraints, the team resorted to selecting 17 out of the 120 villages based on consultation with EDC consultants and a report titled “Benefit Monitoring Report” cited in the GMS Transmission Project Inception. Among these 17 villages in Takeo, eight are located in the north, six in the middle, and three in the south of the province. The treatment village selection procedure ensures that by the next round of the survey, households in these villages will have been connected to the grid which would make an impact evaluation feasible.

² Selection of households which are least likely to get connected to the grid was based on consultation with chiefs of the selected villages, location map of the rural electricity enterprises produced by the Electricity Authority of Cambodia (EAP) and project documents from and consultation with Electricité du Cambodge (EDC).

The team used simple random sampling³ to select households in each treatment village that are willing to be connected to the line once electricity starts to flow. Approximately 20 to 40 households from each village were selected, or between 12 to 23 percent of the total population in the 17 villages (See Table A.1 in the Appendix for further details).

Control group: The team faced greater difficulties in selecting a good control group as household characteristics for this group should be similar or close to those in the treatment group. Based on consultations with the ADB officer, as well as existing reports of the transmission project, the study team selected 10 villages in three communes (see Figure A.1 in the Appendix for location details). This is because the three selected communes do not have rural electricity enterprises and villages are located close to provincial roads in the same way that villages in the treatment group are located along National Road No. 2⁴. Figure A.2 in the Appendix shows the location of electricity enterprises in Takeo province.

The team used simple random sampling to select sample households in each control village, similarly with the treatment group. Approximately 20 to 35 households for each village were obtained or around 13.6 percent of the total population in the 10 villages (See Table A.2 in the Appendix for further details).

2.2. Data Collection Method

Primary and secondary data were collected for this baseline assessment. Secondary data were gathered through various consultations with relevant stakeholders, particularly authorities in charge of the project implementation. The primary data collection involved the design and preparation of a structured questionnaire for the household survey, while qualitative information is applied in this analysis.

Face-to-face interviews with the heads of household, who were asked to depict individual members' activities, were performed for both treatment and control household groups. Prior to the interviews, a generic questionnaire was first drafted by adapting questionnaires used in the Cambodia Socioeconomic Survey (CSES 2007) and the Community-based Poverty Monitoring System (CBMS 2008). The generic questionnaire was pre-tested followed by questionnaire revision and finalisation in order to ensure the quality of the data to be collected. The hiring and training of enumerators followed. Three teams, each with four members and one supervisor, were formed based on geographical location. A team of five enumerators was formed for data coding and cleaning using SPSS.

³ In this technique, the survey team randomly picked a bill from a wallet to acquire the last digit of the serial number on the bill. Then, as each village contains a household list with sequential numbers, the last digit of the serial number on the bill was used to select the first household, while the second, third and following households were selected based on the sum of the last digit of the serial number on the note. The interval number (I) was acquired by dividing the household population in the selected village by the total number of selected households in the same village. For instance, if the team wished to select 30 households out of a village with a household population of 150, the interval number is 5 ($I=150/30$). Assuming that the last number of the note is 4: the first selected household is household 4- second selected household is household 9 and the 30th selected household is household 149. It should be noted that the survey team performed this procedure separately for each village.

⁴ It is worth noting that households who have limited or no access to road connection tend to have poorer living conditions than those living close to or having quicker access to national or provincial roads.

2.3. Data Collection Instruments

As previously noted, structured questionnaires were designed for this household survey. The illustration in the next chapter provides a glimpse of the key socioeconomic indicators used for generating baseline information of households in the sample treatment and control groups:

As indicated in the analytical framework in the previous chapter, impact indicators for this baseline assessment are of three broad categories, namely economic, social and demographic. The economic indicators include income sources, employment, expenditures, ownership of assets, and credit. Social indicators include: i) education: number of years of schooling, ability to read and write, and ii) health: knowledge on health issues, health practices and behaviour. The final group of indicators consists of household size, dependency ratio and the like. The generic questionnaire is in the Appendix.

2.4. Estimation Method

In order to ensure the viability of the application of the double-difference method, which had been anticipated by the regional team leader, propensity score matching technique (psmatch2) was applied following data collection and cleaning. Households in the treatment group were compared with those in the control group by using the “propensity score” (the predicted probability of participation given observed characteristics); the closer the score, the better the match. The main objective of this exercise is to obtain two groups of households (control and treatment groups) which are most similar. STATA software was used for the whole analytical process.

KEY SOCIOECONOMIC INDICATORS

3.1. Village Characteristics

The summary of village characteristics below is derived from the village survey. The control group has a total of 2,123 households and a total population of 10,837, 40 percent of which are less than 18 years old. The treatment group has 2,459 households and a total population of 16,626, 44 percent of which are less than 18 years old.

The treatment villages have total agricultural land of 5,146 ha compared to 2,024 ha in the control villages. Translated into agricultural land per household, a family in a treatment village owns 1.6 ha of land compared to 0.9 ha in the control villages. Irrigation system is underdeveloped in both groups' villages. About 32 percent of agricultural land in the control group is irrigated and the ratio is even lower in the treatment group (6 percent). Almost all agricultural land is used for rice cultivation in the control group, but about half of it is used for rice cultivation in the treatment group. Wet season paddy is the most important crop. The second major crops are mango, watermelon, cucumber, pumpkin, banana and cauliflower.

Education facilities remain limited in both treatment and control groups. On average, there is one primary school to every five villages in the control group compared to one primary school for every two villages in the treatment group. The control group and treatment groups have one secondary school each but no high school. Both groups' villages share common problems concerning education including not enough teachers, school budget constraints, not enough places/desks, and no regular classes.

On health services, the nearest health facility in both control and treatment groups is a commune health centre, followed by a pharmacy. Private clinics and the referral hospital are located considerably far from the villages. Health facilities and services that villagers in both groups use for healthcare are of low quality in many aspects. Not enough medicine, poor quality of service, lack of doctors, expensive health services and unsanitary facilities are the general complaints about the health services. Without proper or sufficient health services, people are vulnerable to health problems. In both villages, the most commonly reported health problems are fever, dengue and respiratory diseases (e.g. chronic cough, tuberculosis)

Majority of villages in both groups receive development assistance from both government and NGOs. Interventions have concentrated on agricultural development, infrastructure development, village development committee, and health.

3.2. Demographic Indicators

The average household size in the sample villages is around five persons. Treatment villages appear to have larger households compared to those in the control villages, but the difference is not statistically significant. The average age of the total population is around 30 years old. Household members of working age (between 15 and 59 years old) account for 64 percent in the control group and 63 percent in the treatment group. Members who are too young or too old to work together represent about 17 percent in both control and treatment groups. In terms of age structure by gender, the male to female ratio in every age category

seems to be nicely balanced in three age categories: age 5-14, age 15-29 and age 30-44 in both control and treatment groups.

The dependency ratio, which refers to an age-population ratio of those typically not in the labour force (the dependent part) and those typically in the labour force (the productive part), is found to be quite high in both control and treatment groups. Households in the treatment villages appear to have a higher dependency ratio than the control group at 70 percent and 60 percent, respectively, with the level of difference being statistically significant.

High dependency ratio in both control and treatment groups is largely influenced by the many children not yet of working age in the family. The child dependency ratio is 60 percent in the treatment group and 50 percent in the control group and the level of difference among the two groups is statistically significant. The age dependency ratio is relatively low at 13 percent in the treatment group and 12 percent in the control group and the level of difference is not significant.

Table 3.1: Key Demographic Indicators

	Control group	Treatment group	Overall	Difference	T-Statistics
Average family size	4.99	5.22	5.13	-0.22	-1.59
Average age (year)	31	30	30	1	1.77
Member of working age (%)	64.1	62.6	63.2	-	-
Member not of working age (%)	17.1	16.9	17	-	-
Dependency ratio	60	70	66	-10	-1.99
Child dependency ratio	49	57	54	-8	-1.91
Age dependency ratio	12	13	12	-1	-0.61

Source: CDRI household survey in 27 villages, December 2009

3.3. Economic Indicators

3.3.1. Household occupation

It is traditionally well known that more than two thirds of the Cambodian population are engaged in agricultural activities and live in rural areas. Data from the survey of 27 villages in Takeo province confirms this. At the individual household member level, the primary occupation of more than half of the households in the sample, both control and treatment groups, is in the agriculture, forestry and fishery sector, while around a third of the sample are students. Therein, the share of the number of farmers in the control group is larger than that of the treatment group.

As rural-urban migration is quite common in Cambodia given the limited linkages between the rural and urban economies, villagers living in provinces bordering the capital city—Phnom Penh, where large and medium sized plants and enterprises are located—as in Takeo province would travel to the capital to seek jobs. Data from the survey seem to reflect this fact as a certain number of villagers travel to the city to work as garment and construction workers. It should also be noted that the majority of the workers in the garment industry are women. Because of the geographical proximity of the treatment villages to the national road and the Mekong River, some of the villagers work as vehicle and boat operators, and street vendors in the province.

Table 3.2: Occupation of HH Head and Individual HH Members

Categories	Occupation of household head			Occupation of individual members		
	Control group (%)	Treatment group (%)	Overall (%)	Control group (%)	Treatment group (%)	Overall (%)
Agriculture-forestry-fishery	92.3	83.8	87.2	55.5	46.9	50.3
Garment	0.0	0.2	0.1	4.0	7.6	6.2
Mining-processing	1.0	1.9	1.5	1.2	2.4	1.9
Street vendors	2.4	4.2	3.5	1.6	4.7	3.4
Vehicle-boat operators	0.3	1.9	1.3	0.6	1.3	1.0
Construction workers	0.3	0.9	0.7	0.7	0.9	0.8
Hotel-restaurant	0.0	0.2	0.1	0.0	0.2	0.1
Handicraft-artistic	1.0	1.4	1.3	3.7	0.9	2.0
Students	0.0	0.0	0.0	30.4	31.6	31.1
Others	2.4	5.6	4.3	2.3	3.7	3.1
Total households/individuals	287	431	718	1288	1993	3281

Source: CDRI household survey in 27 villages, December 2009

The occupation pattern of the household head is also similar to that of individual household members except for student occupation as no household is a student. From the survey, the majority of the household heads work in the agricultural sector where around 92 percent in the control group and 83 percent in the treatment group are engaged in agricultural activities. It should also be noted that 32 household heads were unemployed during the survey period as the sample consists of 300 households in control and 45 households in treatment villages. The proportion of household heads in the treatment group working as street vendors and vehicle operators is higher than in the control group. Almost 90 percent of household heads in both groups are own-account workers, while 7.2 percent (treatment) and 3.8 percent (control) are paid employees (see Table A.7 in the Appendix for details). Overall, household heads in the control group tend to be mainly engaged in agricultural activities, while a smaller proportion of those in the treatment group are engaged in farming activities. Household heads in the treatment group tend to be engaged in petty business, vehicle operation and artisan work.

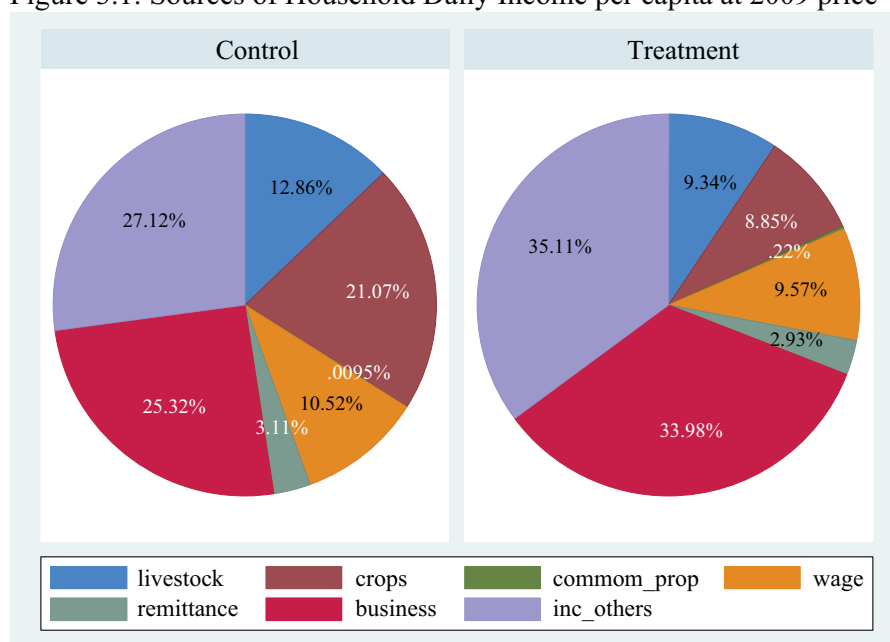
3.3.2. Household income

As Cambodia is an agrarian country, Cambodian rural livelihoods generally depend primarily on agricultural and farming activities as the major source of income. Survey data shows that there are six main sources of household income. Earned income includes income from livestock, crops, common property resources, labour and wages, petty trade and businesses, while unearned income is mainly from remittance, either domestic or from abroad.

By household comparison groups, the patterns of income sources of both control and treatment groups appear somewhat similar, except for income from growing crops and petty business. This reflects the treatment group's geographical proximity to the national roads and provincial town, whereas the control households live in villages at a further distance, but close to provincial roads. Households in both groups earn similar share of income from livestock, common property resources, labour and wages and remittance. Households in the control group earn a larger share of income from crops than households in the treatment group, while households in the treatment group earn a bigger share of income from petty trade and business than households in the control group. On the whole, households in the control group tend to

specialise in crop farming, while households in the treatment group appear to be business-oriented, engaging in petty trade and retail in their individual communities.

Figure 3.1: Sources of Household Daily Income per capita at 2009 price



Source: CDRI household survey in 27 villages, December 2009

Results from testing the mean difference of per capita daily income by source of the two groups show that the mean total income and mean income from other sources, except for income from livestock, of the two comparison groups are statistically different at 1 to 5 percent (Table 3.3). The magnitude of differences does not appear to be substantial for income from livestock, common property resources, wage and labour and remittance, but the magnitude of disparities is bigger for income from crops, business and other sources. The overall mean difference of total income is considerable at around 2,300 riels. In terms of inequality status, the treatment group (Gini: 0.40) tends to suffer more severe inequality than the control group does (Gini: 0.45) (Lorenz curve is presented in Figure A.4 in the Appendix).

Table 3.3: Mean Daily Income per capita by Source (riel price December 2009)

Income sources	Control (n=300)	Treatment (n=444) ⁵	Difference	t-statistics
Crops	1503.77	965.03	538.73	3.12***
Livestock	917.63	1090.53	-172.90	-1.31
Common property	0.67	26.20	-25.53	-2.10**
Wage and labor	750.67	1117.98	-367.30	-2.95***
Remittance	221.88	344.04	-122.15	-2.21**
Business	1806.78	2645.91	-839.13	-2.36**
Others	1935.50	2770.93	-835.43	-2.33**
Total income	5330.14	6314.72	-984.57	-2.26**

Note: Level of significance: *** at 1 percent; ** at 5 percent; and * at 10 percent

Source: CDRI household survey in 27 villages, December 2009

⁵ Total number of households in treatment group has been reduced from 450 to 444 as 6 dropped cases have too high per capita daily income between 50,000 and 150,000 riel (considered to be outliers).

3.3.3. Household consumption

Table 3.3 shows that average total daily per capita household consumption of the treatment group is higher than that of the control group. Mean daily per capita food and non-food consumption of the treatment households are also higher than those in the control group. The difference in total consumption and non-food consumption between the two groups is considerable and statistically significant at 1 percent, while the difference in food consumption of the two comparison groups is small and statistically insignificant. This reflects the fact that households in the treatment group tend to have a better quality of life than those in the control group as households in the control group have less or limited access to education, health, road infrastructure and business or employment opportunities.

Table 3.4: Mean Daily Consumption per capita (riel price December 2009)

Expenditure	Control (n=300)	Treatment (n=450)	Difference	t-statistics
Food and non-food	8619.94	10007.41	-1387.47	-2.88***
Food consumption	4690.55	4908.01	-217.47	-1.35
Non-food consumption	3929.40	5099.40	-1170.00	-3.00***

Note: Level of significance: *** at 1 percent; ** at 5 percent; and * at 10 percent

Source: CDRI household survey in 27 villages, December 2009

Status of inequality in the two groups is somewhat similar and is not severe as the Gini coefficients acquired by applying consumption approach in the control and treatment groups are 0.27 and 0.32, respectively (Lorenz curve is presented in Figure A.5 in the Appendix).

3.3.4. Household housing conditions

By roof condition, survey data (Table A.8 in the Appendix) shows that the proportions of households with a wooden house roofed with tin sheet, and concrete or brick house in the treatment group are larger than those of households in the control group. In contrast, the proportion of households with a wooden house roofed with tiles in the control group is larger than that of households in the treatment group. Surprisingly, the proportion of households with thatched houses in the treatment group is larger than that of the control group.

Table 3.5: Household Dwelling Condition

Housing conditions	Control		Treatment		Total		t-statistic
	mean	n	mean	n	mean	n	
Housing size (m ²)	35.09	300	35.94	450	35.60	750	-0.739
Number of storey	1.05	300	1.10	450	1.08	750	-2.482***
Number of rooms	0.58	300	0.72	450	0.66	750	-2.167**

Note: Level of significance: *** at 1 percent; ** at 5 percent; and * at 10 percent

Source: CDRI household survey in 27 villages, December 2009

In terms of house size in the two groups, there is no significant difference. Although the average number of storeys and average number of rooms of the two groups differ moderately, the differences are statistically significant at 1 and 5 percent, respectively, as shown in Table 3.5 above. Overall, the average housing space in the two groups is approximately 35.6 square metres.

3.3.5. Household land distribution and ownership

The patterns of land distribution of the treatment and control groups are pretty similar as the proportions of landless households, and those with land less than 1 ha, and between 2 and 4 ha in the treatment group are slightly above those in the control group. In contrast, the proportion of households with land above 4 ha in the control group is larger than that in the treatment group, reflecting the fact that households in the control group tend to be more agriculture-oriented (see Table A.9 in the Appendix).

Table 3.6: Average Size of Farm Land to Total Number of Plots by Quintile

Description	Control (mean)	Treatment (mean)	Difference	t-statistic	Mean total
Agricultural land (ha)	1.064	0.948	0.115	1.499	0.995
Agricultural land (ha)					
1st quintile	0.114	0.105	0.009	0.581	0.108
2nd quintile	0.402	0.415	-0.013	-0.999	0.410
3rd quintile	0.695	0.671	0.024	1.533	0.681
4th quintile	1.066	1.061	0.005	0.217	1.063
5th quintile	2.592	2.336	0.256	1.184	2.444

Note: Level of significance: *** at 1 percent; ** at 5 percent; and * at 10 percent

Source: CDRI household survey in 27 villages, December 2009

The overall size of the two groups' agricultural land does not differ markedly. Breaking down agricultural land by quintile, there is evidence of a significant difference in land size between the two groups as indicated in the table above. On land ownership, around 80 percent of the total number of plots in the sample has a land title. However, it should be noted that only around 40 percent of the total number of plots has land tenure from the state, while the other 40 percent has a certificate from local authorities. Additionally, the structures of land ownership of the two groups are somewhat comparable (see Table A.10 in the Appendix).

3.3.6. Durable assets

About 36 percent of respondents in the control villages report owning one or more radios compared to about 44 percent of the respondents in the treatment group. Still, t-statistics do not provide any evidence of significant difference between the two groups. Most of the respondents in the control group (about 70 percent) own a television while only 62 percent of the respondents in the treatment groups own one. This is significantly different both in terms of the number and the value of televisions reportedly owned.

Cow ownership varies significantly between control and treatment villages. Approximately 75 percent of households in the control villages report owning one or more cows whereas only 69 percent of the households in the treatment villages own an animal. T-statistics show the significant difference of cow ownership, both in terms of the number and value of the cows (at least 99 percent of the difference can be explained by the ownership).

Both control and treatment groups are also divided when it comes to hand tractor ownership. Only about 4 percent of households in the treatment group report owning a hand tractor, compared to almost double the number of households (about 8 percent) in the control group.

3.3.7. Household loans

Table 3.7 below shows that almost half of the total number of households in each comparison group is subject to borrowing and on average, one household incurs around 1.30 loans in each group. Additionally, there is no marked difference in average monthly interest rate between the two groups, the rate of which is around 3.0 percent. The difference in the age of loan to the total number of loans in the two groups is slight, where the average period of the loan is around six months. There is remarkable disparity in the average size of loan per household and per loan between the two groups, where t-statistics of the mean test for the two indicators in the two groups are statistically significant at 1 percent level.

Table 3.7: Household Borrowing Situation

Classification	Control group	N	Treatment group	N	t-statistics
Number of households with loan	140	-	234	-	-
Number of households without loan	160	-	216	-	-
Average number of loans per HH	1.35	140	1.29	234	0.86
Average size of loan of each household ('0000 riels)	224.61	140	156.66	234	2.71***
Average monthly interest rate (%)	3.13	189	2.90	301	0.72
Average size of loan ('0000 riels)	166.38	189	121.79	301	2.48***
Age of loan to total number of loans (months)	6.83	189	5.66	301	1.72*

Note: Level of significance: *** at 1 percent; ** at 5 percent; and * at 10 percent

Source: CDRI household survey in 27 villages, December 2009

On the sources of loan, given the geographical proximity of the treatment group to the centre of the province, particularly the national roads, households in the treatment group tend to have better access to formal lending than those in the control group. Households in the treatment group depend largely on loans from banks and microfinance institutions (MFI), while households in the control group rely mainly on loans from money lenders and traders, which are known as informal sources of finance (see Figure A.6 in the Appendix).

It should also be noted that nearly a third of the total number of households in the control group could have access to loans from microfinance institutions. This to a certain extent helps reduce debt severity of the households in the control group as the interest rate on a loan from informal sources, such as money lenders and traders, is normally higher than that on a loan from formal sources such as banks and MFIs. On the sources of finance from relatives, friends, neighbours and NGOs, the proportion of households in the two groups that rely on such sources are similar.

3.4. Social Indicators

3.4.1. Education

Literacy Rate

Literacy rate, defined as the ability to read and write a simple message, is modest among the household members of both control and treatment groups. About 70 percent of the household members in the sample are literate and 30 percent are illiterate. Male household members are more literate than female members and this trend is similar among treatment and control groups.

Literacy rate for adults (i.e. those aged 15 years and above) stands at 74.59 percent for the control group and at 77.01 percent for the treatment group. The overall level of the adult literacy rate for both control and treatment groups is very close to the national adult literacy rate of 77 percent. Adult males have a much higher literacy rate compared to adult females and the trend is similar among control and treatment groups

Table 3.8: Literacy Rate by Group and Gender

	Control group	Treatment group
Overall literacy rate		
Average	70.14	71.15
Male	78.17	78.25
Female	62.90	64.80
Adult literacy rate (age 15 and above)		
Average	74.59	77.01
Male	84.68	86.99
Female	65.87	68.50

Source: CDRI household survey in 27 villages, December 2009

Educational Attainment

Household members in both control and treatment groups have lower education. Around 20 percent have never attended school, 46 percent have the highest level of education at primary school, 22 percent at secondary school and 9 percent at high school. Educational attainment does not differ much between the control and treatment groups.

The education of household heads was also found to be as low as that of the overall population. About half studied at primary school, while 25 percent have never attended formal school. The t-statistic confirms the similarity between the two village groups with no significant difference in educational attainment.

School Enrolment

School enrolment ratio, or the ratio of children of official school age who are enrolled to the population of the corresponding official school age, among members of the household sample in both control and treatment groups is found to be higher than the national average at any education level. Survey data shows that primary school enrolment stands at 96 percent in the control group and 99 percent in the treatment group compared to the national average of 89 percent. Around 80 percent of children between 12 and 17 years old in both control and treatment groups are enrolled in formal secondary school, while only 21 percent of adults in the control group and 24 percent in the treatment group are enrolled in higher education.

Table 3.9: School Enrolment by Education Level

	Control group	Treatment group	Overall
School enrollment, Primary (%)	96	99	98
School enrollment, Secondary (%)	81	78	80
School enrollment, Tertiary (%)	21	24	23

Source: CDRI household survey in 27 villages, December 2009

3.4.2. Health

Health Problems

Survey data on health status show that the health condition of all household members is good. Approximately 34 percent reported having had a health problem in the four weeks prior to the survey. The most commonly reported health problems for household members in both treatment and control groups are flu, fever, arthritis, stomach ache and hypertension.

Health treatment

Approximately 84 percent of those who reported a health problem had sought healthcare or treatment for one or more health issues in the previous four weeks. The most common places that household members in both groups went for healthcare services were a private hospital and or clinic, private pharmacies, and the home of a trained nurse or other health worker. Not many went to the provincial or district health centres for health treatment and even fewer went to a national hospital.

Knowledge on public health issues

Household heads' understanding of key public health issues is high in both control and treatment groups. Over 80 percent of household heads know about health problems caused by smoking, the symptoms of dengue and preventive measures, children's immunisation, HIV/AIDS and its preventive measures, bird flu, birth spacing, TB and malaria. There is no significant difference in knowledge on public health issues among household heads in control and treatment groups.

In terms of sources of knowledge, electronic media appears to be the most effective channel to spread information. The survey found that more than 60 percent of household heads in both control and treatment groups know about key public health issues via television and radio. The other important sources of information are health centres, peer education and community outreach by NGOs.

Health practices

Good knowledge appears to have been translated into good practice in many aspects of public health. One of them is smoking status. The rate of tobacco use, defined as the ratio of persons who smoke cigarettes or chew tobacco to total population, is considerably low in both control and treatment groups. Approximately 13.9 percent of sample household members in the control group and 13.4 percent in the treatment group smoke cigarettes. There is no significant difference between both groups in terms of tobacco use at t-statistics of 0.43. Tobacco use is skewed towards the male population – that is, men are more likely to use tobacco than women.

Another good health practice concerns antenatal care. The ratio of pregnancy check-ups appears to be very high in both control and treatment groups. Regular check-up is very common (77 percent in control group, 87 percent in treatment group), while some at least have an occasional check-up (19 percent in control group versus 9 percent in treatment group). In terms of vaccination programmes for infants, almost all households with young children brought their children for vaccination, and this practice appears similarly among control and treatment groups.

3.4.3. Time allocations on daily activities

Time spent on daily activities in the evening differs greatly for male and female household heads though there is no significant difference across the control and treatment groups. Male household heads spend about half of their time in entertainment activities i.e. watching television and listening to the radio, one quarter in socialising activities, and spend far less time on income earning and educational activities. Female household heads dedicate a considerable amount of time to household chores and entertainment activities, and like their male counterparts, gave limited time to socialising, income earning and educational activities.

There is a similar pattern of time allocation among male and female sample household members who are currently studying at formal school. Watching television or listening to the radio consumes around one third of their time. Female students tend to spend more time on household chores than male students and relatively less time on education. T-statistics confirm insignificant differences in time allocation between household heads and students among treatment and control groups.

Table 3.10: Time Spent on Daily Activities by Household Head and Student

Activity	Control group		Treatment group		Control group		Treatment group	
	Minutes	%	Minutes	%	Minutes	%	Minutes	%
	Male household head				Female household head			
Entertainment	93.41	50.72	82.15	47.2	65.74	35.81	80.54	39.71
Socialising	42.64	23.15	43.22	24.83	34.58	18.84	39.67	19.56
Income earning	6.95	3.77	7.06	4.06	5.79	3.15	7.67	3.78
Education	5	2.71	6.21	3.57	3.32	1.81	0.46	0.23
Total	184.18	100	174.04	100	183.57	100	202.83	100
	Male senior student				Female senior student			
	Minutes	%	Minutes	%	Minutes	%	Minutes	%
	Male senior student				Female senior student			
Entertainment	19.32	35.76	17.49	32.72	24.98	37.38	21.14	33.32
Education	11.96	22.14	13.67	25.57	11.94	17.87	14.52	22.88
Household chores	10.25	18.97	11.02	20.61	16.37	24.5	18.27	28.79
Socialising	10.47	19.38	10.19	19.06	9.48	14.19	8.39	13.22
Income earning	1.8	3.33	1.07	2	4.05	6.06	1.1	1.73

Source: CDRI household survey in 27 villages, December 2009

3.5. Energy Indicators

3.5.1. Status of Energy Consumption

Source and Purpose of Energy Consumption

The main sources of energy in both control and treatment groups are firewood, car batteries and kerosene. Other sources of household energy are candles, dry cell batteries, gas and charcoal, but the level of consumption is quite low. T-statistics confirm that there is no significant difference in the energy consumption patterns between the control and treatment groups.

The primary purposes of energy consumption are lighting, cooking, boiling water and powering electronic equipment such as a television or radio. Households rarely consume energy for business operations or agricultural production (e.g. pumping water). The duration of lighting varies considerably from one source of energy to another. Kerosene and car batteries can power lighting for much longer than a small generator set and candles.

Energy Expenditure

Sample households spend an average of USD10.95 every month on energy. Households in the treatment group spend more than those in the control group at USD11.3 and USD10.41, respectively, yet the difference is not statistically significant. Spending on firewood and car batteries altogether represents the major share of total energy expenditure.

Source of Electricity

Majority of households in both control and treatment groups own a car battery. Households use a car battery as the main source of electricity for about 3.5 hours seven days a week. Ownership and use of car batteries in the treatment and control villages are similar. In the absence of electricity, households in the sample villages use a car battery to power several types of electrical equipment including lighting, television, radio cassette and video recorders.

3.5.2. Household Perception on Electricity Connection

Willingness to connect to electricity

By design, this survey randomly selected households that are currently not connected to an electricity supply. When asked if they would be willing to have a connection to mains electricity supply, 84 percent in the control group and 90 percent in the treatment group were very keen. Their major reasons are for lighting and entertainment. Other reasons include the lower cost of electricity compared to other sources of energy, light for children to study, and for business purposes. A small proportion of households is not willing to connect to electricity and the main reason behind this perception concerns their inability to pay the connection fee and the monthly electricity bill.

Willingness to pay for electricity

Understanding households' willingness to pay for electricity in rural communities is essential for energy planners and operators to set an appropriate electricity tariff. Frequently, operators charge a connection fee which most rural households find expensive. However, if electricity is available, households would be willing to pay but at a low rate and reasonable amount. In the case of households in the sample villages, those in the control group are willing to spend USD14.29 for the connection fee, while those in the treatment group are willing to pay USD10.22.

Another key issue in rural electrification in Cambodia is the high electricity tariff. Households in rural communities usually pay a tariff of between USD0.49 and USD0.61 per Kwh. This rate appears to be very high by any standard and a much lower tariff rate is strongly demanded by the study households. Households in the control group want electricity operators to charge USD0.13 per Kwh, while those in the treatment group propose USD0.12 per Kwh.

Table 3.11: Affordable Electricity Connection Fee

	Control villages	Treatment villages	Total	Difference	T-Statistics
Connection fee (riels)	59242	42387	51078	16855	1.17
Tariff (riels/Kwh)	529	459	503	70	0.82

Exchange rate: 1 USD = 4146 riels

Source: CDRI household survey in 27 villages, December 2009

MATCHING HOUSEHOLDS IN THE CONTROL AND TREATMENT GROUPS

4.1. Steps in estimation

Propensity score matching technique (PSM) is commonly known to be a popular approach in evaluating labour market policies, and this application has been gaining popularity in various other fields of study for situations where there is one group of treated individuals and another group of untreated individuals (Caliendo & Kopeinig, 2008). The principal aim of this is to estimate causal treatment effects of the two groups. As the data collected for this assessment is a baseline survey, this study is intended to produce matching result of similar households between the control and treatment groups.

In order to obtain similar households from the two groups, first, the propensity score (predicted probability) of household participation in the project must be obtained from a standard logistic regression model (probit/logit). The selected independent variables for the model - X, should be unaffected by participation in the project.

Once propensity score is estimated, it is used for matching households of the two groups by selecting one or any of the matching techniques, including one-to-one matching, k-nearest neighbours matching, radius matching, kernel matching, local linear regression matching, spline matching and Mahalanobis matching⁶. The performance of different matching estimators varies case-by-case and depends largely on the data structure at hand (Zhao 2000 cited in Caliendo & Kopeinig 2008:45). Additionally, in order to assess the matching quality, we check standardised bias of each independent variable in the logistic regression before and after matching. Most empirical studies argue that standardised bias below 3 percent or 5 percent after matching is seen as sufficient (Caliendo & Kopeinig, 2008:48).

4.2. Data and Model Specification

In order to predict the probability of household participation in the two groups, this study employs probit regression model as specified in the equation below.

Probit regression equation

$$\begin{aligned} ADB_project = & \beta_0 + \beta_1 hhsz + \beta_2 hhage + \beta_3 hhagesqr + \beta_4 hheduc + \beta_5 hheducsqr + \beta_6 hhsex \\ & + \beta_7 candle_exp + \beta_8 firewood_exp + \beta_9 charcoal_exp + \beta_{10} ker_osene_exp + \beta_{11} carbattery_exp + \\ & \beta_{12} smallbatte_ry_exp + \beta_{13} nemploy + \beta_{14} landtype + \beta_{15} housebrick + \beta_{16} index_hom_equip + \\ & \beta_{17} indextrans_port + \beta_{18} indexagri + \beta_{19} credit + \beta_{20} primschool + \beta_{21} ngoserv + \beta_{22} toilet + \\ & \beta_{23} hhhealth + \beta_{24} wateracc + \beta_{25} literacy + \mu \end{aligned}$$

Data from both household and village surveys were used for this analysis in order to control for both household demographics and village characteristics. Therein, 750 households were selected from 27 villages in various locations of Takeo province. Table 4.1 presents definitions and summary statistics for the variables used in the empirical analysis.

⁶ For detailed STATA command of each algorithm: <http://fmwww.bc.edu/RePEc/usug2001/psmatch.pdf>

Table 4.1: Definition of Variables and Descriptive Statistics

Variables	Description	Sample	Mean	Std. dev.
Dependent variable				
<i>ADB_project</i>	household within the project (treatment=1); household outside the project (control=0)	750	0.60	0.49
Independent variables				
<i>hhsz</i>	household size	750	5.13	1.90
<i>hhage</i>	age of household head	750	47.39	13.42
<i>hhagesqr</i>	squared age of household head	750	2426.09	1325.82
<i>hheduc</i>	number of years of education of household head	750	4.51	3.58
<i>hheducsqr</i>	squared number of years of education of household head	750	33.19	39.55
<i>hhsex</i>	sex of household head (0=female; 1=male)	750	0.71	0.45
<i>candleexp</i>	expense on candles per day per hh in riels	750	11.56	51.30
<i>firewoodexp</i>	expense on firewood per day per hh in riels	750	982.81	689.87
<i>charcoalexp</i>	expense on charcoal per day per hh in riels	750	35.51	336.51
<i>keroseneexp</i>	expense on kerosene per day per hh in riels	750	82.02	119.86
<i>carbatterypexp</i>	expense on car battery recharge per day in riels	750	252.79	286.12
<i>smallbatterypexp</i>	expense on common small battery recharge per day per household in riels	750	35.86	62.84
<i>hhoccup</i>	occupation of household head	750	1.94	0.80
<i>landtype</i>	type of land of household (1=agri.; 0=others)	750	0.95	0.23
<i>housebrick</i>	housing condition of household (1=brick built house; 0=non-brick house)	750	0.08	0.27
<i>indexhomeequip</i>	index of household home equipment	750	0.00	1.82
<i>indextransport</i>	index of household transportation asset	750	0.00	1.07
<i>indexagri</i>	index of household agricultural asset	750	0.00	1.45
<i>telephone</i>	household with or without telephone	750	0.46	0.50
<i>credit</i>	household outstanding loan with (1) without (0)	750	0.50	0.50
<i>primschool</i>	village primary school with (1) without (0)	750	0.39	0.49
<i>ngoserv</i>	village with NGO development programme (1) village without NGO programme (0)	750	0.78	0.41
<i>toilet</i>	toilet (1) no toilet (0)	750	0.33	0.47
<i>hhhealth</i>	health of household head in last four weeks sick (1) not sick (0)	750	0.45	0.50
<i>wateracc</i>	access to tube well water access (1) no access (0)	750	0.55	0.50
<i>literacy</i>	household head able to read and write (1) household head cannot read and write (0)	750	0.69	0.46
Outcome variables				
<i>income</i>	daily per capita income in riels	744	5917.71	5836.02
<i>incomeagri</i>	daily per capita income from agriculture in riels	750	1216.39	2515.48
<i>incomelivestock</i>	daily per capita income from livestock in riels	750	1016.35	1760.59

Variables	Description	Sample	Mean	Std. dev.
<i>incomecommonp</i>	daily per capita income from common property resources in riels	750	15.78	162.36
<i>incomewage</i>	daily per capita income from labour riels	750	965.40	1670.87
<i>incomeremit</i>	daily per capita income from remittance in riels	750	292.42	737.75
<i>incomebusiness</i>	daily per capita income from business in riels	750	3084.00	10991.82
<i>incomeothers</i>	daily per capita income from other sources	750	129.82	602.35
<i>consum</i>	daily per capita consumption in riels	750	9452.42	6501.29
<i>consumfood</i>	daily per capita consumption in riels	750	4821.02	2168.29
<i>consumnonfood</i>	daily per capita consumption in riels	750	5268.99	413.81
<i>malestudy</i>	time spent by male student on reading (minutes in the evening)	750	12.84	26.81
<i>femstudy</i>	time spent by female student on reading (minutes in the evening)	750	13.05	25.75
<i>hhteaching</i>	time spent by parents teaching kids (minutes in the evening)	750	3.76	10.58

Source: CDRI household survey in 27 villages, December 2009

Within the sample households, the average size of a household is around 5.13 persons, while the average age of the household head is 47.40 years. The traditional energy sources of charcoal, wood, kerosene, car battery and small battery are quite common among sample households. Average household daily spending on firewood and charcoal is around 984.2 riels and 35.8 riels, respectively, whereas the average daily spending on kerosene and car battery is 82.2 riels and 250.4 riels, respectively.

The survey produced consistent results on the two variables of income and consumption expenditures. Average daily income per capita is approximately 5,917.7 riels, while average daily consumption per capita is around 9,287.6 riels. However, the standard deviation of income (5,836.0 riels) appears to be larger than that for consumption (6,165.2 riels) reflecting marked disparities in income across sample households. Earnings from business contribute the largest share of total household income, followed by earnings from agriculture, livestock, wages and remittance. It is astounding to note that on average, households spend almost half of their income on non-food items.

4.3. Empirical Results

Result of the probit regression before matching is shown in Table 4.2, out of which predicted probabilities of each household participating in the ADB project were estimated. Predicted probabilities of participation, also known as propensity score, are used for matching households of the two comparison groups. Table 4.2 indicates that there are a couple of control variables which have strong association with household decision to connect to the transmission grid and statistically significant at between 1 and 5 percent. For instance, the more number of employments household head has during the last six months, the higher probability household connect to electricity. The same evidence is also seen in the case of candle expense, kerosene expense, housing condition, home equipment, and presence of NGO services and primary school in the village.

Table 4.2: Probit Regression of a Sample of 744 Households

Dependent variable (ADB project)			
Independent variables	Coefficients	Standard error	z
Household size	0.04	0.03	1.24
Household age	-0.01	0.03	-0.41
Household age square	0.00	0.00	0.39
Household education	-0.06	0.06	-0.99
Household education square	0.01	0.00	1.28
Household sex	0.05	0.13	0.36
Candle expense	0.00	0.00	1.99**
Firewood expense	0.00	0.00	0.54
Charcoal expense	0.00	0.00	-0.24
Kerosene expense	0.00	0.00	1.97**
Car battery expense	0.00	0.00	-0.66
Battery expense	0.00	0.00	0.96
Household occupation	0.20	0.08	2.68***
Land type	-0.24	0.25	-0.96
House brick	0.71	0.25	2.85***
Index home equipment	0.12	0.04	2.75***
Index transportation	0.04	0.05	0.74
Index agriculture equipment	-0.11	0.04	-2.65***
Telephone	-0.32	0.10	-3.12***
Credit	0.09	0.11	0.89
Primary school	1.00	0.13	7.88***
Ngo services	0.67	0.15	4.49***
Toilet	-0.01	0.12	-0.10
Household health	0.12	0.11	1.11
Water access	0.15	0.11	1.43
Literacy	0.11	0.18	0.58
Constant	-0.92	0.71	-1.31
Number of observation	744		
Pseudo R ²	0.169		

Note: level of significance: * at 10 percent; ** at 5 percent; *** at 1 percent level

Table 4.3 below shows that the matching operation using k-nearest neighbour (k=3) produces favourable results for mean total income, consumption, adult's study time in the family and children's teaching time, but differences in income components, such as crops, common property resource, wage and remittance, between households in the two groups remain significant. This indicates that after controlling for household and village characteristics, households in both control and treatment groups have similar overall income, consumption behaviour and time allocation for reading and teaching at home. Unfortunately, the matching operation could not produce better results in terms of household income from different sources.

Table 4.3: Comparison of Outcome Variables after Matching

Outcome variables	Difference (Unmatched)		Difference (Matched)	
	Unmatched	T-statistics	Matched (ATT)	T-statistics
Income	984.57	2.26**	167.06	0.31
Income crops	-538.73	-3.12***	-1042.53	-4.18***
Income livestock	172.90	1.31	276.00	1.52
Income common	25.53	2.10**	27.38	2.52***
Income wage	367.30	2.95***	272.71	1.75*
Income remittance	122.15	2.21**	121.37	1.90*
Income business	839.13	2.36**	520.24	1.18
Income others	-3.70	-0.08	-8.11	-0.13
Consumption	1118.82	2.44***	143.65	0.24
Food consumption	138.16	0.90	98.53	0.48
Nonfood consumption	980.66	2.62***	45.12	0.09
Male study	1.67	0.84	-4.10	-1.43
Female study	2.06	1.07	4.86	1.89*
Household teaching	-0.05	-0.06	0.07	0.06

Source: Matching outcome from survey data

However, it is worth noting that the median bias of the matching operation has been reduced substantially. The level of bias of the independent variables before matching was 13.505 percent, which was then reduced to 3.965 percent after matching. This increases the credibility of the matching outcomes (see Table A.27 in the appendix for the ptest results on the balance of the two comparison groups or reduction in the percentage bias of all the independent variables in the logit regression equation and Figures A.9,10,11 in appendix for the ps-graph, kernel density estimate before and after matching). From the matching operation, there are 35 households, which are off-support/dropped creating the final sample of 709 households (Table A.29 in appendix).

SUMMARY AND CONCLUSION

This research project represents the first baseline socioeconomic survey that CDRI has conducted for the Greater Mekong Sub-region Transmission Project of Asian Development Bank. The study was designed to develop a set of comprehensive baseline demographic, social and economic as well as energy consumption indicators for the project. The tools for data collection were village and household surveys in 27 villages, of which 17 villages are potentially project beneficiaries (treatment group) and 10 are non-beneficiaries (control group). It then used propensity score matching method to predict the probability of household participation (propensity score) in the two groups.

The key socioeconomic indicators derived from household survey are summarised as follows:

- The average household size in the sample villages is around five persons. Household members of working age account for the majority of the household population, while members who are too young or too old to work together represent about 17 percent of the population in both control and treatment groups.
- Dependency ratio, which refers to the age-population ratio of those typically not in the labour force (the dependent part) and those typically in the labour force (the productive part), was found to be quite high in both groups. High dependency ratio in both control and treatment groups is largely influenced by the many children not yet of working age in the family.
- The main primary occupations of the household heads and members in both control and treatment groups are agriculture, forestry and fishery labourers. Household heads' non-farm employment includes garment, construction, mining and processing and artisan work, where the majority of labourers in the garment employment group are female. In addition, the majority of households in the control (93.7 percent) and treatment (88.9 percent) groups are self-employed.
- On per capita daily income, households in the treatment group tend to earn higher income than those in the control group who live far from town and the national roads. Households in the control group are mainly engaged in agricultural activities, particularly crop farming, while those in the treatment groups are primarily involved in petty trade and small business activities. In addition, the mean daily per capita consumption of households in the treatment group is higher than that of households in the control group. There is no significant difference in household food consumption, but there is a marked difference in non-food consumption.
- The pattern of agricultural land distribution of each group is to a large extent similar to that of the overall pattern of the land distribution of all households. The fraction of households who are landless in the treatment group is larger than that in the control group, while percentage of households with agricultural land of less than 1 hectare in the treatment group is also bigger than that of the control group. However, larger

agricultural land (above 1 hectare) tends to be more concentrated in the households of the control group than those in the treatment group.

- On household financing, around half of the total number of households in the control group seek loans for various consumption and production purposes, while just over half the total number of households in the treatment group are subject to borrowing, which indicates a similar status of household indebtedness in the two groups. On the sources of loan, given the geographical proximity of the treatment group to the centre of the province, particularly the national roads, households in the treatment group tend to have better access to formal lending than those in the control group.
- Literacy rate, or the ability to read and write a simple message, is modest in both the control and treatment groups. About 70 percent of the total population is literate and 30 percent is illiterate. Males are more likely to have higher literacy levels than females and the t-statistic confirms the similarity between control and treatment groups. Overall education attainment among the whole sample and household heads is quite low.
- School enrolment ratio, or the ratio of children of official school age who are enrolled in school to the population of the corresponding official school age, in both control and treatment groups is higher than the national average at all education levels. Survey data shows that primary school enrolment stands at 96 percent in the control group and 99 percent in the treatment group, compared to the national average of 89 percent.
- About one third of the sample households reported having a health problem in the four weeks prior to the survey and the most commonly reported health problems are flu and fever. Majority of those who encounter health problems sought care for one or more health issues. The most common places to get healthcare services are private hospital and or clinic, private pharmacies, and the home of trained nurses or other health workers. Not many people went to provincial or district health centres for health treatment and even fewer went to national hospital.
- Household heads' understanding on key public health issues is high. More than 80 percent of household heads know about the health dangers of smoking, symptoms of dengue and preventive measures, child immunisation, HIV/AIDS and its preventive measures, bird flu, birth spacing, TB and malaria. Electronic media appears to be the most effective channel to spread information; other sources of information include health centres, community outreach by NGOs and peer education.
- Good knowledge has been accompanied by some good health practices. One of them is smoking status, which is found to be considerably low in both control and treatment groups. Another good health practice concerns pregnancy and child vaccination. The ratio of pregnancy check-up appears very high, while almost all households with infants had taken their children for vaccination.
- Time spent on daily evening activities differs greatly between male and female household heads but no significant difference between the control and treatment groups was found. Male household heads spend about half of their time in entertainment activities i.e. watching television and listening to the radio, one quarter in socialising activities but spend much less time on income generation and educational activities. Female household heads dedicate a considerable amount of time to household chores,

watching television and listening to the radio, but less on socialising, income generation and educational activities.

- The main sources of energy in the study villages are firewood, car batteries and kerosene. The primary purposes of energy consumption are lighting, cooking, boiling water and entertainment.
- Households spend an average of USD10.59 every month on energy. Households in the treatment group spend more than those in the control group (USD11.3 versus USD10.41); yet the difference is not statistically significant. Spending on firewood and car batteries altogether represents the major share of total energy expenditure.
- Majority of the households own a car battery and use this as the main source of electricity. When asked whether they would be willing to connect to a mains electricity supply, the majority of households expressed a deep interest. Their major reasons are to use it for lighting and entertainment (television, radio). Other reasons they cited include the lower cost of electricity compared to other sources of energy and light for children to study and for business purposes. A small proportion of the households are not willing to have an electricity connection, the major reason for which concerns their inability to pay the connection fee and the monthly electricity bill.
- Electricity connection fee is usually charged by the operator and that fee is expensive for most rural households. However, if electricity is available, households would be willing to pay a low and reasonable amount ranging from USD10.22 to USD14.29.
- Another key issue in rural electrification in Cambodia is the high electricity tariff. Households in rural communities usually pay a tariff of between USD0.49 and USD0.61 per Kwh. This rate appears to be very high by any standard and a much lower tariff is strongly demanded by the study households. Households in the control group want electricity providers to charge USD0.13 per Kwh, while those in the treatment group propose USD0.12 per Kwh.

As the data collected for this assessment is a baseline survey, this study is intended to produce a matching result of similar households between the control and treatment groups by applying propensity score matching technique—k-nearest-neighbour matching ($k=3$). In order to predict probability of household participation (propensity score) in the two groups for matching purpose, the study employs the probit regression model, presented in section 4.

Overall, the matching operation produces favourable results for consumption, male adults' study time the family and children's teaching time, and total income differences of households in the two groups, income from sources such as crops, common property resources, labour & wage and remittance remain statistically significant, albeit reduced. This indicates that after controlling for household and village characteristics, households in the control and treatment groups that have similar consumption behaviour, total spending and time allocation for reading and teaching at home were obtained. Unfortunately, the matching operation could not produce better results in terms of household income of different sources. However, it is worth noting that the median bias of the matching operation has been reduced substantially. The level of bias of the independent variables before matching was 13.505 percent, which was then reduced to 3.965 percent after matching.

The propensity score matching analysis enables us to see if good matches for the treatment households can be found in the comparison sub-sample, and to consider the possibility of dropping some of the comparison households (those with highly different characteristics) from any follow-up survey. After matching, 35 households, which were off-support, were dropped creating the new sample of 709 reduced from 744. For follow-up evaluation study, the research team should refer to after-match sample villages as the study site and it is hoped that the survey costs could be reduced.

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APPENDICES

Figure A.1: Map of Study Areas (Treatment villages in blue and control villages in yellow)

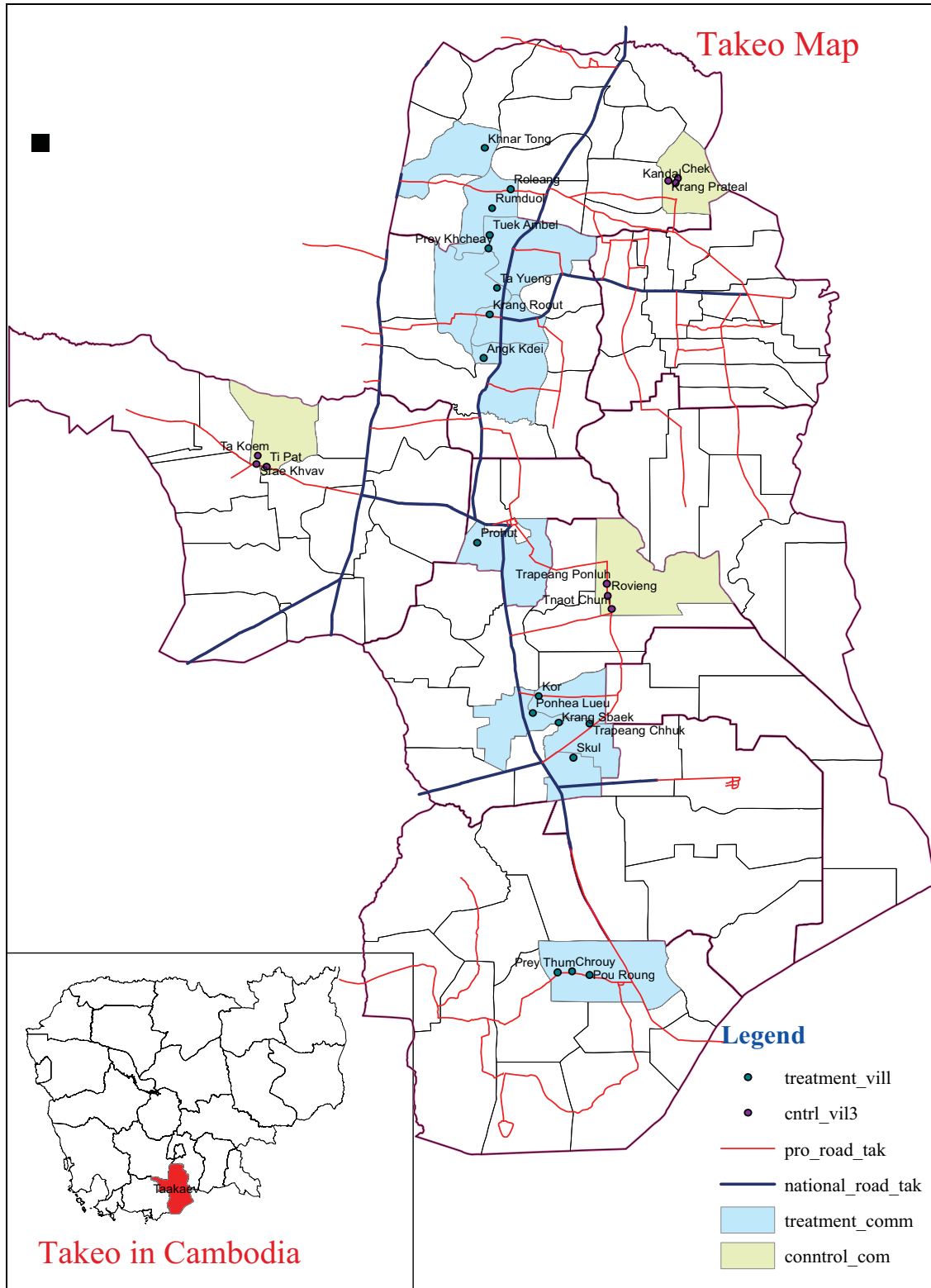


Figure A.2: Map of Rural Electricity Enterprises in Takeo (in red)

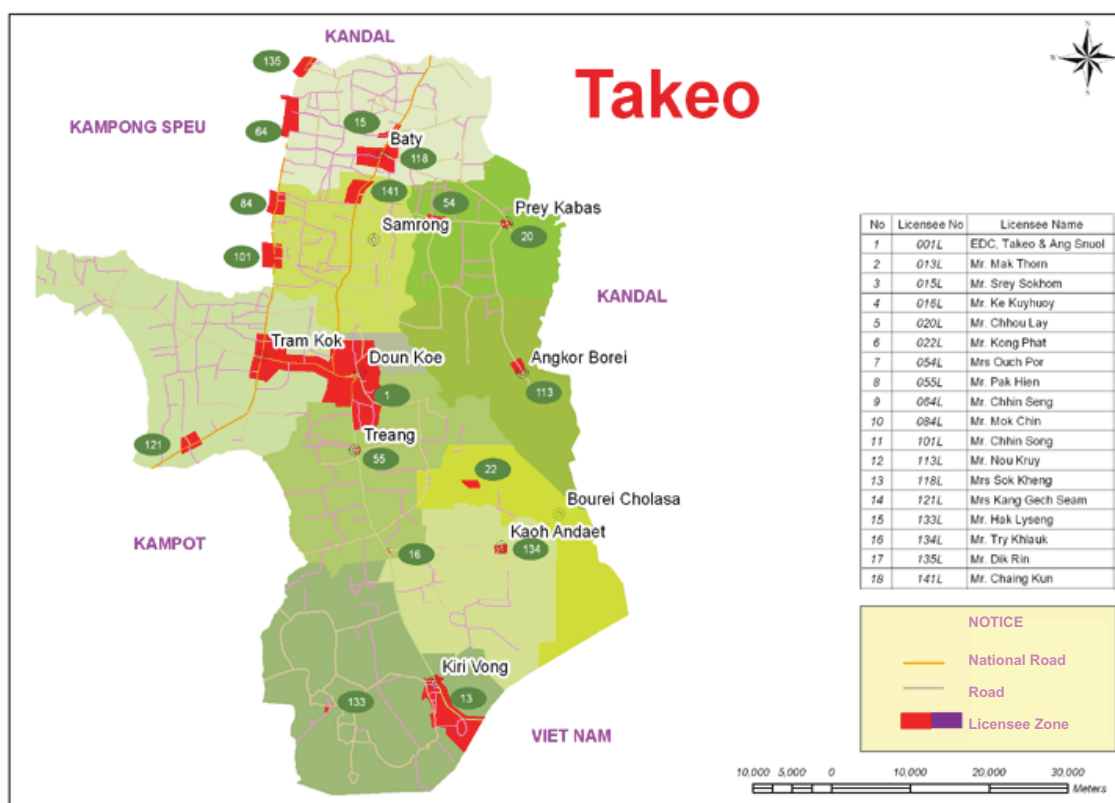


Table A.1: Number of Households Selected from Takeo Province as Treatment Group

No	District	Commune	Village	Households	Proportion (%)	Sample
1	Bati	Komar Reachea	Khmar Tong	247	14.17	35
2	Bati	Trapeang Krasang	Roleang	94	21.28	20
3	Bati	Trapeang Krasang	Rumduol	99	20.20	20
4	Samraong	Chumreah Pen	Ta Yueng	156	12.82	20
5	Samraong	Rovieng	Tuek Ambel	160	12.50	20
6	Samraong	Rovieng	Prey Khcheay	116	17.24	20
7	Samraong	Samraong	Krang Roout	173	14.45	25
8	Samraong	Soengh	Angk Kdei	192	13.02	25
9	Doun Kaev	Roka Krau	Prohut	330	12.12	40
10	Treang	Angk Khnaor	Kor	175	14.29	25
11	Treang	Prambei Mom	Krang Sbaek	117	17.09	20
12	Treang	Prambei Mom	Ponhea Lueu	173	14.45	25
13	Treang	Smaong	Skul	224	16.62	35
14	Treang	Tralach	Trapeang Chhuk	87	22.99	20
15	Kiri Vong	Preah Bat Choan Chum	Prey Thum	149	16.78	25
16	Kiri Vong	Preah Bat Choan Chum	Pou Rong	339	11.80	40
17	Kiri Vong	Preah Bat Choan Chum	Chrouy	296	11.82	35
Total				3132	15.51	450

Source: Cambodia General Population Census 2008

Table A.2: Number of Households Selected from Takeo Province as Control Group

No.	District	Commune	Village	Households	Proportion (%)	Sample
1	Bati	Doung	Krang Prateal	300	11.7	35
2	Bati	Doung	Chek	178	19.7	35
3	Bati	Doung	Doung	185	13.5	25
4	Bati	Doung	Kandal	206	17.0	35
5	Tram Kak	Cheang Tong	Srae Khvav	197	12.7	25
6	Tram Kak	Cheang Tong	Ta Toem	102	19.6	20
7	Tram Kak	Cheang Tong	Ti Pat	114	17.5	20
8	Treang	Sambuor	Rovieng	310	11.3	35
9	Treang	Sambuor	Trapeang Ponluh	225	15.6	35
10	Treang	Sambuor	Tnaot Chum	306	11.4	35
	Total			2123	13.6	300

Source: Cambodia General Population Census 2008

Figure A.3: The Process and Time-line of Data Collection

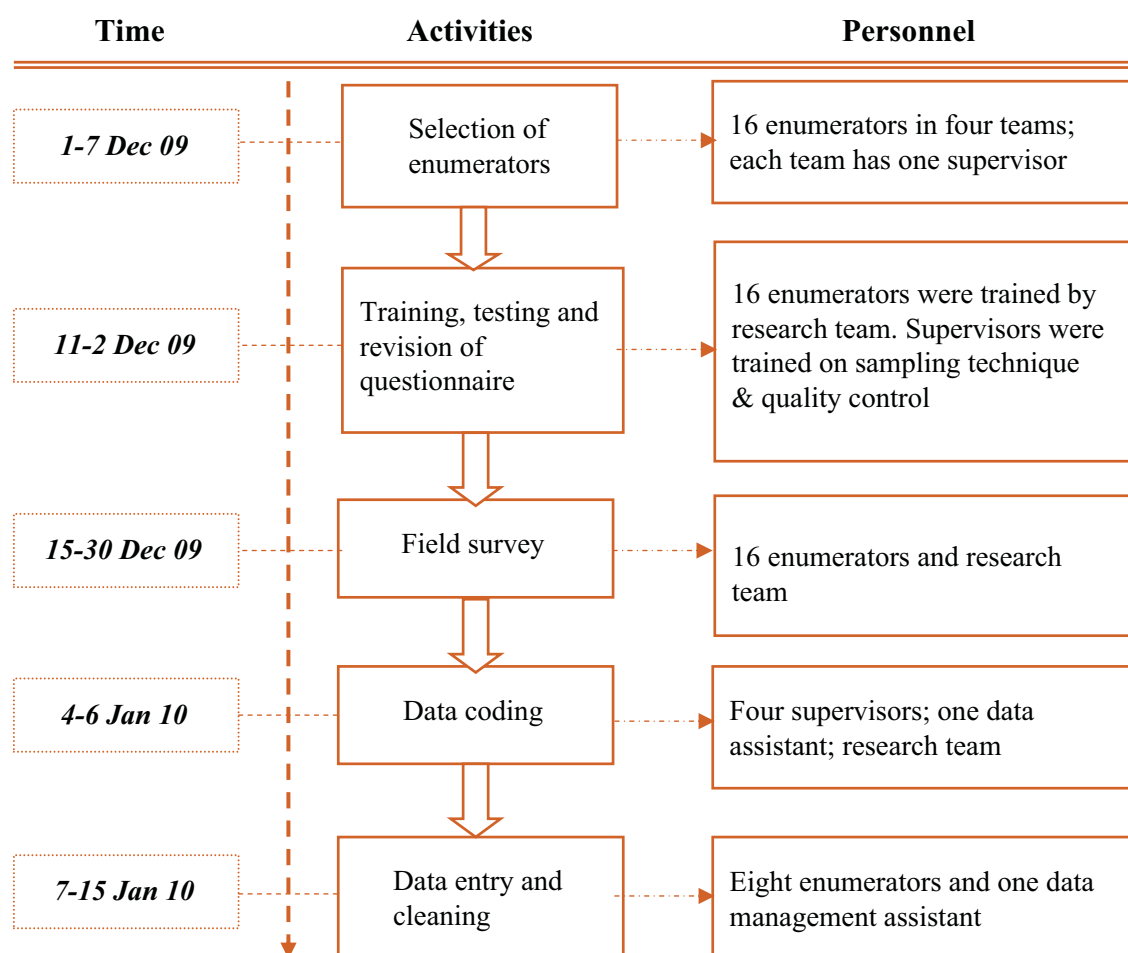


Table A.3: Summary of Village Characteristics

	Control group	Treatment group
Total number of households	2123	2459
Average number of households	228	176
Number of population	10837	16624
- Below 18 years old	4345	7315
- Above 18 years old	6502	9309
Agricultural land	2024 ha	5146 ha
Irrigated agricultural land	648 ha	309 ha
Agricultural land per household	0.9 ha	1.6 ha
Number of schools		
- Primary school	2	8
- Secondary school	1	1
- High school	0	0
Major problems of health services	<ul style="list-style-type: none"> - Not enough medicine - Poor service quality - Lack of doctors - Expensive health services 	<ul style="list-style-type: none"> - Not enough medicine - Poor service quality - Lack of doctors - Expensive health services - Unsanitary facilities - Health workers are not helpful
Health problems	<ul style="list-style-type: none"> - Fever - Dengue - Respiratory diseases (e.g. chronic cough, tuberculosis) 	<ul style="list-style-type: none"> - Fever - Dengue - Respiratory diseases (e.g. chronic cough, tuberculosis) - Diarrhea - Child malnutrition
Assistance received from government	<ul style="list-style-type: none"> - Agriculture development - Infrastructure development - Village development committee 	<ul style="list-style-type: none"> - Infrastructure development - Health - Water project
Assistance received from NGOs	<ul style="list-style-type: none"> - Agriculture development - Infrastructure development - Health - Village development committee 	<ul style="list-style-type: none"> - Agriculture development - Infrastructure development - Education - Health - Village development committee

Source: CDRI village survey in 27 villages, December 2009

Table A.4: Sample Distribution by Size of Household (% of total household)

Household size	Control group	Treatment group	Overall	Difference	T-Statistics
Less than 4	21	17.78	19.07	-	-
4 to 5	43.33	40.44	41.6	-	-
6 to 7	24.67	31.11	28.53	-	-
8 and above	11	10.67	10.8	-	-
No. households	300	450	750	-	-
Average size	4.99	5.22	5.13	-0.22	-1.59

Source: CDRI household survey in 27 villages in December 2009

Table A.5: Age Distribution of Sample Household Members (%) (% of total household members)

Age Group (in years)	Control group	Treatment group	Overall	Difference	T-Statistics
Age 0-4	7.88	9.07	8.61	-	-
Age 5-14	18.83	20.53	19.86	-	-
Age 15-29	35.38	34.16	34.63	-	-
Age 30-44	14.09	15.63	15.03	-	-
Age 45-59	14.62	12.78	13.49	-	-
Age 60 and above	9.21	7.84	8.37	-	-
Total population	1498.00	2348.00	3846.00	-	-
Average age	31	30	30	1	1.77

Source: CDRI household survey in 27 villages in December 2009

Table A.6: Dependency Ratio by Age and Gender (%)

	Control group	Treatment group	Overall	Difference	T-Statistics
Total dependency ratio					
Male	64.9	71.94	69.13	-7.04	-1.17
Female	56.01	68.71	63.66	-12.7	-1.62
Average	60	70	66	-10	-1.99
Child dependency ratio					
Male	49.2	59.89	55.62	-10.69	-0.81
Female	48.69	54.69	52.3	-6	-1.81
Average	49	57	54	-8	-1.91
Aged dependency ratio					
Male	15.69	12.05	13.51	-3.64	-0.47
Female	7.32	14.02	11.36	-6.7	-0.39
Average	12	13	12	-1	-0.61

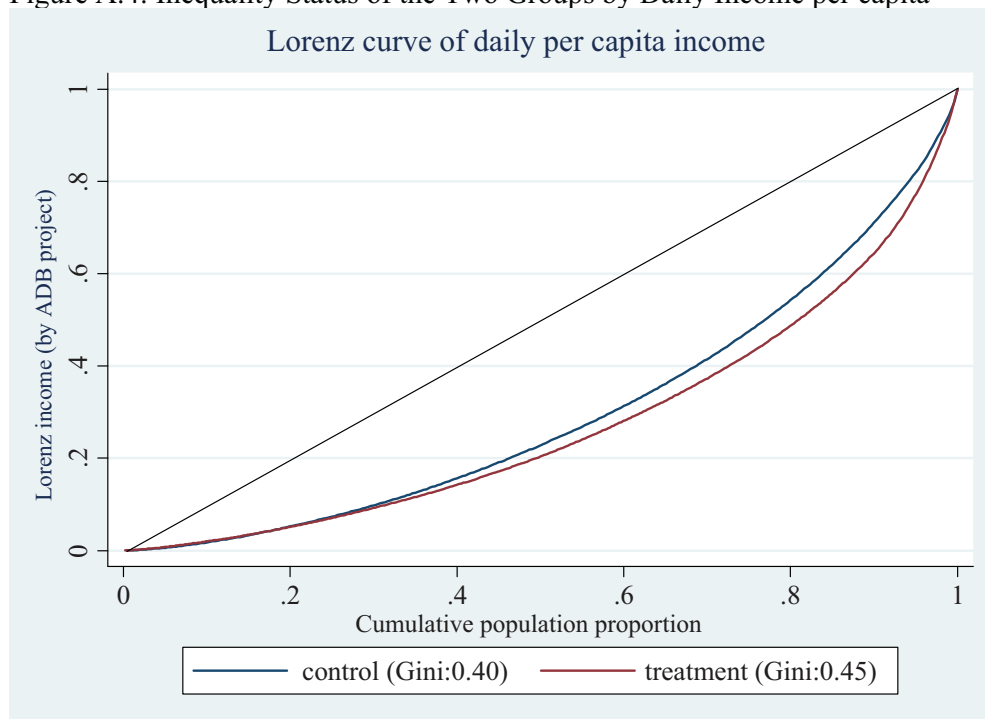
Source: CDRI household survey in 27 villages in December 2009

Table A.7: Employment Status of Household Heads

Employment status	Control group	Treatment group	Overall
Paid employee	11	31	42
Proportion (%)	3.8	7.2	5.9
Own account worker	269	383	652
Proportion (%)	93.7	88.9	90.8
Unpaid family worker	7	17	24
Proportion (%)	2.4	3.9	3.3
Total	287	431	718

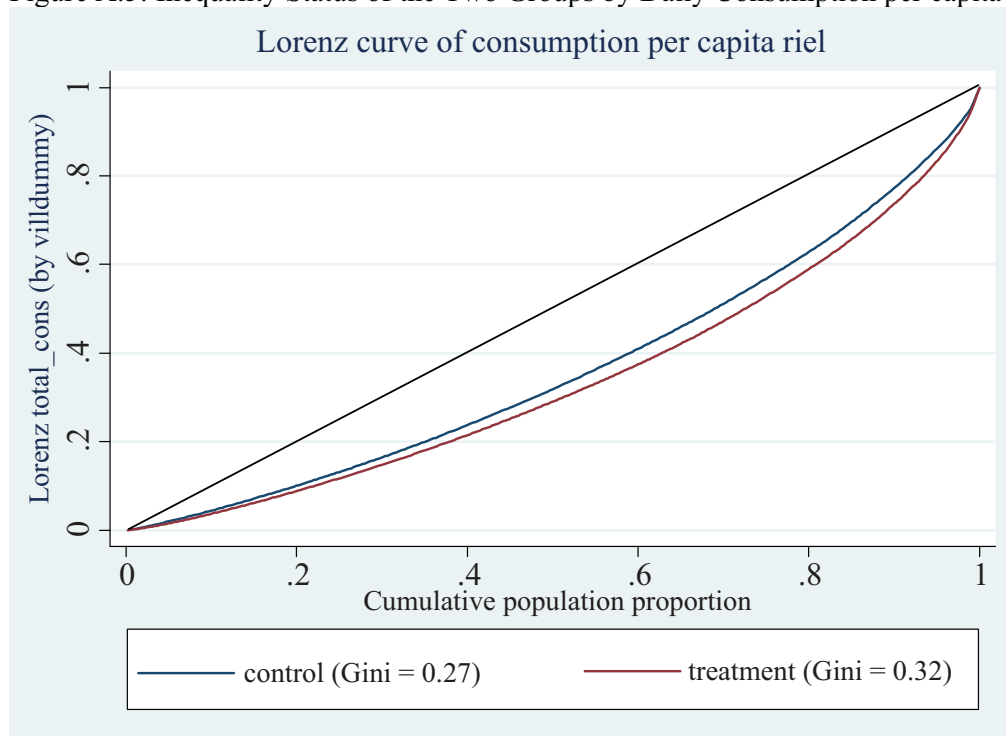
Source: CDRI household survey in 27 villages, December 2009

Figure A.4: Inequality Status of the Two Groups by Daily Income per capita



Source: CDRI household survey in 27 villages, December 2009

Figure A.5: Inequality Status of the Two Groups by Daily Consumption per capita



Source: CDRI household survey in 27 villages, December 2009

Table A.8: Types of House

Condition	Control group	Treatment group	Overall
Thatched house	23	52	75
Proportion (%)	7.67	11.56	10
Wooden house roofed with tin sheets	95	156	251
Proportion (%)	31.67	34.67	33.47
Wooden house roofed with tiles	175	190	365
Proportion (%)	58.33	42.22	48.67
Concrete/brick house	7	52	59
Proportion (%)	2.33	11.56	7.87
Total	300	450	750

Source: CDRI household survey in 27 villages, December 2009

Table A.9: Land Distribution

Land distribution	Control group	Treatment group	Overall
Landless households	12	29	41
Proportion (%)	4	6.44	5.47
Less than 1ha	180	273	453
Proportion (%)	60	60.67	60.40
Between 1 and 2ha	70	103	173
Proportion (%)	23.33	22.89	23.07
Between 2 and 3ha	22	25	47
Proportion (%)	7.33	5.56	6.27
Between 3 and 4ha	9	14	23
Proportion (%)	3	3.11	3.07
Between 4 and 5ha	4	2	6
Proportion (%)	1.33	0.44	0.8
Over 5ha	3	4	7
Proportion (%)	1	0.89	0.93
Total	300	450	750

Source: CDRI household survey in 27 villages, December 2009

Table A.10: Number of Plots With and Without Land Tenure

Categories	With land title	No land title	Lost certificate	Don't know
Control group				
Agricultural	733	86	3	6
Backyard farm	3	2	0	0
Idle land	2	0	0	0
Residential	263	33	1	1
Treatment group				
Agricultural	1051	193	20	1
Backyard farm	8	0	0	0
Idle land	8	1	0	0
Residential	392	58	1	1
Total	2460	373	25	9

Source: CDRI household survey in 27 villages, December 2009

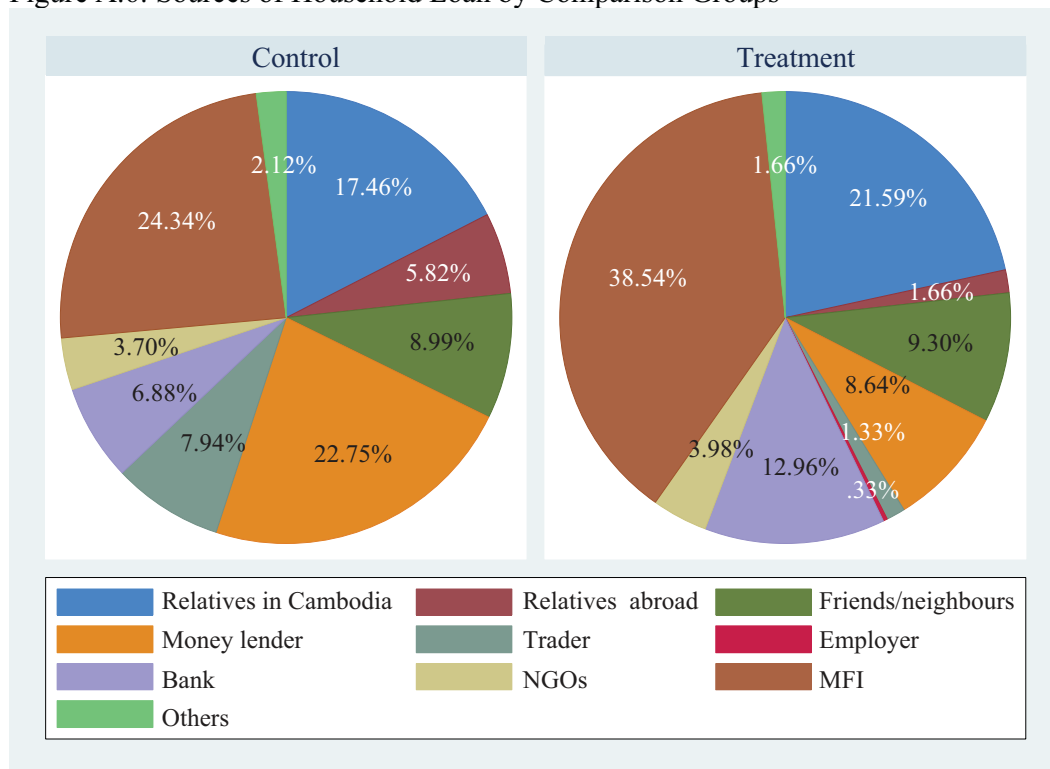
Table A.11: Durable Assets

	Selected durable goods	Control group			Treatment group			T-state (Mean of number)	T-state (Mean of value)
		N	Mean (number)	Mean (value)	N	Mean (number)	Mean (value)		
1	Radio	107	1.04	1.09	198	1.05	1.32	-0.3081	-1.4386
2	Television	211	1.03	6.50	281	1.07	8.35	-1.8377*	-2.2323**
3	Telephone	146	1.31	11.76	250	1.48	17.08	-1.8664*	-1.7315
4	Video/VCD/DVD	49	1.12	7.45	131	1.02	7.36	1.6834*	0.073
5	Bicycle	262	1.62	6.05	373	1.44	6.97	2.8283***	-1.1374
6	Motorcycle	160	1.09	241.38	303	1.15	204.88	-1.5114	1.4267
7	Car	1	1.00	600.00	9	1.00	1613.33	-	-
8	Sewing machine	12	1.08	19.67	40	1.18	17.78	-0.668	0.3504
9	Electric fan	13	1.23	1.96	36	1.28	3.67	-0.2254	-1.7409*
10	Refrigerator	0	-	-	0	-	-	-	-
11	Computer	4	1.00	103.00	5	1.00	120.40	-	-0.4082
12	Cart	106	1.02	24.76	105	1.02	20.53	-0.0095	1.213
13	Plough	149	7.36	1.03	243	7.91	1.04	-0.1798	-0.8573
14	Hand tractor	23	1.00	499.57	17	1.00	407.06	-	1.6907*
15	Cow	226	2.80	311.16	312	2.44	243.48	3.1726***	4.1895***
16	Buffalo	0	-	-	0	-	-	-	-
17	Pig	110	2.12	65.40	169	3.55	98.25	-2.8304***	-1.93*
18	Chicken	250	9.03	10.08	315	9.24	9.62	-0.1896	0.3556

Note: Level of significance: *** at 1 percent; ** at 5 percent; and * at 10 percent

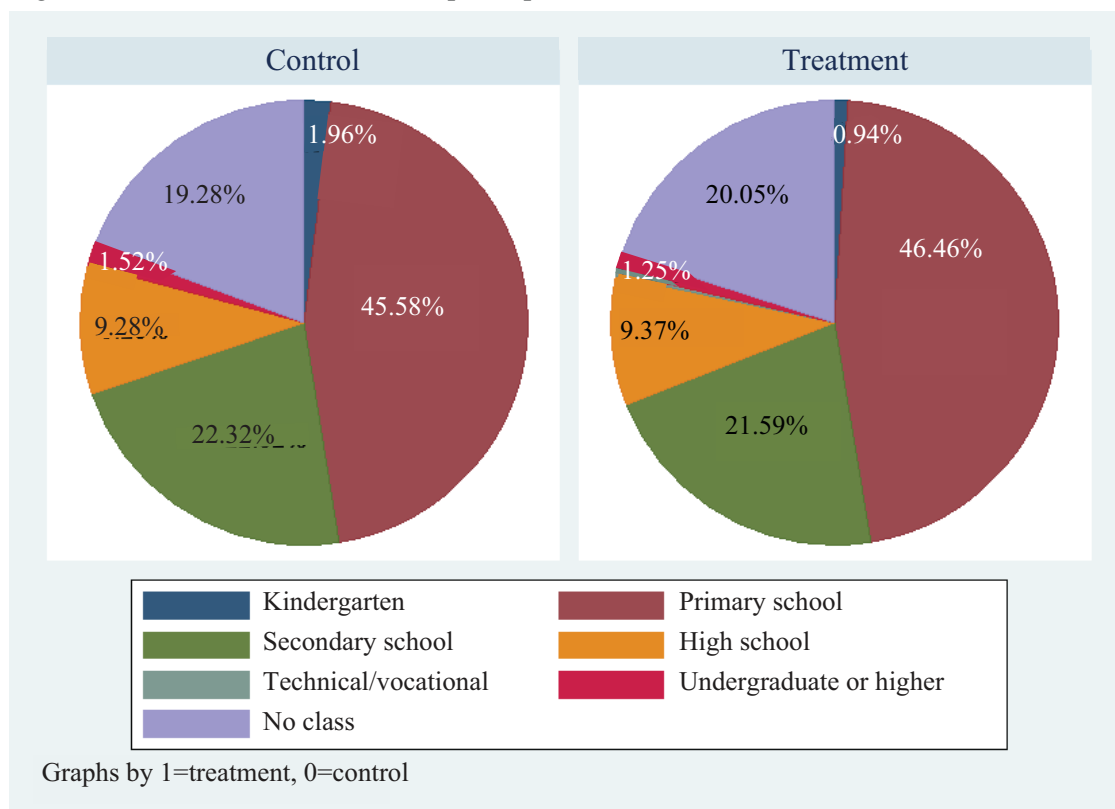
Source: CDRI household survey in 27 villages, December 2009

Figure A.6: Sources of Household Loan by Comparison Groups



Source: CDRI household survey in 27 villages, December 2009

Figure A.7: Education Level of Sample Population



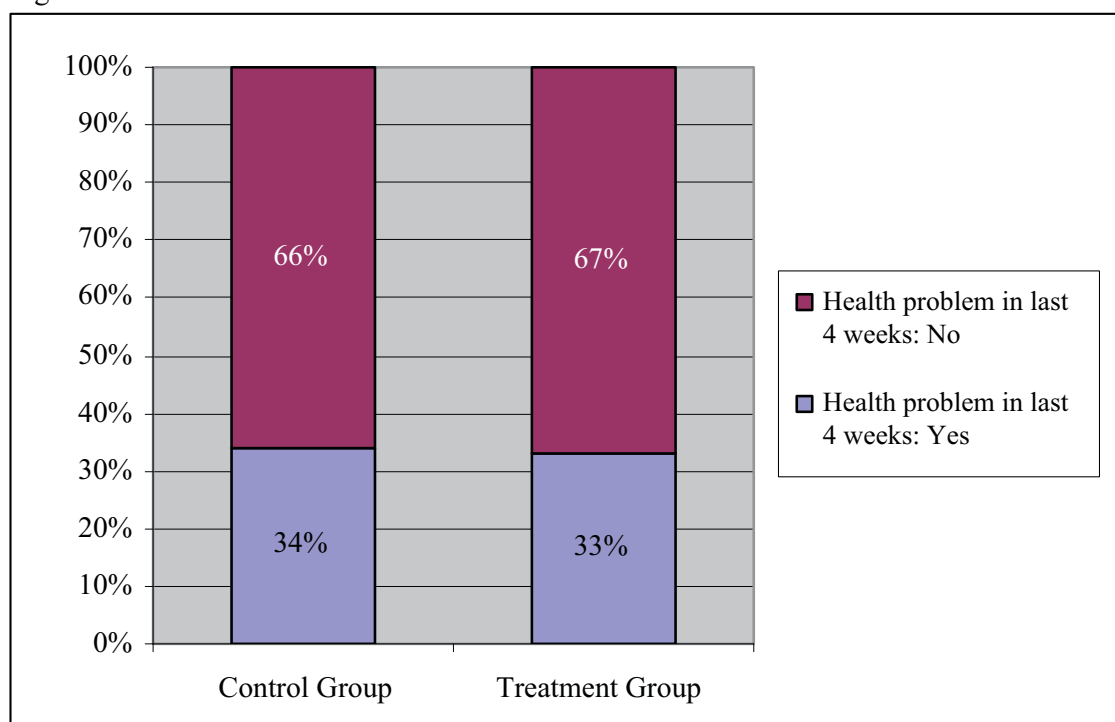
Source: CDRI household survey in 27 villages, December 2009

Table A.12: Education Level of Household Head by Gender

Education level	Control group (%)			Treatment group (%)		
	Male	Female	Both	Male	Female	Both
Kindergarten	0.5	1.1	0.7	0.0	0.0	0.0
Primary school	50.7	42.1	48.0	43.6	40.0	42.7
Secondary school	21.5	8.4	17.3	26.7	10.0	22.2
High school	11.2	1.1	8.0	13.0	1.7	10.0
Technical/vocational	0.0	0.0	0.0	0.6	0.8	0.7
Undergraduate or high	0.0	0.0	0.0	0.9	0.0	0.7
No class	16.1	47.4	26.0	15.2	47.5	23.8

Source: CDRI household survey in 27 villages, December 2009

Figure A.8: Health Status in the Last Four Weeks



Source: CDRI household survey in 27 villages, December 2009

Table A.13: Most Common Health Problems

Treatment group		Most common health problems	Control group	
Percentage	Frequencies		Frequencies	Percentage
39.49	280	Flu	180	38.46
15.66	111	Fever	80	17.09
9.17	65	Arthritis	44	9.4
5.08	36	Stomach ache	31	6.62
3.24	23	Hypertension	22	4.7

Source: CDRI household survey in 27 villages, December 2009

Table A.14: Places Visited for Health Care and Treatment (%)

	Control villages	Treatment village	Overall
Private hospital, clinic	28	24	26
Pharmacy	28	26	27
Home, office of trained health worker, nurse	15	19	17
Health centre	11	13	12
Provincial, district hospital	7	13	11
NGO health worker	6	1	3
National hospital	3	3	3
Others (outreach, kru khmer,...)	2	1	1

Source: CDRI household survey in 27 villages, December 2009

Table A.15: Knowledge on Key Public Health Issues (%)

	Control Group	Treatment Group
Swine flu and preventive measure	87	87
Symptoms of malaria and preventive measures	85	86
Symptoms of TB and where to get treatment	70	67
Birth spacing	91	93
Bird flu and preventive measures	82	80
HIV and its prevention	83	83
Vaccination for children	87	90
Symptoms of dengue and precautions measure	85	90
Health risks of smoking	93	85

Source: CDRI household survey in 27 villages, December 2009

Table A.16: Sources of Knowledge on Key Public Health Issues (%)

	Control Group	Treatment Group	Overall
Radio	50	37	44
Television	18	27	23
Health centre/hospital	15	17	16
Peer educator	9	9	9
Community outreach by NGOs	8	9	8
Others (flier, study at school)	1	1	1

Source: CDRI household survey in 27 villages, December 2009

Table A.17: Tobacco Consumption

Variable	Control group			Treatment group			T-statistic
	N	Mean	Standard Dev	N	Mean	Standard Dev	
Daily tobacco users (smoking and chewing tobacco)	1380	0.13913	0.346208	2135	0.133958	0.340687	0.4368

Source: CDRI household survey in 27 villages, December 2009

Table A.18: Pregnancy Check-up and Child Vaccination

	Control group (%)	Treatment group (%)	Overall (%)
Regular pregnancy check-up	77.27	86.91	83.39
Occasional pregnancy check-up	19.09	9.42	12.96
No pregnancy check-up	3.64	3.66	3.65
Received vaccination programme book / card and brings child for vaccination	90.83	87.43	88.67
Did not receive vaccination programme book / card BUT brings child for vaccination	8.26	10.47	9.67

Source: CDRI household survey in 27 villages, December 2009

Table A.19: Main Source of Energy Consumption (% of total households)

Source of energy	Control group	Treatment group	Overall	Difference	T-Statistics
Firewood	97	96	96	1	0.32
Car batteries	84	77	80	7	2.5
Kerosene	48	51	50	-3	-0.74
Candles	8	11	10	-3	-1.56
Dry cell battery	8	6	7	2	1.36
Gas	3	9	7	-6	-3.21
Charcoal	3	3	3	-	-
Generator	1	4	3	-3	-2.12
Biogas	3	0	1	3	2.61
Solar	0	1	1	-1	-1.64

Source: CDRI household survey in 27 villages, December 2009

Table A.20: Purposes of Energy Consumption (% of total household)

	Control group	Treatment group	Overall
Lighting	41.17	42.58	42.02
Cooking	24.42	25.08	24.82
Water boiling	16.21	16.58	16.43
Entertaining	15.98	14.11	14.86
Business use	1.38	1.03	1.17
Ironing	0.15	0.15	0.15
Water pumping	0.08	0.05	0.06
Other	0.61	0.41	0.49
Total	100	100	100

Source: CDRI household survey in 27 villages, December 2009

Table A.21: Average Lighting Duration by Source of Energy (hours) (In minute)

	Control group	Treatment group	Overall	Difference	T-Statistics
Candle	51	65	61	-13.53	-1
Kerosene	182	246	221	-63.26	-3
Car batteries	212	205	208	7.52	0.85
Small generator set	150	185	179	-35	-0.84

Source: CDRI household survey in 27 villages, December 2009

Table A.22: Monthly Energy Expenditure by Major Sources

Source of energy	Control group		Treatment group		Overall		Difference	T-Statistics
	Riels	%	Riels	%	Riels	%		
Firewood	28913	67	29865	63.72	29484	64.97	-952	-0.62
Car batteries	7368	17.07	7728	16.49	7584	16.71	-360	-0.56
Kerosene	2184	5.06	2645	5.64	2461	5.42	-461	-1.72
Charcoal	1408	3.26	837	1.79	1065	2.35	572	0.76
Total	43153	100	46870	100	45383	100	-3717	-1.43

Exchange rate: 4,146 riels/USD (National Bank of Cambodia, Dec. 2009)

Source: CDRI household survey in 27 villages, December 2009

Table A.23: Information on the Use of Car Batteries

	Control group	Treatment group	Overall	Difference	T-Statistics
Use in past 12 months: sometimes/seldom (%)	3	3	3	-	-
Use in past 12 months: always (%)	97	97	97	-	-
Average number of car batteries owned by household	1.17	1.24	1.21	-0.07	-1.7
Average number of days per week using car batteries	6.96	6.92	6.94	0.04	1.01
Average number of hours per day using car batteries	212.23	204.71	207.89	7.52	0.85
Average number of times per month battery is recharged	6.6	6.84	6.74	-0.24	-0.59
Average cost of each recharge (riels)	1299.8	1443.79	1382.97	-143.98	-3.58
Average cost of battery recharge per month (riels)	8793.68	10083.24	9538.56	-1289.56	-1.81

Source: CDRI household survey in 27 villages, December 2009

Table A.24: Utilisation of Car Batteries (% of total households who use car batteries)

Electrical equipment	Control group	Treatment group	Overall	Difference	T-Statistic
Lighting appliances	85	77	80	8	2.93
Black and white TV	52	39	44	13	3.44
Colour TV	15	12	13	3	1.5
Radio tape cassette	13	14	13	-1	-0.31
VCR/VCD machine	9	14	12	-5	-2.07
Fans	3	3	3	0	0.09
Karaoke	2	1	1	1	0.96

Source: CDRI household survey in 27 villages, December 2009

Table A.25: Household's Willingness for Electricity Connection (% of total household)

	Control group	Treatment group	Overall	Difference	T-Statistics
Connection to electricity	83.67	89.78	87.33	-6.11	-2.47
Reasons					
For better lighting	38.0	39.8	38.9	-	-
For entertainment	31.0	30.1	30.6	-	-
For children's education	13.7	16.5	15.1	-	-
Electricity is cheaper	9.5	9.1	9.3	-	-
To improve income generation	5.8	2.8	4.3	-	-
For information/news	1.3	1.2	1.3	-	-
Other	0.7	0.5	0.6	-	-

Source: CDRI household survey in 27 villages, December 2009

Table A.26: Households Preferring Present Energy Sources (% of total household)

	Control group	Treatment group	Total	Difference	T-Statistics
Prefer present energy	32.67	20.44	25.33	12.23	2.47
Reasons					
Cannot afford to pay monthly electricity bill	45.24	34.92	40.82	-	-
Cannot afford to pay connection fee	39.29	49.21	43.54	-	-
Cannot afford to buy electrical equipment	5.95	4.76	5.44	-	-
Satisfied with present energy	2.38	6.35	4.08	-	-
No connection grid available	3.57	1.59	2.72	-	-
See no use for it	3.57	0	2.04	-	-
Others	0	3.17	1.36	-	-

Source: CDRI household survey in 27 villages, December 2009

Table A.27: Test for Standardised Bias of Independent Variables

Variables	Sample	Treated (mean)	Control (mean)	% bias	% reduced |bias|
hhsz	Unmatched	5.22	4.99	12	
	Matched	5.22	5.19	1.5	87.8
hhage	Unmatched	46.65	48.51	-13.8	
	Matched	47.10	47.86	-5.7	59
hhagesqr	Unmatched	2353.20	2538.20	-13.9	
	Matched	2393.30	2478.40	-6.4	54
hh_educ	Unmatched	4.74	4.17	16.1	
	Matched	4.60	4.43	4.7	70.8
hh_educsqr	Unmatched	36.15	28.79	19	
	Matched	34.24	34.10	0.4	98.1
hhsex	Unmatched	0.73	0.68	10.7	
	Matched	0.72	0.72	1.1	89.9
candle_exp~e	Unmatched	14.52	7.41	14.1	
	Matched	12.76	14.53	-3.5	75
firewood_exp~e	Unmatched	998.10	963.76	5	
	Matched	983.11	967.48	2.3	54.5
charcoal_exp~e	Unmatched	28.27	46.94	-5.2	
	Matched	19.64	12.17	2.1	60
kerosene_exp~e	Unmatched	88.53	72.80	13.2	
	Matched	90.93	95.89	-4.2	68.4
carbattery~exp	Unmatched	253.63	245.59	2.9	
	Matched	238.53	229.57	3.2	-11.5
battery_exp~e	Unmatched	40.02	29.08	18	
	Matched	36.05	39.04	-4.9	72.6
occupation	Unmatched	2.05	1.80	31.5	
	Matched	2.04	2.05	-1.9	94
land_type	Unmatched	0.93	0.96	-11.3	
	Matched	0.94	0.95	-5.5	51.7
house_brick	Unmatched	0.11	0.02	36.6	

	Matched	0.06	0.05	3.6	90.2
index_home~exp	Unmatched	0.15	-0.27	24.4	
	Matched	-0.07	-0.07	0	100
index_transp	Unmatched	0.07	-0.11	16.6	
	Matched	0.01	0.10	-9.1	45.5
index_agri	Unmatched	-0.11	0.18	-19.9	
	Matched	-0.07	-0.13	4.2	79.2
telephone	Unmatched	0.40	0.55	-30.2	
	Matched	0.42	0.53	-22.1	26.8
credit	Unmatched	0.52	0.47	10.3	
	Matched	0.53	0.54	-3.4	66.7
prim_schol	Unmatched	0.51	0.20	68.7	
	Matched	0.47	0.45	3.8	94.5
ngo_serv	Unmatched	0.79	0.77	5.7	
	Matched	0.78	0.84	-13.1	-128.7
toilet	Unmatched	0.33	0.32	2.1	
	Matched	0.31	0.26	11.8	-454.2
hh_health	Unmatched	0.47	0.44	6.4	
	Matched	0.46	0.47	-1.6	74.4
water_acc	Unmatched	0.55	0.55	0.4	
	Matched	0.53	0.47	11.6	-3111.5
literacy	Unmatched	0.71	0.66	10.6	
	Matched	0.70	0.66	9.8	7.7

Source: Authors' calculation based on survey data

Table A.28: Summary of ptest before and after Matching

Summary of the distribution of the abs(bias)				
BEFORE MATCHING				
	Percentiles	Smallest		
1%	.3617366	.3617366		
5%	2.12659	2.12659		
10%	2.886181	2.886181	Obs	26
25%	6.383514	4.96934	Sum of Wgt.	26
50%	13.50523		Mean	16.10241
		Largest	Std. Dev.	14.04548
75%	19.01064	30.15183		
90%	31.47223	31.47223	Variance	197.2754
95%	36.647	36.647	Skewness	2.157688
99%	68.66474	68.66474	Kurtosis	8.652711
AFTER MATCHING				
	Percentiles	Smallest		
1%	.0116811	.0116811		
5%	.3554499	.3554499		
10%	1.075123	1.075123	Obs	26
25%	2.084334	1.457869	Sum of Wgt.	26

50%	3.965003		Mean	5.434519
		Largest	Std. Dev.	4.937881
75%	6.393112	11.61714		
90%	11.7855	11.7855	Variance	24.38266
95%	13.13876	13.13876	Skewness	1.711691
99%	22.08508	22.08508	Kurtosis	6.07584

Source: Authors' calculation based on survey data

Table A.29: Summary of number of households with on and off-support

psmatch2: treatment assignment	psmatch2: common support		Total
	Off support	On support	
Untreated	0	300	300
Treated	35	409	444
Total	35	709	744

Source: Authors' calculation based on survey data

Figure A.9: Ps-graph after Matching Operation

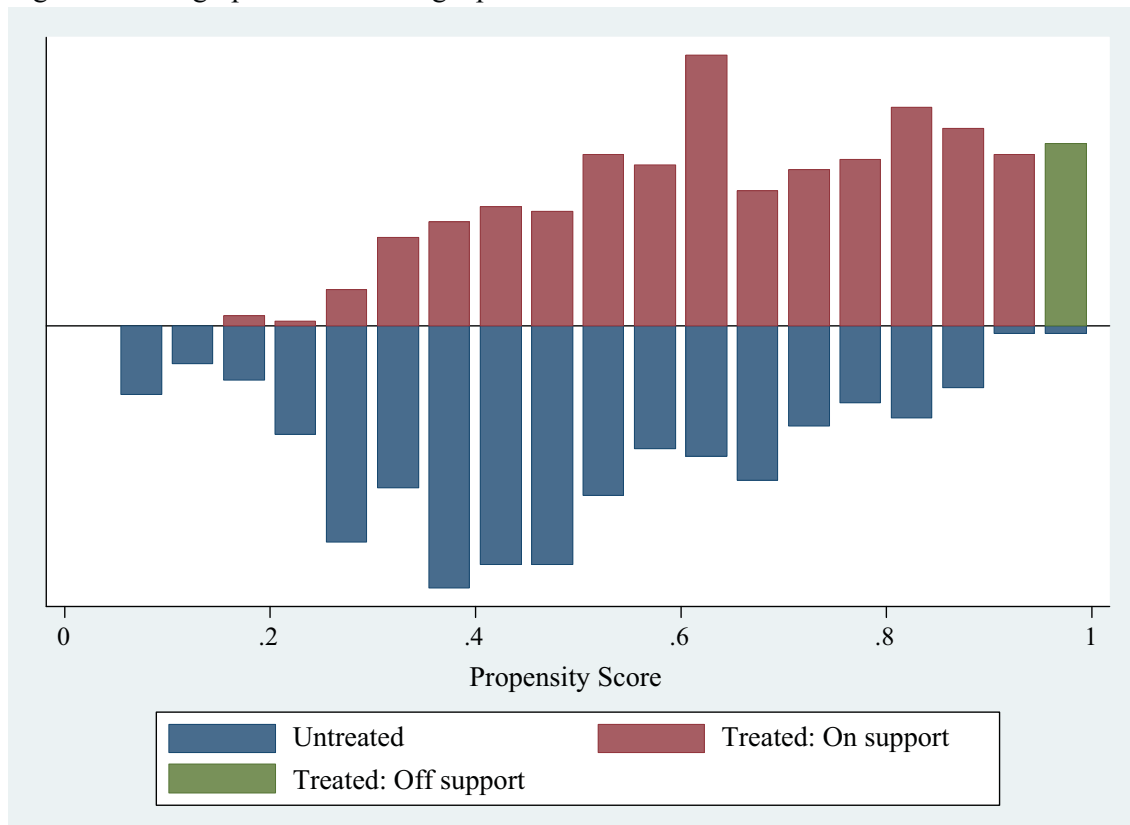
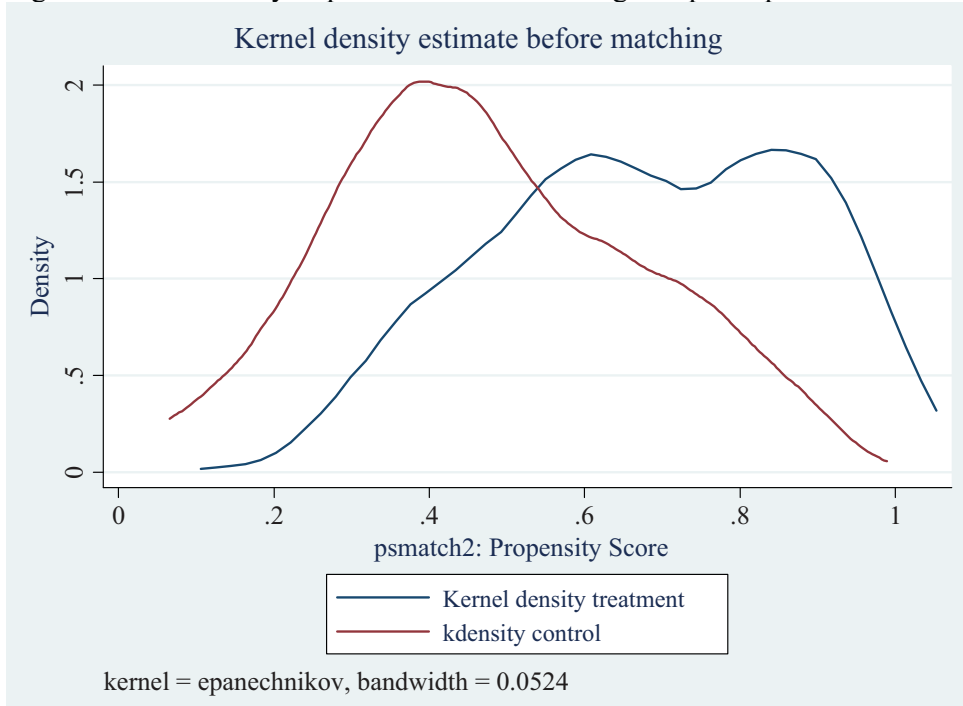
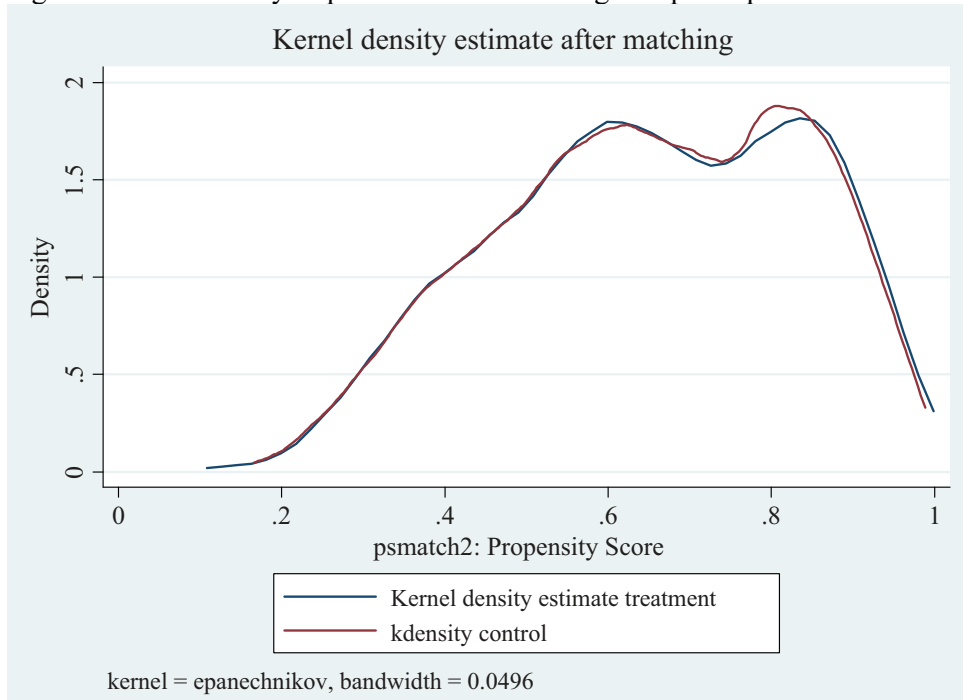


Figure A.10: K-density of p-score Before Matching Sample Population of 744



Source: Authors' calculation based on survey data

Figure A.11: K-density of p-score After Matching Sample Population of 709



Source: Authors' calculation based on survey data

CONFIDENTIALITY

All information collected in this survey is strictly confidential and will be used for statistical purposes only.

Baseline Survey on Socioeconomic Impacts
of GMS Transmission Project
December 2009

Ordinal Number of Questionnaire:

A. To be completed by interviewer before interview																											
Province																											
District																											
Commune																											
Sample Village																											
B. To be completed by interviewer																											
Name of household head																											
Address (house No., street...) of other identification																											
Interviewer's name:																											
Date of Survey																											
C. To be completed by supervisor after checking completed questionnaire thoroughly																											
Supervisor's name:																											
Date checked by supervisor																											
Supervisor's signature																											
Reception																											
Id: <input type="text"/> Date: <input type="text"/> Id: <input type="text"/> Date: <input type="text"/>																											
Q. Does Your Household Connect To Electricity Grid (either national grid or REE grid)?																											
1. Yes (If Yes, Give Up)																											
2. No (If No, Go Ahead)																											
Data Entry																											
Day Month Year																											
Id: <input type="text"/> Date: <input type="text"/>																											

Note: The following questions should be asked to only the head of the household, spouse of the head of the household, or any other adult household member.

I. Demographic Information

Q.1.1 How many members are there in your family? _____

Q.1.2 How many males are there in your family? _____

Q.1.3 How many females are there in your family? _____

ID No	Name	(a) Sex 1=Male, 2=Female	(b) Age (Write 999 if don't know)	(c) Relationship with the household head (Enter Code)	(d) Ethnicity (Enter Code)	(e) Marital Status (Enter Code)
Q.1.4 (1)	Q.1.5 (2)	Q.1.6 (3)	Q.1.7 (4)	Q.1.8 (5)	Q.1.9 (6)	Q.1.10 (7)
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						

Relationship codes (Col 5)	1= Head, 2= Spouse, 3= Son/daughter, 4= Stepchild, 5= Adopted child/foster child, 6= Parent, 7= Sibling, 8= Grandchild, 9= Niece/nephew, 10= Son/daughter-in-law, 11= Brother/Sister-in-law, 12= Parent-in-law, 13= Other relative, 14= Servant, 15= Other non-relative
Ethnicity codes (Col 6)	1= Khmer, 2= Cham, 3=Other local ethnic group, 4= Chinese, 5=Vietnamese, 6=Thai, 7=Lao, 8=Others (specify.....)
Marital status code (Col. 7)	1 = Never Married, 2 = Currently Married, 3 = Live Together, 4 = Widowed , 5 = Divorced , 6 = Separated

II. EDUCATION AND LITERACY

ID No	(a) Can ..[NAME]... read a simple message in any language? 1 = Yes 2 = No	(b) Can ..[NAME]... write a simple message in any language? 1 = Yes 2 = No	(c) Has ..[NAME]... ever attended school? 1 = Yes 2 = No (=>10)	(d) How many years has ...[NAME]... attended school? (Enter completed number of years)	(e) What is the highest level ..[NAME]... successfully completed? (Enter code)	(f) Is ..[NAME]... currently in the school system? 1 = Yes 2 = No (=> 9)	(g) What's ..[NAME]... 's.. current grade? (Enter code)	(h) Is ..[NAME]... currently taking private lessons after school? (languages, math, science, music, sports)? 1 = Yes 2 = No	(i) If below 18 years of age: Why is ..[NAME]... not attending (has never attended) school? (Enter code)
Q.2.1 (1)	Q.2.2 (2)	Q.2.3 (3)	Q.2.4 (4)	Q.2.5 (5)	Q.2.6 (6)	Q.2.7 (7)	Q.2.8 (8)	Q.2.9 (9)	Q.2.10 (10)
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									

Level of education Code (Col.6)	98 = Don't know 11 = Class eleven completed 16 = Technical/vocational post-secondary diploma/certificate 88 = No class completed 12 = Class twelve completed 17 = College/university undergraduate 0 = Pre-school/Kindergarten 13 = Lower Secondary school certificate 18 = Bachelor degree (B.A., BSc, etc.) 1 = Class one completed 14 = Upper secondary school certificate 19 = Masters degree (M.A., MSc, etc) 2 = Class two completed... 15 = Technical/vocational pre-secondary diploma/certificate 20 = Doctorate degree (PhD) 21 = Others (Specify.....)
Current grade Code (Col.8)	0 = Pre-school/Kindergarten 1 = Class one 2 = Class two....., 11 = Class eleven 12 = Class twelve 13 = Technical/vocational pre-secondary diploma/certificate 14 = Technical/vocational post-secondary diploma/certificate 15 = College/university undergraduate studies 16 = Postgraduate studies
Reasons not attending school (Col.10)	1 = Don't want to 4 = No teacher/Supplies 7 = Must help with household chores 2 = Did not do well in school 5 = High cost of schooling/No money 8 = Due to disability/illness 3 = No suitable school available/school is too far 6 = Must contribute to household income 9 = Others (specify.....)

Activity Status And Main Occupations During The Past 6 Months

Primary occupation			Secondary occupation											
	Is ... [NAME]... able to work? (<i>enter code</i>)	How many occupations did... [NAME]... have in the past 6 months ?	What was ...[NAME] ... 's primary occupation during the past 6 months ? (<i>Write specific occupation</i>)	What was ...[NAME] ... 's primary occupation during the past 6 months ? (<i>Enter code</i>)	What was ... [NAME] ... 's employment status? (<i>Enter code</i>)	Under what type of ...[NAME] ... work? (<i>Enter code</i>)	How many month on average did ... [NAME]... work for the past 6 months?	What was ... [NAME] ... 's income from the primary occupation during the past 6 months? (<i>Mocun riel</i>)	What was ...[NAME] ... 's secondary occupation during the past 6 months? (<i>Write specific occupation</i>)	What was ... [NAME]... 's secondary occupation during the past 6 months? (<i>Enter code</i>)	What was ... [NAME] ... 's employment status? (<i>Enter code</i>)	Under what type of employer did ...[NAME]... work? (<i>Enter code</i>)	How many months on average did ...[NAME]... work for the past 6 months?	What was ... [NAME] ... 's income from the primary occupation during the past 6 months? (<i>Mocun riel</i>)
Q.3.1 (1)	Q.3.2 (2)	Q.3.3 (3)	Q.3.4 (4)	Q.3.5 (5)	Q.3.6 (6)	Q.3.7 (7)	Q.3.8 (8)	Q.3.9 (9)	Q.3.10 (10)	Q.3.11 (11)	Q.3.12 (12)	Q.3.13 (13)	Q.3.14 (14)	Q.3.15 (15)
01														
02														
03														
04														
05														
06														
07														
08														
09														
10														
Employment ability (Co.2)			1. Full time work 6. Too old to work		2. Part time work 7. Too young to work		3. Study and work 8. Do house work and other family works (no-payment)		4. Study 5. Disable to work					
Employment Codes (Col.5 and Col.11)			To be completed											
Employment status Codes (Col.6 and Col.12)			1=Paid employee, 2=Employer, 3=Own account worker, /self-employed, 4=Unpaid family worker, 5=Other(specify)											
Type of employer Codes (Col.7 and Col.13)			01 = Government, 02 = State enterprise, 03 = Private enterprise, 04 = Joint venture, 05 = Foreign govt, international organization and NGO, 06 = Local NGO, 07 = Self-employed farm, 08 = Non-farm self-employed, 09 = Domestic servant, 10 = Others (specify.....)											

IV. HOUSEHOLD INCOME AND EXPENDITURE

Please provide the information about TOTAL household incomes (incomes of all members usually residing in the household) **during the last 6 months:**

1. INCOME

Income Source	Total Income (In moeun riels)
Q.4.1. Rice	..... moeun riels
Q.4.2. Maize	..... moeun riels
Q.4.3. Beans	..... moeun riels
Q.4.4. Sesame	..... moeun riels
Q.4.5. Cucumber	..... moeun riels
Q.4.6. Watermelon	..... moeun riels
Q.4.7. Cassava	..... moeun riels
Q.4.8. Vegetables	..... moeun riels
Q.4.9. Reed / lotus	..... moeun riels
Q.4.10. Pig	..... moeun riels
Q.4.11. Cow / buffalo	..... moeun riels
Q.4.12. Chicken	..... moeun riels
Q.4.13. Duck	..... moeun riels
Q.4.14. Fish	..... moeun riels
Q.4.15. Hunting	..... moeun riels
Q.4.16. Collecting wood	..... moeun riels
Q.4.17. Palm juice/sugar production	..... moeun riels
Q.4.18. Labour	..... moeun riels
Q.4.19. Wage	..... moeun riels
Q.4.20. Pension	..... moeun riels
Q.4.21. Remittances	..... moeun riels
Q.4.22. Transfers (support from NGOs	..... moeun riels
Q.4.23. Income from lottery or gambling	..... moeun riels
Q.4.24. Bank interests	..... moeun riels
Q.4.25. Interests on loans to others	..... moeun riels
Q.4.26. Small business/petty trade	..... moeun riels
Q.4.27. Rental	..... moeun riels
Q.4.28. Others .....	..... moeun riels
Q.4.29. TOTAL	..... moeun riels

2. EXPENDITURE

Respondent: the household member who knows most about food, beverage, tobacco consumption in the last 7 days. The following questions should be asked of the household member who knows most about food consumption, beverage and tobacco in the **last 7 days.**

B1. Food/ Beverage/ Tobacco Items

For each item group try to estimate quantity of items consumed, and then how much of the consumed quantity had been purchased in cash and how much was from own production or received as payment in kind for work, or as gift, or free collection		(a) Purchased in cash (In moeun Riel)	(b) Own produce, wages in kind, gifts, free collections (imputed value) (In moeun Riel)
FOOD/BEVERAGE/TOBACCO ITEMS			
Q.4.30.	Cereals (rice, bread, corn, wheat flour, rice flour, corn meal, rice cakes, noodles, biscuits, etc.)	.....moeun riels	.....moeun riels
Q.4.31.	Fish (fresh fish, salted and dried fish, canned fish, shrimp, prawn, crab, etc.)	.....moeun riels	.....moeun riels
Q.4.32.	Meat & poultry (beef, buffalo, mutton, lamb, pork, chicken, duck, innards, incl liver, spleen, dried beef)	.....moeun riels	.....moeun riels

Q.4.33.	Eggs (chicken egg, duck egg, quail egg, fermented/salted egg, etc.)	.....moeun riels	.....moeun riels
Q.4.34.	Dairy products (fresh milk, condensed or powdered milk, ice cream, cheese, other dairy products, etc.)	.....moeun riels	.....moeun riels
Q.4.35.	Oil and fats (rice bran oil, vegetable oil, pork fat, butter, margarine, coconut/frying oil, etc.)	.....moeun riels	.....moeun riels
Q.4.36.	Fresh vegetables (trakun, onion, shallot, cabbage, spinach, carrot, beans, chilli, tomato, etc.)	.....moeun riels	.....moeun riels
Q.4.37.	Tuber (cassava, sweet potato, potato, traov, sugar beet, etc.)	.....moeun riels	.....moeun riels
Q.4.38.	Pulses and legumes (green gram, dhall, cowpea, bean sprout, other seeds, etc.)	.....moeun riels	.....moeun riels
Q.4.39.	Prepared and preserved vegetables (cucumber pickles, other pickles, tomato paste, etc.)	.....moeun riels	.....moeun riels
Q.4.40.	Fruit (banana, orange, mango, pineapple, lemon, papaya, durian, water melon, grape, apple, canned and dried fruits, etc.)	.....moeun riels	.....moeun riels
Q.4.41.	Dried nuts and edible seeds (coconut, cashew nut, lotus nut, peanut, gourd seed, other nuts)	.....moeun riels	.....moeun riels
Q.4.42.	Sugar, salt and spices (sugar, jaggery, salt, chocolate, candy, coriander, red pepper spice, garlic, ginger, soy sauce, fish sauce, monosodium glutamate, etc.)	.....moeun riels	.....moeun riels
Q.4.43.	Tea, coffee, cocoa	.....moeun riels	.....moeun riels
Q.4.44.	Non-alcoholic beverages (canned or bottled soft drinks, mineral water, fruit juice, fruit syrup, etc.)	.....moeun riels	.....moeun riels
Q.4.45.	Alcoholic beverages (beer, wine, whisky, scotch, other distilled spirits)	.....moeun riels	.....moeun riels
Q.4.46.	Tobacco products (cigarettes, mild tobacco, strong tobacco, etc.)	.....moeun riels	.....moeun riels
Q.4.47.	Other food products (fried insects, peanut preparation, flavoured ice, ice, other food products)	.....moeun riels	.....moeun riels
Q.4.48.	Food taken away from home (meals at work, school, restaurants, snacks, coffee, soft drinks purchased outside home)	.....moeun riels	.....moeun riels
Q.4.49.	Prepared meals bought outside and eaten at home	.....moeun riels	.....moeun riels
Q.4.50.	TOTAL	.....moeun riels	.....moeun riels

B2. Non-Food Expenditure

What was your household's expenditure on the following items during the last 6 months?

	NON-FOOD ITEMS	Time period	(a) In cash expenditure (In moeun Riel)	(b) In-kind expenditure or gift given away (In moeun Riel)
Q.4.51.	House rent (house rent, rental value of rent-free housing, rental value of owner-occupied housing, hotel charges, and house maintenance and repair)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.52.	Water charges	Last 6 month	...moeun Riel	.....moeun Riel
Q.4.53.	Fuel and power (kerosene, candles, electricity, LPG, etc.) Excluding wood fuel.	Last 6 month	...moeun Riel	.....moeun Riel
Q.4.54.	Wood fuel (firewood, charcoal)	Last 6 month	...moeun Riel	.....moeun Riel
Q.4.55.	Medical care (doctors' fees, other medical services, drugs, hospital charges, other medical supplies, etc.)	Last 6 month	...moeun Riel	.....moeun Riel
Q.4.56.	Transportation (personal transport equipment, operation of transport equipment, maintenance and repair of equipment, fees for public transport, moving fee, driving lessons, etc.)	Last 6 month	...moeun Riel	.....moeun Riel

Q.4.57.	Communication (postage stamps, fax and telephone charges, cell phones, phone cards, Internet charges etc.)	Last 6 month	...moeun Riel	.....moeun Riel
Q.4.58.	Personal care (soap, toothpaste, razor, sanitary napkins, haircut, manicure, etc.)	Last 6 month	...moeun Riel	.....moeun Riel
Q.4.59.	Clothing and footwear (tailored clothes, ready-made clothes, rain clothes, underwear, baby clothes, diapers, hats, shoes, boots, etc.)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.60.	Furniture, furnishings and household equipment and operation (curtain, household appliances, cooking utensils, light bulbs, soap and detergents etc.)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.61.	Domestic salaries (servant's salary, hired labour for cleaning, laundry, cooking)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.62.	Recreation (entertainment services, recreational goods and supplies, tourist travel)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.63.	Education (school fees, textbooks, private tutoring charges, etc.)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.64.	Personal effects (costume/gold jewellery, handbags, wallets, wristwatch, clocks, umbrella)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.65.	Gambling (lottery, sports betting, casino gambling, card games etc.)	Last 6 months	...moeun Riel	.....moeun Riel
Q.4.66.	Miscellaneous items (special occasions as funerals, weddings, parties, rituals, cash gifts, charity, etc.)	Last 6 months	... moeun Riel	.....moeun Riel
Q.4.67.	TOTAL			

V. HOUSING CONDITION, PROPERTIES AND ASSETS

A. HOUSING CONDITION

	Enter Code Or other answer
Q.5.1. What is your Housing condition? 1. thatch house 2. wooden house roofed with tin sheets 3. wooden house roofed with tiles and Fibrous cement 4. concrete/brick house 5. Others (specify).....	
Q.5.2. What is the area of your house? width..... m length.....m	..... m ²
Q.5.3. Number of Storey?	----- storey
Q.5.4. Number of Room?	----- room
Q.5.5. What is your household's main source of drinking water? 1. piped in dwelling or on premises 2. hand pump/bore hole 3. dug well 4. pond, river or steam 5. (big) river 6. Rain water 7. Tanker truck, vendor or otherwise bought 8. Others (specify).....	
Q.5.6. Do you have a toilet? 1. Yes 2. No	

Q.5.7. If yes, what type of toilet?	
1. Flush toilet	
2. Latrine	
3. wooden toilet	
4. Others (specify).....	

B. LAND OWNERSHIP

Q.5.8. How many plots of land does your household own or operate?
Please list for each plot your household owns (including rented out and rented in) from others.

PLOT NUMBER	(a) What is the area of the plot in square meters (m2)?	(b) Do you own this land, rent it or have it some other way? (Enter Code)	(c) What type of land is it? (Enter Code)	(d) In what year did you first have/ start using this plot? (Year)	(f) How did you acquire it? (Enter Code)	(g) Do you have a paper to certify your ownership or rental agreement? (Enter Code) (If answer 2 and 4, => next section)	(h) What kind of paper do you have? (Enter Code)
Q.5.9. (1)	Q.5.10. (2)	Q.5.11. (3)	Q.5.12. (4)	Q.5.13. (5)	Q.5.14. (6)	Q.5.15. (7)	Q.5.16. (8)
(Plot1)							
(Plot2)							
(Plot3)							
(Plot4)							
(Plot5)							
(Plot6)							
(Plot7)							

Land ownership Code (Col. 3)	1 = Own 2 = Own, but rent out 3 = Rented in 4 = Free use of land 5 = Other (specify)
Land type Code (Col.4)	1 = Wet-season land 4 = Chamkar land 7 = Land for raising livestock 2 = Dry-season land 5 = Kitchen garden 8 = Idle land 3 = Wet and dry season land 6 = Land with permanent crops (backyard) 9 = residential land 10= Other lands (specify.....)
Land acquisition Code (Col. 6)	1 = Given by the state or local authority 3 = Bought it 5 = Donated by friend 2 = By inheritance or gift from relatives 4 = Cleared land/occupied for free 6 = Rented in 7 = Others (specify.....)
Ownership certification Code (Col. 7)	1 = Yes 2 = Never had 3 = Lost it 4 = Don't know
Paper type Code (Col.8)	1 = Application receipt 3 = Certificate (title) from the state 5 = Rental contract 2 = Land investigation paper 4 = Paper from local authority 6 = Others (specify.....)

C. DURABLE GOODS

Items	(a) Ownership 1. Yes 2. No (If answer 2 => next question)	(a) Number	(b) Present value (in moeun Riel)
Home Electronics			
Q.5.17. Radio			..... moeun riels
Q.5.18. TV			..... moeun riels
Q.5.19. Telephone			..... moeun riels
Q.5.20. Icom			..... moeun riels

Items	(a) Ownership 1. Yes 2. No (If answer 2 => next question)	(a) Number	(b) Present value (in moeun Riel)
Q.5.21. Video/VCD/DVD			..... moeun riels
Q.5.22. Stereo			..... moeun riels
Q.5.23. Camera			..... moeun riels
Q.5.24. Satellite dish (DTV)			..... moeun riels
Transport			
Q.5.25. Bicycle			..... moeun riels
Q.5.26. Motorcycle			..... moeun riels
Q.5.27. Car			..... moeun riels
Q.5.28. Remorque / tuk tuk			..... moeun riels
Q.5.29. Jeep / Van			..... moeun riels
Q.5.30. Rowing boat			..... moeun riels
Q.5.31. Machine boat			..... moeun riels
Home Equipment			
Q.5.32. Sewing machine			..... moeun riels
Q.5.33. Refrigerator			..... moeun riels
Q.5.34. Electric kitchen / Gas stove			..... moeun riels
Q.5.35. Washing machine			..... moeun riels
Q.5.36. Dishwasher			..... moeun riels
Q.5.37. Freezer			..... moeun riels
Q.5.38. Vacuum cleaner			..... moeun riels
Q.5.39. Electric Iron			..... moeun riels
Q.5.40. Electric fan			..... moeun riels
Q.5.41. Air conditioner			..... moeun riels
Q.5.42. Generator			..... moeun riels
Q.5.43. Batteries			..... moeun riels
Computer and Printer			
Q.5.44. Computer			..... moeun riels
Q.5.45. Printer			..... moeun riels
Agriculture and other production			
Q.5.46. Cart			..... moeun riels
Q.5.47. Tractor			..... moeun riels
Q.5.48. Bulldozer / roller			..... moeun riels
Q.5.49. Plough			..... moeun riels
Q.5.50. Threshing machine			..... moeun riels
Q.5.51. Hand tractor			..... moeun riels
Q.5.52. Rice mill			..... moeun riels
Q.5.53. Water pump			..... moeun riels
Animal			
Q.5.54. Cow			..... moeun riels
Q.5.55. Buffalo			..... moeun riels
Q.5.56. Horse			..... moeun riels
Q.5.57. Pig			..... moeun riels

Items	(a) Ownership 1. Yes 2. No (If answer 2 => next question)	(a) Number	(b) Present value (in moeun Riel)
Q.5.58. Goat			..... moeun riels
Q.5.59. Chicken			..... moeun riels
Q.5.60. Duck			..... moeun riels
Furniture			
Q.5.61. Sofa set			..... moeun riels
Q.5.62. Dining set (dining table + chair)			..... moeun riels
Q.5.63. Bed sets (bed, mattress,....)			..... moeun riels
Q.5.64. Wardrobe, cabinets			..... moeun riels
Recreation			
Q.5.65. Musical instruments			..... moeun riels
Q.5.66. Sport equipments			..... moeun riels
Others			
Q.5.67. Others (specify.....)			..... moeun riels
Q.5.68. Others (specify.....)			..... moeun riels
Q.5.69. TOTAL			..... moeun riels

VI. HOUSEHOLD LIABILITY

Q.6.1. Does your household have outstanding loans or debts to other households or institutions?

1. Yes

2. No (If no, go to section VII)

Q.6.2. If have, How much?loans or debts

LOAN NUMBER	(a) How old is the debt? Months	(b) From whom did you obtain the loan? (Enter Code)	(c) What was the primary purpose for which you borrowed the money? (Enter Code)	(d) What was the total amount borrowed? Moeun riels	(e) If interest is charged, what is the monthly rate of interest? Percentage	(f) How much of the amount in Col. 5 is still to be repaid, including interest? Moeun riels
Q.6.3 (1)	Q.6.4 (2)	Q.6.5 (3)	Q.6.6 (4)	Q.6.7 (5)	Q.6.8 (6)	Q.6.9 (7)
(Loan1)						
(Loan2)						
(Loan3)						
(Loan4)						
(Loan5)						
(Loan6)						

Loan source Code (Col. 3)	1 = Relatives in Cambodia 2 = Relatives who live abroad 3 = Friends/neighbours	4 = Moneylender 5 = Trader 6 = Landlord	7 = Employer 8 = Bank 9 = NGO	10. MFI 11 = Others (specify.....)
Loan purpose Code (Col.4)	1 = Agricultural production and operation 2 = Non-agricultural activities 3 = Household consumption needs 4 = Illness, injury 5 = Other emergencies (fire, flood, theft) 6 = Marriage ceremony 7 = Funeral 8 = Other ceremonials (specify) 9 = Purchase/improvement of Purchase/improvement of dwelling 10 = Purchase of consumer durables 11 = Agricultural Implementation 12 = Servicing and existing debts 13 = Others (specify.....)			

VII. CONSUMPTION AND EXPENDITURE FOR ENERGY

What kind of energy source does your household use?

	(a) Utilization	(b).Purpose of Use	(c) Monthly expenditure
	1: Yes 2: No (if no => next question)	1. Lighting 2. Cooking 3. Water boiling 4. Entertaining 5. Water pumping 6. Washing 7. Ironing 8. Business use 9. Other.....	Riels
Q.7.1. Candles			.....Riels
Q.7.2. Firewood			.....Riels
Q.7.3. Charcoal			.....Riels
Q.7.4. Kerosene			.....Riels
Q.7.5. Gas			.....Riels
Q.7.6. Biogas			.....Riels
Q.7.7. Dry Cell Battery			.....Riels
Q.7.8. Car Batteries			.....Riels
Q.7.9. Solar power			.....Riels
Q.7.10. Household owned generator			.....Riels
Q.7.11. Generator owned by local supplier			.....Riels
Q.7.12. Battery			.....Riels

Note: Below ask only the energy sources that are used in the above question.

CANDLES

	Enter Code Or other answer		
Q.7.13. During the last 12 months how often did your household use candles? 1. Used sometimes / seldom 2. Always			
Q.7.14. Do any household members use candlelight in the evening for what purposes? (More than one answer is possible) 1. Area lighting 2. Reading/writing/studying 3. Others (specify.....)	Q.7.14.1	Q.7.14.2	Q.7.14.3
Q.7.15. Generally, how many hours per evening does your household usually use candles for lighting?	.....minutes		

KEROSENE

	Enter Code Or other answer				
Q.7.16. During the past 12 months how often did your household use kerosene? 1. Used sometimes / seldom 2. Always					
Q.7.17. What percentage of the kerosene your household uses for the following purposes? (More than one answer is possible) 1. Cooking and boiling water for drinking 2. Area lighting 3. Reading/Writing/Studying 4. For home business 5. Others (specify.....)	Q.7.17.1	Q.7.17.2	Q.7.17.3	Q.7.17.4	Q.7.17.5
Q.7.18. If kerosene is used for lighting, on average how many hours per evening your household usually use?	.....minutes				

DRY CELL BATTERIES

	Enter Code Or other answer				
Q.7.19. During the past 12 months did your household use a dry cell battery for any of the following applications: torch, radio, tape cassette, other? 1. Used sometimes / seldom 2. Always					
Q.7.20. Do any household members use dry cell battery for what purposes? (More than one answer is possible) 1. Listening to radio 2. Area lighting 3. Reading/Writing/Studying 4. For home business 5. Others (specify.....)	Q.7.20.1	Q.7.20.2	Q.7.20.3	Q.7.20.4	Q.7.20.5

CAR BATTERY

	Enter Code Or other answer
Q.7.21. During the past 12 months did your household use car battery to supply electricity? 1. Used sometimes / seldom 2. Always	
Q.7.22. During the past 30 days, did your household use a car battery to supply electricity? 1. No, did not use 2. Used as supplementary source of electricity 3. Used as the main source of electricity	
Q.7.23. How many car batteries does your household have?	.....battery
Q.7.24. On average, how many days per week does your household use electricity from car battery?	.....days
Q.7.25. On average, how many hours per day does your household use electricity from car battery?	.....minutes
Q.7.26. On average, how many time in a month does your household recharge battery?	.....times
Q.7.27. How much does each recharge cost?	.....Riels
Q.7.28. On average, how much do you spend on recharging all your batteries each month?	.....Riels

More information about each battery:

	(a) Capacity Amp	(b) Voltage	(c) How much did it cost? Riels
Q.7.29. Battery1			.....Riels
Q.7.30. Battery2			.....Riels

More information about use of batteries:

Items	(a) Do you use a car battery for any of these devices? 1. Yes 2. No (if answer 2 => next question)	(b) Average no. days used in the last 30 days? Days	(c) Average no. minutes used in a day? Minutes
Q.7.31. Black & white TV		.....days	.....minutes
Q.7.32. TV		.....days	.....minutes
Q.7.33. Radio and/or tape cassette		.....days	.....minutes
Q.7.34. Karaoke		.....days	.....minutes
Q.7.35. Video VCR /VCD machine		.....days	.....minutes
Q.7.36. Lighting appliances		.....days	.....minutes
Q.7.37. Electric fan		.....days	.....minutes
Q.7.38. Others (specify...)		.....days	.....minutes

SOLAR POWER SYSTEM

	Enter Code Or other answer
Q.7.39. During the past 12 months did your household use power solar system? 1. Used sometimes / seldom 2. Always	
Q.7.40. How would you rate your current electricity supply? 1. Not enough for household need 2. Just enough for household need 3. More than enough for household need	
Q.7.41. What is the size (in watt-peak, Wp) of the solar system?	.....
Q.7.42. On average, how many days per week does your household use solar power?	.....days
Q.7.43. On average, how many minutes per day does your household use solar power?	.....minutess
Q.7.44. How much do you spend on whole solar system?	.....Riels
Q.7.45. How long it would last?	.....years

What does your household use of solar power for the following devices:

Item	(a) Do you use solar power for any of these devices? 1. Yes 2. No (if answer 2 => next question)	(b) Average no. days used in the last 30 days? Days	(c) Average no. minutes in a day? Minutes
Q.7.46. Black & white TV		.....days	.....minutes
Q.7.47. TV		.....days	.....minutes
Q.7.48. Radio and/or tape cassette		.....days	.....minutes
Q.7.49. Karaoke		.....days	.....minutes
Q.7.50. Video VCR /VCD machine		.....days	.....minutes
Q.7.51. Lighting appliances		.....days	.....minutes
Q.7.52. Fan		.....days	.....minutes
Q.7.53. Iron		.....days	.....minutes
Q.7.54. Electric mixer/ grinder		.....days	.....minutes
Q.7.55. Refrigerator		.....days	.....minutes
Q.7.56. Others (specify...)		.....days	.....minutes

Small Generator Set

	Enter Code Or other answer
Q.7.57. During the past 12 months did your household use small generator? 1. Used sometimes / seldom 2. Always	
Q.7.58. How much did you spend in purchasing your generator set?	..... Riels
Q.7.59. What is the rating in KVA of your generator set?	..... KVA
Q.7.60. On average, how many minutes per day does your household use generator?	..... minutes
Q.7.61. On average, how many days per month does your household use generator?	..... days

What does your household use of small generator set for the following devices?

Items	(a) Do you use generator for any of these devices? 1. Yes 2. No (if answer 2 => next question)	(b) Average no. days used in the last 30 days? days	(c) Average no. minutes in a day? Minutes
Q.7.62. Black & white TV		.....days	.....minutes
Q.7.63. TV		.....days	.....minutes
Q.7.64. Radio and/or tape cassette		.....days	.....minutes
Q.7.65. Karaoke		.....days	.....minutes
Q.7.66. Video VCR /VCD machine		.....days	.....minutes
Q.7.67. Lighting appliances		.....days	.....minutes
Q.7.68. Fan		.....days	.....minutes
Q.7.69. Iron		.....days	.....minutes
Q.7.70. Electric mixer/ grinder		.....days	.....minutes
Q.7.71. Refrigerator		.....days	.....minutes
Q.7.72. Others (specify.....)		.....days	.....minutes

Household Perception on Electricity Connection

	Enter Code Or other answer		
Q.7.73. For household which have no electricity connection, would you like to have access to electricity or would you prefer to continue using your present energy sources? 1. Electricity (<i>if answer 1 => Q.7.74</i>) 2. Prefer present energy sources (<i>if answer 2 => Q.7.75</i>)			
Q.7.74. If answer 1 for Q.7.73 above, please give us reason for connecting to grid electricity? (Please choose 3 most important answers) 1. For children's education 2. For better lighting 3. For entertainment 4. For information/news 5. To improve income-generating opportunities 6. Electricity is cheaper than other sources of energy i.e. kerosene, batteries,... 7. Others (specify.....)	Q.7.74.1	Q.7.74.2	Q.7.74.3
Note: After finish this question => Q.7.78 Q.7.75. If answer 2 for Q.7.73, please give us reason for not connecting to grid electricity: 1. Cannot afford to pay for the cost associated connection 2. Cannot afford to pay for monthly usage fee of electricity 3. Cannot afford to buy electrical equipment 4. No connection grid available 5. Satisfied with present energy sources 6. See no application 7. Others (specify.....)	Q.7.75.1	Q.7.75.2	Q.7.75.3
Note: if answer 3,4,5,6 and 7 => Q.7.78 Q.7.76. If answer 1 for Q.7.75, how much connection fee can you afford?	..... Riels		
Q.7.77. If answer 2 for Q.7.75, how much tariff rate can you afford?	..... Riels/Kwh		
Q.7.78. If you have electricity, what will you use it for? (More than on answer is possible) 1. Electric lighting 2. Radio / Radio-Cassette 3. TV 4. Video (VHS, VCD) 5. Electric fan 6. Electric rice cooker 7. Electric water pup for drinking and housework 8. Electric water pup for irrigation 9. Iron 10. Refrigerator 11. Washing machine 12. Grains / Cereal / Meat grinder 13. Air conditioner 14. Computer 15. Others (Specify.....)			

VIII. HEALTH

A. GENERAL HEALTH STATUS

ID No	(a) Did ..[NAME].. Have any illness, injury or other health problem in the past 4 weeks? 1 = Yes 2 = No (If No => Q.8.6)	(b) What kind of illness, injury or other health problem related symptom? (Enter Code)	(c) Did ..[NAME].. Seek care for any health problem in the past 4 weeks? 1 = Yes 2 = No (If No => Q.8.6)	(d) Where did you get treatment? (Enter Code)	(e) Does ... [NAME]... smoke cigarette or tobacco daily? 1 = Yes I smoke cigarette 2 = Yes I smoke tobacco 3 = No (If answer 2 or 3 => Q.8.8)	(f) How many cigarettes are you usually smoking per day? Cigarettes	(g) Does ..[NAME].. Use (hammock) mosquito net while sleeping? 1 = Yes 2 = No
Q.8.1 (1)	Q.8.2 (2)	Q.8.3 (3)	Q.8.4 (4)	Q.8.5 (5)	Q.8.6 (6)	Q.8.7 (7)	Q.8.8 (8)
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							

Illness Code (Col. 3)	1 = Fever 2 = Diarrhoea 3 = Bronchitis 4 = Pleurisy 5 = Tuberculosis	6 = Diabetes 7 = Disease of urinary system 8 = Disease of the heart 9 = Hypertension 10 = Typhoid fever	11 = Dengue fever 12 = Chickenpox 13 = Cancer 14 = Leprosy 15 = Malaria	16 = Mental disorders 17 = Dropsy (Swollen belly) 18 = HIV/AIDS 19 = QWsnøak;EdeCIg 20 = Cough	21 = Having cold 22 = Stomach ache 23. Others(specify)
Treatment Code (Col.4)	1 = National hospital 2 = Provincial/District hospital 3 = Health center 9 = Home/Office of trained health worker/nurse	4 = Outreach 5 = Private hospital/clinic 6 = Private pharmacy	7 = Kru khmer/ Magician 8 = Monk/religious leader 10 = Others (Specify)-----		

B. CHILD BIRTH AND DELIVERY

	Enter Code Or other answer
Q.8.9. How many children do you have?	-----children
Q.8.10. Are there any children death when you delivered?	-----children
Q.8.11. In the last 5 years Did any of your household deliver baby? 1. Yes 2. No (If No => next section)	
Q.8.12. For last pregnancy of your spouse, whether she receives pregnancy check-up? 1. Yes regularly 2. Yes but occasionally 3. No (If No=> Q.8.14)	
Q.8.13. If yes, where did she go for check-up? 1. National/provincial hospital 2. District / commune health centre 3. Private Clinic 4. Traditional health attendants (in Khmer called <i>Chhmorb</i>) 5. Others (specify).....	
Q.8.14. For your last child birth, where did you give birth? 1. National/provincial hospital 2. District / commune health centre 3. Private Clinic 4. Home 5. Others (specify).....	
Q.8.15. Whether you receive Yellow Card where vaccinations are written down? 1. Yes 2. No, but child have been vaccinated 3. No, child never vaccinated (If No=> next section)	

Q.8.16. If your child receives vaccinations, what kind of vaccinations? (More than one answer is possible) 1. TB 2. Polio 3. DTC/DPT 4. Measles 5. ជាំតិដៃក 6. ថ្លើម 7. ថ្នាំកម្លាំង 8. ការពាររោគស្រោមខួរ 9. Others (specify.....)	
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C. KNOWLEDGE ON CRUCIAL PUBLIC HEALTH ISSUES

	(a) Knowledge	(b) Source of knowledge
	1: Know 2: DK	1. Radio 2. TV 3. Health centre 4. Community outreach 5. Peer educator, 6. Others (specify.....)
Q.8.17. Do you know about HIV/AIDS and how to prevent it?		
Q.8.18. Do you know how to prevent HIV/AIDS?		
Q.8.19. Do you know bird flu?		
Q.8.20. Do you know the precautionary measure of bird flu?		
Q.8.21. Do you know swine flu?		
Q.8.22. Do you know the precautionary measure of swine flu?		
Q.8.23. Do you know the symptom of dengue?		
Q.8.24. Do you know the precautionary measure of dengue?		
Q.8.25. Where to go for treatment of dengue?		
Q.8.26. Do you know the symptom of malaria?		
Q.8.27. Do you know the precautionary measure of malaria?		
Q.8.28. Where to go for treatment of malaria?		
Q.8.29. Do you know the symptom of TB?		
Q.8.30. Where to go for treatment of TB?		
Q.8.31. Do you know that children need to be vaccinated?		
Q.8.32. Do you know where to go for vaccination?		
Q.8.33. Do you know about birth spacing?		
Q.8.34. Do you know about pregnancy and the need for check-up and consultation at health centre?		
Q.8.35. Do you know where to go for such services?		
Q.8.36. Do you know that the impact of smoking health?		

IX. HOUSEHOLD ALLOCATION OF TIME

Information about how household members past time between sunset and bed time:

Activities	(a) Household Head	(b) Spouse	(c) Senior most female student	(d) Senior most male student
	<i>Time spent in minutes</i>	<i>Time spent in minutes</i>	<i>Time spent in minutes</i>	<i>Time spent in minutes</i>
Q.9.1. Cooking	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.2. Eating	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.3. Washing dish	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.4. Washing cloths	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.5. Bed preparation	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.6. Teaching kids	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.7. Studying	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.8. Watching TV	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.9. Listening to radio	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.10. Sewing/weaving	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.11. Business	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.12. Visiting neighbours	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.13. Evening chat with family	.....minutes	.....minutes	.....minutes	.....minutes
Q.9.14. Others: -----minutesminutesminutesminutes
Q.9.15. TOTALminutesminutesminutesminutes

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