

# **Diversification of Sources of Rural Income: The Case of a Rural Area in Kdol Tahaen Commune, Bavel District, Battambang Province, Cambodia**

Rido Thath<sup>1</sup> and Sethik Rath

## **Abstract**

Rural households generate income from agriculture and agriculture related activities. In the survey of rural villages in Battambang Province, Northwestern part of Cambodia, it was found that agricultural income accounts for about 68 percent of the total household income. The non-agricultural income account for only 32 percent, and the sources of the non-agricultural income are very few. In addition, villagers who are engaged in non-agricultural activities work in the informal sector such as petite trade and manual labor such as being a construction worker. Very few villagers are engaged in formal employment such as doctor, teacher or soldier. This indicates that in order to improve the rural livelihood, it is important to increase agricultural income through improving its productivity or increasing its value added by promoting food processing industry or industry that demand agricultural raw material. Also, it is important to diversify alternative sources of non-agricultural income by creating more low-skilled or semi-skilled income generation activities.

*Key words:* rural income, income diversification

## **1.Introduction**

Rural households in developing countries are relatively worse off than their urban counterparts for many attributes including access to education, medical services, market and infrastructure, and they generally own fewer assets (Jazairy et. al., 1992; Alkire et. Al.,

---

<sup>1</sup> Corresponding author: thath.rido@gmail.com

2014 ;Macourse and Swinnen, 2008); reducing poverty in general and rural poverty in particular are tedious tasks. There is no one-size-fits-all solution for poverty reduction (Food and Agriculture Organization, 2017)—there is no single policy that all countries can apply and expect to achieve the same result. In fact, poverty reduction appeared in the United Nations’ Millennium Development Goals and is still in the institution’s Sustainable Development Goals. While different policies have been implemented, the outcome varies; some countries have performed better than others. Nonetheless, what is common in poverty reduction is that understating the socio-economic status and endowment of the poor is indispensable in formulating an effective policy (Engvall et.al., 2008). The information on how the poor are able to generate income, and what kind of and how much asset they own are important inputs that policy makers can incorporate to prescribe effective policies. If the poor is low skilled, for example, labor intensive industries must be created, and if the poor engages in agriculture, food processing and other agriculture related industries must be promoted.

In Cambodia, economic growth in the last two decades has been impressive—the average growth of gross domestic product (GDP) has been about 7.8 percent annually from 2000 to 2016 (ADB, 2017); however, the country remains one of the poorest in the Southeast Asian region (World Development Indicator, 2018) and had just graduated from the status of low income to lower middle income country in July 2016<sup>2</sup>. In addition, poverty is more prevalent in the rural areas. The World Bank estimated that 90 percent of the Cambodian poor live in the countryside<sup>3</sup>. While the urban poverty rate in 2012 is 6.4 percent, the rural poverty rate is 20.8 percent, more than three times the urban rate (World Development Indicator, 2018). Like other developing countries, in order to reduce rural poverty in Cambodia, it is vitally important to understand their context and characteristics. This study explores the socio-economic characteristics and alternative sources of income of rural Cambodian households, and the factors that affect their income. The remainder of the study is organized as follows. Section 2 briefly reviews the literature on rural income diversification and factors affecting rural income. Section 3 describes the study site and data collection process. Section 4 presents the research method and Section 5 the results of the study. Finally, the discussion and conclusion are presented in Section 6.

---

<sup>2</sup> <https://blogs.worldbank.org/opendata/new-country-classifications-2016>

<sup>3</sup> <https://www.worldbank.org/en/country/cambodia/overview>

## **2.Literature review**

### *Rural income diversification*

Rural households generate income from multiple sources including diversified crop production (Démurger et. al., 2010), and engaging in other local off-farm labor intensive activities (Démurger et. al., 2010; Zhao and Barry 2014). Income diversification has been found to have a positive attribute for livelihood strategies and should be encouraged (Ellis, 2000). There are two objectives of income diversification. While Ellis (2000) classified diversification into diversification of necessity and diversification by choice, Reardon et. al. (2007) classified the diversification into pull and push objectives; diversification by pull factors means households try to accumulate assets while households that diversify by push factors undertakes that activities to manage risk, dealt with unexpected event or escape from agricultural stagnation. Regardless of the objective, income diversification benefit households through improving food consumption (Reardon et.al., 1992) and general consumption (Xu, 2017), and it enable households to become more resilient to natural disaster such as drought (Wan et. al., 2016). In addition, income diversifying households have a stable and increased income (Reardon et.al.,1992).

Although diversification provides many benefit, not all rural households are able to diversify. Poorer and lower educated households (Escobal, 2001) and households in the remote villages have been found to be less diversified (Abulai and CroleRees, 2001). Also, when poorer or lower educated households diversify their income sources, they tend to work in less lucrative jobs (Rahut & Micevska Scharf, 2012; Woldenhanna, & Oskam, 2001). In addition to education and locality of residence, assets such as rural road and the availability of credit also influenced diversification (Escobal, 2001; Ellis, 2008). Other important factors that encourage diversification are seasonality, risk, labor markets , asset strategies, and coping strategies.

### *Factors affecting rural income*

Rural households generate income, to some extends, differently from urban residence. While there are generally more jobs at the city, it is scarce in the country side. Like the urban counterparts, rural households need sufficient level of education to generate income; however, other factors including size of household labor force and agricultural land as well as the

ownership of non-farm enterprises significantly affects income (Aikaeli, 2010; Schwarze, 2004). And household asset position play important role as it influences the income-generating activities and its return; in addition, the availability of social and public capital such as rural road also affect income (Winters et.al., 2002; Schwarze, 2004).

Furthermore, location of residence influences how rural households generate income; in the village close to the tourism sites, it was found that villagers generate income from tourism significantly by providing farm supplies (Igiha, 2014). Another important factor affecting rural income is access to formal credit; although credit access reduce the rural households' cultivation of annual crop, it induced them to grow perennial crop and participate in non-farm income-generating activities, thus increasing their total income (Schwarze, 2004).

### **3. Research site and data collection**

#### **3.1. Research site**

The survey was conducted in seven villages of Kdol Tahaen commune (i.e., *Tahaen, Tuol Krosang, Phum Thmey, Kandol Leur, Kdol Leur* and *Pong Ro* villages) in Bavel District, which is one of the 14 districts in Battambang Province<sup>4</sup>. Battambang is known as Cambodia's rice bowl as it is one of the major rice producing provinces (Chon & Thet, 2011; Gartell, 2010). After the independence from France, in the 1950s and 1960s, Battambang alone produced sufficient amount of rice to feed the whole Cambodian population (Chon & Thet, 2011), and rice from Battambang is well known for its high quality, which farmers can obtain premium prices in domestic as well as international markets (Chuon and Suzuki, 2005). In addition to rice, the province has other economic potential. It is one of the provinces surrounding the Cambodia's great lake, the Tonle Sap, one of the most productive fresh water fishery in the world (Lamberts, 2001). Also, there is large areas of fertile land for rice cultivation and other agricultural products. The province is bordered with Thailand, so it is one of the main routes for Thailand and Cambodia cross border trade, and also a route for migration; many villagers from Battamgang have crossed the border to find alternative jobs in Thailand. Although the

---

<sup>4</sup> In Cambodian administration, the country is divided into 24 provinces and one capital city. The province is sub-divided into districts and township, and districts into commune, which is in the lowest administration hierarchy. However, unlike the province, and district, commune is elected for the terms of five years.

province has several favorable condition such as a lake which is rich of fishery resources, fertile agricultural land and potential for cross border trade, Battambang has relatively high poverty rate<sup>5</sup>.

Bavel is one of the poorest districts in the province according to socio-economic indicators such as electricity access, types of house and TV ownership (Battambang Provincial Department of Information, 2016, page 8 and 9). This commune, Kdol Tahaen, is one of the rural communes.

### **3.2. Data Collection**

Systematic sampling method was used to collect the data—enumerators selected the first household to be surveyed and then the interval of five households would be skipped; that means every sixth household in the selected villages would be surveyed. The enumerators kept repeating the process until enough observations were collected. To ensure the quality of the data, the enumerators had been trained prior to data collection. After the training, they were assigned to conduct a pilot questionnaire survey. After the pilot survey had shown satisfactory results, the enumerators were sent to conduct the actual survey. Due to the limitation of resources, only 150 households were surveyed, although it is commonly understood that it would be better to collect larger sample size. The data collection was from November 1 to November 3, 2017. However, after processing and cleaning the data, some observations were lost and reduced to 116 households. Households whose variables of interests were missed were excluded. As a result, due to the limited data and specific location<sup>6</sup> of the survey, the generalization of the result should be done with caution.

### **4. Research Methods**

As mentioned in the previous section, the study comprises of two objectives. The first objective is to explore the sources of income of the rural Cambodian households, and the

---

<sup>5</sup> Cambodia is divided into four region, Mountain/Plateau, Coast, Plain and Tonle Sap. Mountain/Plateau is the poorest region followed by Tonle Sap, Plain and Coast. And Battambang is in the Tonle Sap region.

<sup>6</sup> Rural households in different regions such as the Mountain/Plateau or Coast may have different socio-economic characteristics.

second objective is to determine the factors that affect their income. Descriptive methods are used to answer the first objective while the regression analysis is used to answer the second objective.

In the literature, there are many factors influencing household income including asset ownership, household socio-economic characteristics, local resource endowment (Aikaeli, 2010), and government policies (Winters et. al., 2002). Based on the literature, the following regression equation was employed to estimate the determinants of rural household income.

$$Y_i = \beta_0 + \beta_1 Age_i + \beta_2 Gen_i + \beta_3 Edu_i + \beta_4 Dep_i + \beta_5 Catt_i + \beta_6 Ht_i + \beta_7 TV_i + \beta_8 MB_i + \beta_9 MP_i + \beta_{10} ELE + \beta_{11} PR_i + \varepsilon_i \quad (1)$$

Where,

*Y* = natural log of household income

*Age* = age of household head

*Gen* = gender of household head (1= male, 0 = female)

*Edu* = education level of household head (classified into four categories, primary, lower secondary, higher secondary and university level)

*Dep* = dependency ratio (measured as the number of household member aged below 15 or over 64 years old)

*Catt* = ownership of a cow or buffalo

*Ht* = ownership of hand tractor

*TV* = ownership of Television

*MB* = ownership of motorbike

*MP* = ownership of mobile phone

*ELE* = access to electricity

*PR* = paved road in the village

#### 4.1. Summary Statistics

Table 1 presents selected data from the field survey. It shows that in the study site, the average age of household head is around 42 years old, which is common in rural area of

developing countries like Cambodia<sup>7</sup>. Each household has around five members, which is similar to the national average<sup>8</sup>. Most of the head of household are low educated, that is about 67 percent of them only have primary school education. University level education is very rare among the sampled households. According to the table, less than one percent of the household surveyed have a head with university education. As Battambang is relatively sparsely populated and agriculture is an important source of households' income, it can be seen from Table 1 that the size of agricultural land owned by the household in this area is quite large, averaged about two hectares per household.

Table 1. Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Age of Household Head	113	41.920	12.687	20.000	80.00
<i>Education of Household Head</i>					
Primary Level	116	0.672	0.471	0.000	1.00
Lower Secondary Level	116	0.129	0.337	0.000	1.00
Upper Secondary Level	116	0.017	0.131	0.000	1.00
University Level	116	0.009	0.093	0.000	1.00
Daily Income Per Capita	116	3391.694	3814.159	136.986	20000.00
Number of Household Members	116	4.888	1.763	2.000	10.00
MFI Access	116	0.164	0.372	0.000	1.00
Number of Dependent	116	1.655	1.266	0.000	5.00
Agricultural Land	116	2.2	1.797	0.300	12.00

Source: Data from field survey

As aforementioned, the Bavel district is poorer than other districts. Therefore, the average per capita income of people in the study areas is also low. The average income per capita of the member of the surveyed household is about 3,400 KHR, lower than the national

<sup>7</sup> In Developed countries like Japan where population is aging, the average age of an active farmer is 66 years old (Semuels, 2017).

<sup>8</sup> The average household size in Cambodia was 4.7 persons in 2008 and slightly reduced to 4.6 persons in 2013 (National Institute of Statistics, 2013).

poverty line for rural areas<sup>9</sup> in 2009, which is 3,503 KHR<sup>10</sup>. However, it is worth noting that it is difficult to accurately compute the rural income as it is irregular and is generated from multiple sources. We had tried our best to encourage them to provide information of all sources of income and to recall income that they had received in the recent past. In addition, another reason for low income is that many activities of rural households are not transacted in the market. For example, they may grow and consume their own vegetables or consume fish, chicken or meat they raise or catch themselves. Thus, even their monetary income is low, it does not necessarily mean they do not have sufficient calorie intake or are living under the poverty line.

## **5. Results and findings**

### **5.1. Sources of rural income**

Agriculture remains one of the main sources of the income for village households in Cambodia. According to the result of the field work presented in Table 2, agricultural income accounts for more than one third of the total household income. Agriculture is considered a low value-added industry, which means that farmers, in particular small-scale ones, cannot generate higher income from agriculture than from other non-agricultural sources. In addition, at the cultivation stage, Cambodian agriculture is susceptible to the climate vagary due to the lack of irrigation system, so production is unstable, and at the marketing stage, crop price is unpredictable—farmers have lower bargaining power vis a vis middlemen and buyers. However, many villagers still engage in agriculture because they are familiar with the work for many generations—crop cultivation is basically learned from older generation, parents or grandparents and does not require high education. Moreover, farmers do not have the necessary skills to work in other industries, and there is limited job opportunity in the village—garment factories are located in the provinces surrounding the capital Phnom Penh but not the rural

---

<sup>9</sup> There are four different poverty lines in Cambodia, rural, Phnom Penh, other urban, and national poverty line. The rural poverty line for 2009 is 3,503 KHR (Ministry of Planning, 2013). Given the average annual inflation of 3.1 percent per year since 2009 (ADB, 2017), the rural poverty line should have increased to around 4,500 KHR in 2017, roughly 1.12 USD.

<sup>10</sup> KHR stands for Cambodian Riel. According to the National Bank of Cambodia, in April 27, 2018, 4032 KHR = 1 USD.



areas; and beside factory jobs, other job opportunities for low skilled people in the rural areas are very scarce.

Being low-skilled coupled with the limited availability of the non-agricultural labor intensive employment opportunities, rural households have limited options to diversify their income sources to generate higher income. Table 2 shows that there are seven alternative jobs for the rural villagers; among the jobs, four are formal jobs and three are informal—the formal ones are army, medical practice, teaching and working in the village administration. Although there are larger number of formal jobs, the number of people working in informal jobs are much larger—among households who have non-agricultural income, about 90 percent of them generate income from informal sources. It is worth noting that one of the main sources of non-agricultural income is remittance. Remittance is not the income that rural households generate in their neighborhood; it is sent from somewhere else, from the city or from abroad. However, that remittance becomes a main source of income accentuate the shortage of rural jobs. Because people, especially younger generation, cannot find a job in their locality, they need to migrate internally or internationally.

Table 2. Income share and source of non-agricultural income

<i>Income share</i>	Frequency	Percentage
Agriculture		68
Non-agriculture		32
<i>Sources of non-agricultural income</i>		
Petite trade	14	38.9
Remittance	12	33.3
Construction work	6	16.7
Teaching	1	2.8
Army	1	2.8
Medical practice	1	2.8
Village administration	1	2.8

Source: Data from field survey

## 5.2. Rural asset ownership

Physical assets such as land and house, and infrastructural assets such as electricity access influence the potential of rural income generation. In the previous section, the sources of income were explored; in this section, asset ownership is presented in Table 3. The most

important asset for rural households is probably agricultural land as most of them engage in agriculture. Agricultural land enables them to grow crops for consumption and generate income. According to the survey, the average size of the land is 2.2 hectares per household; given the average household size of 4.88 persons, the average land size per person in the study site is 0.45 hectare. This size is larger than the national average because Battambang is not densely populated. However, given the size of agricultural land, it is difficult for households to lead a decent life depending solely on agricultural income. Table 3 also shows the different land holding size between male and female headed households, but it is not statically different.

Table 3. Land and asset ownership and sources of rural electricity

	Overall	Male	Female	P-value
<i>Land ownership (hectare per household)</i>				
Agricultural land	2.2	2.1	2.2	0.701
<i>Housing (percentage)</i>				
Corrugated zinc roof	84.5	87.0	82.3	0.478
Leaf roof	9.5	9.3	9.7	0.939
Concrete house	3.5	3.7	3.2	0.888
Other	2.6	0.0	4.8	0.012**
<i>Assets (percentage)</i>				
Radio	38.8	35.2	41.9	0.457
TV	50.0	42.6	56.5	0.137
Mobile phone	77.6	72.2	82.3	0.196
Bicycle	69.0	70.4	67.7	0.760
Motorbike	55.2	53.7	56.5	0.767
Car	2.6	1.9	3.2	0.642
Hand tractor	43.1	51.9	35.5	0.076*
Tractor	1.7	0.0	3.2	0.183
Cattle	59.5	66.7	53.2	0.141
<i>Sources of electricity power (percentage)</i>				
Electricity access	49.1	53.7	45.2	0.359
Solar energy	7.8	3.7	11.3	0.128

Note: \*\* and \* significant at 5% and 10% respectively

Source: Authors' calculation based on field survey data

Besides land, house is one of household's most important asset<sup>11</sup>. Housing or shelter is one of the human basic needs. It provides not only comfort for household members but also to

<sup>11</sup> With secure title, house can also be used as collateral as land.

protect them from unfavorable events such as rain, heat and in more extreme cases, from disaster such as flood and storm. People will waste a lot of resource if their houses are easily destroyed by flood or storm. In Cambodian rural villages, the quality of the house correlates with the wealth of the household. If they can afford, people prefer to have a big and high quality house, concrete house or wooden house with corrugated roof are more preferable to leaf roof house. For many villagers, their first priority is housing, i.e. when their income increases they will invest in improving the quality of their houses. Some households even borrow money to build a new house or renovate an old one.

Table 3 shows that in the surveyed villages, corrugated zinc roof houses predominate. Only small portion of households own other types of houses including concrete houses and leaf roof houses. It should be noticed that although the house is classified in one category, its size and quality of material may be different. Both the better off and the normal villagers may have the same types of houses, for example, corrugated zinc houses. However, the size of the house owned by the former may be much larger. Also, the quality of wood or other materials used to construct the house may be different. Thus, the value of each house may vary significantly<sup>12</sup>. House size and quality are important for Cambodian villagers. It shows both the wealth and social status of the owner, so it is easy to distinguish better off from poor villages by the appearances of the houses of villagers.

We are interested in exploring if the difference in house ownership exists between male and female headed households. When classified by the gender of household head, there is a slight difference between the types of house owned by male and female heads. According to Table 3, more female headed households own leaf roof houses, but fewer of them own a corrugated zinc roof house. Although more female headed households seem to own more concrete houses, the percentage of villagers who own concrete houses is negligible. However, the difference is not statistically significant.

In addition to the agricultural land and house, this section also describes other important assets owned by rural households. The electricity access is also reported. Electricity access plays important role in rural livelihood. It enables households to access to important

---

<sup>12</sup> In the report of the Battambang Provincial Department of Information, there are seven types of houses, and the corrugated zinc roof houses account for about 80 percent of the houses in the province (Battambang Provincial Department of Information, 2016).

sources of information such as TV and use welfare enhancing electronic products such as fridge, air-conditioner, rice cookers, and washing machines. Also, it enables them to operate capital goods such as agricultural machineries which boost their productivity and income.

According to Table 3, only about 50 percent of our surveyed households have electricity access, and only about 7.8 percent of them have access to solar energy. Electricity access in Cambodia has been expanded but mainly in the urban areas, thus there is an access gap between the urban and rural households<sup>13</sup>. The electricity tariff in Cambodia is highest among ASEAN countries, and in rural areas the cost is much higher than in the city (Poch and Tuy, 2012). For example, while Phnom Penh residents spend less than USD 0.2 per kWh (Poch and Tuy; Sok, 2018) rural residents may spend more than USD 0.75 per kWh (Board, 2016). The higher electricity cost in rural villages is attributable to the fact that the national grid does not yet reach the village, thus most electricity available in rural villages are supplied by private company. For these reasons, many rural households still cannot access electricity. However, some of them use solar energy although the price is still relatively high.

For other important asset ownership, Table 3 shows that about 77.7 percent of households own mobile phone followed by bicycle (69 percent), cattle (59.5 percent) and motorbike (55.2 percent) and TV (50 percent). All these assets play vitally important role in the rural households' income-generating activities. Mobile phone, for instance, allows villagers to contact different middlemen inquiring for crop prices and other information; TV is a source of information such as weather forecast and market price while bicycle and motorbikes are important means of transportation. In some rural villages, cattle are still used for plowing and preparing agricultural land as well as a means of transportation. Thus, cattle are still useful for supporting villagers' income-generating activities. Some assets such as car and tractors are pricey and thus are unaffordable for most of the rural households; therefore, the percentage of ownership is low.

To explore the differences between ownership of assets and electricity access of male and female headed households, the study separated the percentage of ownership by the gender

---

<sup>13</sup> According to the World Bank report as cited in Surrusco (2017), 97 percent of Cambodia's urban population have access to electricity while only 49 percent of the rural population got electricity access. Many rural households use other sources of electricity such as solar home system, solar lanterns and rechargeable batteries (World Bank, 2018).

of the household head. Table 3 shows that there is no statistically differences of ownership between male and female headed households except for the ownership of hand tractors. It was found that more male headed households own hand tractors. Hand tractor is mainly used for agricultural activities, and it requires physical strength to operate. This, perhaps, is the reason that fewer female headed households owned a hand tractor although it is very useful. Hand tractors can be used a means of transportation, plowing and preparing land; it is a substitute for cattle power. In addition, owners of hand tractors can generate extra income by providing rental services to other villagers.

### **5.3. Determinants of rural income**

Table 4 shows the regression result of the household income on the dependent variables. Although most of the independent variables and the household income are not significant at the conventional level, it indicates the direction of the relationship between income and socio-economic status of the rural households. In the table, there are three regressions with three different dependent variables—natural logarithm of total household income is the dependent variable in Regression 1, natural logarithm of total non-agricultural income in Regression 2, and natural logarithm of agricultural income in Regression 3. What is worth noting is the difference of the sign of the coefficient of hand tractor in the Regression 2 and Regression 3. It is negative in Regression 2, which mean that owing hand tractor does not increase non-agricultural income; it indicates that hand tractors are not useful for non-agricultural activities—households who own a hand tractor but are not working in agriculture, may leave the hand tractor idle. Hand tractors, on the other hand, is positive in Regression 3, indicating that owing hand tractor improves the household agricultural income. Hand tractors play important role in mechanization of agriculture. As mentioned before, it gradually replaces the draft animal power (buffalos and cows) and improve the productivity of farmers—for example, hand tractors enable farmers to prepare larger farm land per day and transport larger volume of agricultural products than using animal power. With the decreasing farming population and the lack of interest among younger generation on agriculture, hand tractors become a helping hand. It can be used for many agricultural activities from the stage of planting to marketing. Hand tractors are seen utilized for preparing land and transporting agricultural products—the

role of draft animal power in the past. In addition, because it is relatively less expensive, increasing number of farming households can afford to own a hand tractor

Table 4: Determinants of Rural Income

	Dependent variable: <i>Total income</i> (1)	Dependent variable: <i>Non-agricultural income</i> (2)	Dependent variable: <i>Agricultural income</i> (3)
Age	0.004 (0.008)	-0.010 (0.061)	0.019 (0.049)
Gender	-0.310 (0.221)	-1.042 (1.603)	-0.188 (1.284)
Edu_univ	1.321 (1.157)	9.903 (8.379)	3.864 (6.715)
Edu_secondary	-1.108 (0.833)	-4.067 (6.034)	3.293 (4.835)
Edu_lower secondary	-0.167 (0.392)	-1.086 (2.842)	1.520 (2.278)
Edu_primary	-0.081 (0.307)	-0.516 (2.222)	0.0962 (1.781)
Dependence	-0.359 (0.463)	-1.384 (3.355)	-0.976 (2.688)
Cattle	-0.321 (0.230)	0.105 (1.667)	-0.966 (1.335)
Hand tractor	-0.273 (0.219)	-3.713** (1.583)	2.429* (1.268)
TV	-0.234 (0.242)	-0.803 (1.750)	-0.948 (1.402)
Motorbike	-0.023 (0.247)	1.019 (1.790)	-2.139 (1.434)
Mobile phone	0.038 (0.265)	-2.860 (1.916)	2.822* (1.536)
Electricity	0.262 (0.230)	1.806 (1.666)	-0.095 (1.335)
Paved road	-0.053 (0.252)	-1.724 (1.824)	1.871 (1.462)
Microfinance	-0.001 (0.288)	1.303 (2.084)	-1.210 (1.669)
R-squared	0.114	0.136	0.137
Observation	113	113	113

Note: \*\* and \* significant at 5% and 10% respectively

Source: Authors' calculation based on field survey data

Mobile phone has a positive and significant relationship only in the Regression 3. This means that owning mobile phone improves agricultural income. Mobile phone provides farmers the means to communicate and to access information. For example, farmers can use the mobile phone to check the market price of the products, so they are able to sell their products at the highest price and become less dependent on any middleman. They may check the market demand of the products and can plan their cultivation accordingly. Also, with mobile phone, they may be able to receive weather information, which is vitally important for farmers. Not all agricultural products are marketable; some rice varieties, for example, can command high price in international markets, other varieties may not be marketable. Farmers need this kind of information to plan their cultivation. Because the price of mobile phone become more affordable due to the improved global technology and the increased service coverage, most rural households can afford a mobile phone, which assist their income generation effort.

## **6. Discussion and conclusion**

### **6.1. Discussion**

#### ***Importance of rural assets***

Many rural households, in the study sites, are engaged in agricultural and other low value-added income generation activity in the informal sector such as petite trade. To diversify the sources of and increase income, they need to improve the ownership of rural assets in terms of both quantity and quality. Winter et.al. (2009) suggested three important rural assets—agricultural land, rural infrastructure and education. With larger agricultural land, household can produce larger surplus of crops to sell it the market; this increases their income. However, agricultural land cannot be expanded indefinitely. Thus, if the expansion reaches the limit, rural households need to improve the quality of their land—increasing land productivity. Land productivity can be improved through the proper use of other inputs such as fertilizers, quality seed and water management. In order to perform such a task, farmers need to have sufficient level of education, which is another important asset.

Education, beside allowing farmers to increase their land and labor productivity, offers the chance for them to access to non-farm income-generating activities. However, the study

shows that the mean years of schooling in the study site is slightly less than primary education. With this level of education, it is difficult for farmers to access and apply modern agricultural techniques let alone finding a formal job outside agriculture. It is costly and irrational to supply formal education to adult farmers as it is time consuming and they may not be able to invest their time to participate in formal education again. Alternatively, it is necessary to provide them training on agricultural technique and other practical skills that they can apply to generate income in their locality. Nonetheless, it is vitally important to provide quality education at the rural areas so that the offspring of the farm households can better access to non-farm income generating activities and other higher value-added sectors. Also, households with highly educated members may benefit indirectly from them—they can access to new knowledge and technology, then transfer to other members of the households.

Another important asset is rural infrastructure, which include road, irrigation system electricity and telecommunication. Without all-weather road, farmers cannot transport their produces to the market, while irrigation system is important for crop cultivation. Recently, electricity become important part of rural livelihood although in the study site, the electricity access is only about 50 percent. Rural electrification increases household income and improving general welfare (Kooijman-van Dijk, 2012; Rao, 2013) as well as increase the profitability of micro enterprise (Akpan et. al., 2013). Electricity access allows households access to information because they can use television or mobile phone, and other electric products. Ownership of mobile phone was found to reduce the cost of marketing of farm produces and induce farmer to participate more in the market (Muto and Yamano, 2009). It also strengthens the capacity of rural households to deal with emergencies and expand their social network (Sife et. al., 2010). Recently, because the price of mobile phone becomes cheaper, so most rural households can afford to possess. Therefore, it will be beneficial for them if useful information can be accessed through mobile phone. Given the limited access to electricity through national grid, some households in the study site use electricity via solar energy; however, the number of solar energy using households are still small. Solar power provides the same benefit although its cost is a higher.

### ***Diversifying and improving agriculture value added***



Agriculture has been playing important role in rural Cambodia. It keeps providing income to the villagers and also it plays a role as an employers of last resort to rural-urban migrant workers. This mean that, when there is shortage in urban jobs, migrants can always come back to their villages and generate income from agricultural activities<sup>14</sup> provided that the households own or can rent agricultural land. However, agriculture in Cambodia is undiversified; in the study site, most farmers grow only rice and few others grow corn. They do not diversify more than that as there is no demand, and it is risky to diversify given unpredictable demand. There is frequent news report of oversupply of particular products and of farmers unable to find the market to sell their products, or if there is a market, the price is too low, thus unprofitable<sup>15</sup>. Most of the Cambodian agricultural products including those cultivated by households in the study site have been sold to the neighboring Thailand and Vietnam, and farmers complain that middlemen have the power to set price, which is usually cheaper than farmers deserve (Muyhong, 2014b). The low price and limited demand are probably attributable to the undeveloped food processing industry in Cambodia. There are very few factories to process raw agricultural products, and in the market it is easy to find many imported processed food. Thus, to increase the agricultural income, it is important to diversify agriculture<sup>16</sup> and also promote the food processing industry<sup>17</sup>.

The diversified agriculture helps farmers reduce oversupply and thus increase their income by producing high value added crops. There are large number of agricultural products

---

<sup>14</sup> For example, in 2009, because of Lehman shock, many garment factories were closed and workers became unemployed. Workers may have chosen to stay in the city and find jobs in other sectors. However, agriculture provided one of the alternative sources of job.

<sup>15</sup> The unprofitability of agricultural products cause indebtedness among farmers as they usually borrow money to invest in input such as seeds, fertilizers, gasolines and the like. Tan (2017) provides the anecdote of microfinance and farmers' indebtedness; some farmers borrow to fertilize their land but could not repay.

<sup>16</sup> Cambodia has been importing annually about 200 million USD of vegetable from Vietnam, Laos and Thailand (VOV, 2016). Farmers will benefit a lot if they are able to substitute the imported products, but they lack technique of vegetable farming as it is more difficult than rice cultivation which has been practiced centuries ago in Cambodia (Muyhong, 2014a).

<sup>17</sup> The government has noticed the importance of food agribusiness sector and food processing, and has incorporated the promotion of this sector into the Industrial Development Policy (Muyhong, 2015). If it is carried out as planned, rural households will reap a lot of benefit.

that are imported from the neighboring countries due to limited domestic supply. Hence, in addition to increase farmers' income, diversification of agriculture will reduce import. Moreover, the food or agriculture processing industries must be developed so that farmers can have a stable market demand; developed processing industry means that products can be stored in longer time period, so farmers do not need to worry about products being spoiled when market demand is low. Also, processing industry will create low or semi-skilled jobs, which are suitable for large number of Cambodian rural laborers.

### *Increasing Off-farm income sources*

The income of rural households is low, on the one hand, because they engage in the low productivity and low value added agricultural sector. On the other hand, there is shortage of alternative income sources. In the study site, there are only few informal sources of off-farm income such as petite trade and construction work, and few formal jobs such as army, teaching, medical practice and working in the village administration. Although the formal and informal jobs are available, it cannot supply the rapidly growing number of workforces. The shortage of alternative employments at the rural areas are problems from both the supply and demand side. On the demand side, companies or factories are not interested in setting up their facilities in the rural areas because infrastructure is undeveloped. Electricity tariff, for example, is more expensive and the supply is unstable, causing damage to the machinery. Road is not well paved, so transportation of products is not efficient. Therefore, the operation cost is much higher if the facilities such as factories are in rural areas. In addition, the skilled labor forces are not available. In the study site, the mean years of school is less than 6 years. With this level of education, they cannot be employed at the provincial or local administration, or in factories that demand some skills. Education of the labor force is an important factor in attracting private firms—foreign firms, in particular, will set up the facility in the county where there is skilled work forces. However, we cannot blame the low level of education on the rural households. Rural villagers may see it unnecessary to get higher education due to the nature of their jobs. They have been working in agricultural sectors for many generations, so they may think that it is not necessary or not beneficial to get more than primary level education; to be able to read and write is sufficient to carry out most of their rural jobs. Thus, studying more than primary level of education may be a waste of time. In this case, the government intervention to increase

the level of education of the rural population is important in the long run. The government need to encourage the people to upgrade their skills by enrolling them in the formal school or informal training center as, for most adult villagers, it is impossible to go back to formal school. So, informal training is one of the viable options. In addition, only the government can effectively encourage private firms to locate in the rural areas by supply them physical infrastructure as well as skilled workforces and other preferential treatment. In the short and medium run, creating low-skilled job by diversifying agriculture or promoting food processing industry is necessary as these jobs can absorb large number of workforces who have only primary education.

## **5.2). Conclusion**

Improving the income and welfare of the population is a priority for all governments. Concerted effort and resources have been mobilized to formulate and implement the policies that aim at reducing poverty and enhancing the welfare of the worse off segment of the population. However, the task is tedious and still far from complete; hundreds of millions of people in the world are still living under poverty line and are deprived of the basic needs although many other have seen their welfare improved substantially since the inception of the Millennium Development Goals. In order to formulate an effective poverty reduction policies, questions such as who the poor are, what their endowment is and how do they make a living, must be answered. This knowledge is vitally important as it provides the government and policy makers the target to be directly attacked. The rural poor have different problem from the urban poor and need different support; also, the landless poor need different support from landed or small-scale farmers.

In Cambodia, the majority of the poor are living in rural areas. Most of them own small size of agricultural land, and it is getting smaller per capita due to the increased number of household members and the need to sell off the land for urgent need. They are relatively low-skilled—the average education is less than primary level. They generate income largely from agriculture and other informal sources such as petite trade and working in the construction site. Therefore, in order to increase rural income and reduce rural poverty, it is necessary to diversify agriculture and sources of rural non-agricultural employment opportunities. Diversifying agriculture allows farmers to grow diverse cash crops and reduce oversupply

while diversifying rural non-agricultural jobs enable rural households to increase alternate income and reduce the migration of younger generation. Promoting the food processing industry will serve these two purposes as food processing needs inputs from agriculture and labors from rural households. Beside food processing it would also be better to create other low skill employment opportunities as many villagers are low-skilled—having education of less than primary level.

### **Acknowledgments**

The authors would like to express our deep gratitude to the Royal University of Phnom Penh for providing the faculty research grant. We are also greatly indebted to the research office for their coordination and the reviewers for constructive comments; without their professional and moral support, this study would have never been possible.

### **References**

- Abdulai, A., & CroleRees, A. (2001). Determinants of Income Diversification amongst Rural Households in Southern Mali. *Food policy*, 26(4), 437-452.
- Akpan, U., Essien, M., & Isihak, S. (2013). The Impact of Rural Electrification on Rural Micro-Enterprises in Niger Delta, Nigeria. *Energy for Sustainable Development*, 17(5), 504-509.
- Aikaeli, J. (2010). *Determinants of Rural Income in Tanzania: An Empirical Approach*. Research on Poverty Alleviation (REPOA). Last accessed April 28, 2018 from [http://www.repoa.or.tz/documents/rr10\\_4.pdf](http://www.repoa.or.tz/documents/rr10_4.pdf)
- Alkire, S., Chatterje, M., Conconi, A., Seth, S., & Vaz, A. (2014). Poverty in Rural and Urban Areas: Direct comparisons using the global MPI 2014. Retrieved August 10, 2018 from <https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/11802/Poverty-in-Rural.pdf?sequence=1&isAllowed=y>
- Asian Development Bank. (2017). Key Indicators for Asia and the Pacific 2017. Retrieved April 27, 2018 from <https://www.adb.org/publications/key-indicators-asia-and-pacific-2017>
- Battambang Provincial Department of Information. (2016). *Battambang Socio-Economic Information 2016*. Battambang: Provincial Department of Information

- Board, J. (2016). *Cambodia Opposition Promises to Slash Power Prices, Encourage Solar Energy*. Channel News Asia, December 20, 2016.  
<https://www.channelnewsasia.com/news/asia/cambodia-opposition-promises-to-slash-power-prices-encourage-sol-7654294>
- Chon, G., & Thet, S. (2011). *Behind the Killing Fields: A Khmer Rouge Leader and One of His Victims*. University of Pennsylvania Press.
- Chuon, H., & Suzuki, N. (2005). Characteristics of the Rice Marketing System in Cambodia. *Journal of the Faculty of Agriculture-Kyushu University*, 50(2), 693-714.
- Démurger, S., Fournier, M., & Yang, W. (2010). Rural Households' Decisions towards Income Diversification: Evidence from a Township in Northern China. *China Economic Review*, 21, S32-S44.
- Ellis, F. (2000). The Determinants of Rural Livelihood Diversification in Developing Countries. *Journal of Agricultural Economics*, 51(2), 289-302.
- Engvall, A., Sjöberg, Ö., & Sjöholm, F. (2008). Poverty in Rural Cambodia: The Differentiated Impact of linkages, Inputs, and Access to Land. *Asian Economic Papers*, 7(2), 74-95.
- Escobal, J. (2001). The Determinants of Nonfarm Income Diversification in Rural Peru. *World Development*, 29(3), 497-508.
- Food and Agriculture Organization. (2017). *End Rural Poverty: A Path Towards Hunger-free, Peaceful and Inclusive Societies*, retrieved October 13, 2018, from: <http://www.fao.org/sustainable-development-goals/news/detail-news/en/c/1044650/>
- Gartrell, A. (2010). 'A Frog in a Well': The Exclusion of Disabled People from Work in Cambodia. *Disability & Society*, 25(3), 289-301.
- Igiha, E. (2014). Contribution of Tourism On Household's Income In Tanzania: The Case Of Mto Wa Mbu In Arusha Region, Retrieved October 15, 2018 from: <http://scholar.mzumbe.ac.tz/bitstream/handle/11192/365/MSc%20Eco-Dissertation-Igiha%2C%20Emmanuel%202013.pdf?sequence=1>
- Jazairy, I., Alamgir, M., Stanier, J., & Panuccio, T. (1992). *The State of World Rural Poverty: An Inquiry into Its Causes and Consequences*. NYU Press.
- Kooijman-van Dijk, A. L. (2012). The Role of Energy in Creating Opportunities for Income Generation in the Indian Himalayas. *Energy policy*, 41, 529-536.

- Lamberts, D. (2001). *Tonle Sap Fisheries: A Case Study on Floodplain Gillnet Fisheries in Siem Reap, Cambodia*. FAO Regional Office for Asia and the Pacific, Bangkok Thailand. *RAP Publication 2011/11*.
- Ministry of Planning (2013). *Poverty in Cambodia—A New Approach: Redefining the Poverty Line*. Phnom Penh: Ministry of Planning.
- Macours, K., & Swinnen, J. F. (2008). Rural–urban Poverty Differences in Transition Countries. *World Development*, 36(11), 2170-2187.
- Mondal, A. H., & Klein, D. (2011). Impacts of Solar Home Systems on Social Development in Rural Bangladesh. *Energy for Sustainable Development*, 15(1), 17-20.
- Muyhong, C. (2014a). *Vegetable Farming Lacks Technique*. The Phnom Penh Post, October 17, 2014. <https://www.phnompenhpost.com/business/vegetable-farming-lacks-technique>
- Muyhong, C. (2014b). *Farmers Air Their Agriculture Concerns*. The Phnom Penh Post, December 5, 2014. <https://www.phnompenhpost.com/business/farmers-air-their-agriculture-concerns>
- Muyhong, C. (2015). *Cambodia Agrees Agro-industrial Framework*. The Phnom Penh Post, July 1, 2015. <https://www.phnompenhpost.com/business/cambodia-agrees-agro-industrial-framework>
- Muto, M., & Yamano, T. (2009). The Impact of Mobile Phone Coverage Expansion on Market Participation: Panel Data Evidence from Uganda. *World development*, 37(12), 1887-1896.
- National Institute of Statistics. (2013). Release of Preliminary Results of 2013 Inter-censal Population Survey of the Kingdom of Cambodia. Last accessed April 29, 2018 from [http://www.stat.go.jp/info/meetings/cambodia/pdf/ci\\_prpr.pdf](http://www.stat.go.jp/info/meetings/cambodia/pdf/ci_prpr.pdf)
- Poch, K., & Tuy, S. (2012). Cambodia’s Electricity Sector in the Context of Regional Electricity Market Integration. In *Energy Market Integration In East Asia: Theories, Electricity Sector And Subsidies*, 141.
- Rahut, D. B., & Micevska Scharf, M. (2012). Non-farm Employment and Incomes in Rural Cambodia. *Asian-Pacific Economic Literature*, 26(2), 54-71.
- Rao, N. D. (2013). Does (better) Electricity Supply Increase Household Enterprise Income in India?. *Energy Policy*, 57, 532-541.

- Reardon, T., Berdegue, J., Barrett, C. B., & Stamoulis, K. (2007). Household Income Diversification into Rural Nonfarm Activities. *Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World*, 115-140.
- Semuels, A. (2017). Can Anything Stop Rural Decline? The Atlanta, August 23, 2017. <https://www.theatlantic.com/business/archive/2017/08/japan-rural-decline/537375/>
- Sife, A. S., Kiondo, E., & Lyimo-Macha, J. G. (2010). Contribution of Mobile Phones to Rural Livelihoods and Poverty Reduction in Morogoro Region, Tanzania. *The Electronic Journal of Information Systems in Developing Countries*, 42(1), 1-15.
- Sok, C. (2018). *New Electricity Bill Cuts Planned to Start in April*. Khmer Times, February 21, 2018. <https://www.khmertimeskh.com/50109671/new-electricity-bill-cuts-planned-start-april/>
- Surrusco, M. (2017). *Electricity Access Is Growing but Divide Persist*. The Cambodia Daily, April 6, 2017. <https://www.cambodiadaily.com/news/electricity-access-is-growing-but-divide-persists-127606/>
- Schwarze, S. (2004). Determinants of income generation activities of rural households in Central Sulawesi, Indonesia, *Georg-August University Göttingen, Germany*. Available at: <https://d-nb.info/97405061X/34>
- Tan, H.Y. (2017). *Microloans: Boon or Bane for Cambodia's Rural Poor?* The Strait Times, December 28, 2017. <https://www.straitstimes.com/asia/microloans-boon-or-bane-for-cambodias-rural-poor>
- Tong, K., Pide, L., Bopharath, S., & Tūrīṇā, P. (2013). *Levels and Sources of Household Income in Rural Cambodia 2012*. Phnom Penh: Cambodia Development and Resource Institute.
- Wan, J., Li, R., Wang, W., Liu, Z., & Chen, B. (2016). Income Diversification: A Strategy for Rural Region Risk Management. *Sustainability*, 8(10), 1064.
- Winters, P., Davis, B., & Corral, L. (2002). Assets, Activities and Income Generation in Rural Mexico: Factoring in Social and Public Capital. *Agricultural Economics*, 27(2), 139-156.
- Winters, P., Davis, B., Carletto, G., Covarrubias, K., Quiñones, E.J., Zezza, A., Azzarri, C. and Stamoulis, K., (2009). Assets, Activities and Rural Income Generation: Evidence from a Multicountry analysis. *World Development*, 37(9), 1435-1452.

- Winters, P., Davis, B., & Corral, L. (2002). Assets, Activities and Income Generation in Rural Mexico: Factoring in Social and Public Capital\*. *Agricultural Economics*, 27(2), 139-156.
- World Bank. (2018). *Cambodia: Electricity Access Increased, Reliability Needs Improvement*. Last accessed April 28, 2018  
<http://www.worldbank.org/en/news/press-release/2018/03/22/cambodia-electricity-access-increased-reliability-needs-improvement>
- Woldenhanna, T., & Oskam, A. (2001). Income Diversification and Entry Barriers: Evidence from the Tigray Region of Northern Ethiopia. *Food Policy*, 26(4), 351-365.
- VOV. (2016). *Cambodia Imports 100,000 tons of Fresh Vegetables*. The Voice of Vietnam, February 15, 2016. <https://english.vov.vn/trade/cambodia-imports-100000-tons-of-fresh-vegetables-312357.vov>
- Zhao, J., & Barry, P. J. (2014). Income Diversification of Rural Households in China. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*, 62(3), 307-324.



## Appendix 1: Correlation Matrix

	Log_income	Age	Gender	Edu_univ	Edu_secondary	Edu_lower secondary	Edu_primary	Dependence	Cattle	Hand tractor	TV	Motorbike	Mobile phone	Electricity	Paved road	Micro-finance
Log_income	1.000															
Age	0.045 (0.637)	1														
Gender	-0.045 (0.637)	0.086 (0.365)	1													
Edu_univ	0.148 (0.637)	0.016 (0.870)	0.099 (0.286)	1												
Edu_secondary	-0.052 (0.578)	0.027 (0.773)	0.142 (0.129)	-0.012 (0.895)	1											
Edu_lower secondary	0.008 (0.929)	0.000 (0.997)	0.001 (0.993)	-0.036 (0.702)	-0.051 (0.586)	1										
Edu_primary	-0.045 (0.629)	-0.093 (0.329)	0.025 (0.787)	-0.134 (0.153)	-0.189 (0.041)	-0.552 (0.000)	1									
Dependence	-0.073 (0.438)	-0.208 (0.027)	0.044 (0.639)	-0.136 (0.145)	-0.098 (0.296)	-0.022 (0.813)	0.137 (0.143)	1								
Cattle	-0.198 (0.033)	-0.012 (0.897)	0.137 (0.144)	-0.113 (0.227)	0.109 (0.243)	-0.205 (0.027)	0.023 (0.809)	-0.067 (0.474)	1							
Hand tractor	-0.159 (0.089)	0.039 (0.678)	0.165 (0.077)	-0.081 (0.386)	0.152 (0.103)	-0.024 (0.797)	0.014 (0.881)	-0.179 (0.054)	0.222 (0.017)	1						
TV	-0.021 (0.823)	0.175 (0.065)	-0.138 (0.139)	0.093 (0.319)	0.133 (0.156)	-0.077 (0.411)	0.112 (0.239)	-0.169 (0.069)	0.018 (0.852)	0.104 (0.265)	1					
Motorbike	0.034 (0.719)	0.213 (0.024)	-0.027 (0.769)	0.084 (0.369)	0.119 (0.202)	0.141 (0.132)	-0.112 (0.231)	0.018 (0.847)	-0.144 (0.124)	0.085 (0.367)	0.347 (0.000)	1				
Mobile phone	0.015 (0.876)	0.065 (0.495)	-0.120 (0.199)	0.050 (0.593)	0.071 (0.448)	0.084 (0.371)	-0.023 (0.808)	-0.150 (0.108)	0.019 (0.835)	0.176 (0.059)	0.165 (0.076)	0.347 (0.000)	1			
Electricity	0.023 (0.805)	0.093 (0.327)	0.085 (0.363)	0.095 (0.311)	0.135 (0.149)	-0.019 (0.839)	0.172 (0.065)	-0.049 (0.603)	0.179 (0.055)	0.085 (0.366)	0.328 (0.000)	0.262 (0.005)	0.156 (0.094)	1		

Paved road	-0.000 (0.996)	0.148 (0.117)	-0.117 (0.211)	0.158 (0.091)	0.073 (0.436)	0.007 (0.939)	-0.259 (0.005)	-0.160 (0.086)	0.207 (0.026)	0.043 (0.651)	0.158 (0.091)	0.057 (0.541)	0.034 (0.716)	0.049 (0.597)	1
Microfinance	-0.011 (0.904)	-0.014 (0.883)	-0.086 (0.358)	-0.041 (0.660)	0.120 (0.198)	0.177 (0.058)	-0.088 (0.347)	-0.006 (0.946)	-0.109 (0.243)	0.038 (0.685)	0.209 (0.024)	0.258 (0.005)	0.182 (0.051)	-0.016 (0.867)	0.058 (0.538)

Note: Number in parenthesis is p-value

Source: Author's calculation based on field survey data

#### Appendix2: Population information of Bavel district

Commune name	Number of villages	Number of households	Total population	Female population
Bavel	19	5,896	26,969	13,600
Khnach Romeas	8	2,450	12,528	6,502
Lvea	12	2,847	12,235	6,211
Prey Khpos	10	2,580	11,747	5,941
Ampril Pram Daeum	15	3,272	13,891	7,003
Kdol Ta Haen	15	2,452	10,587	5,389
Klaeng Meas	13	2,950	13,141	6,513
Boeung Pram	8	2,068	9,282	4,746

Source: Commune database, 2014