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Sources of income in rural households at Kdol Tahaen Commune, Bavel District, Battambang

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សង្ខិត្តន័យ

ភាពក្រីក្រនៅប្រទេសកម្ពុជាច្រើនប្រមូលផ្តុំនៅជនបទ។ ដូច្នេះ ការកាត់បន្ថយភាពក្រីក្រទូទាំងប្រទេសតម្រូវឱ្យមានការកាត់បន្ថយភាពក្រីក្រនៅតាមទីជនបទ ដោយបង្កើនប្រភពផ្សេងៗនៃប្រាក់ចំណូល។ ការសិក្សានេះបានប្រើកម្រងសំណួរផ្លូវការ ដើម្បីស្រាវជ្រាវរកប្រភពប្រាក់ចំណូល និងកត្តាផ្សេងៗដែលជះឥទ្ធិពលដល់ការបង្កើតប្រាក់ចំណូលក្នុងឃុំមួយនៅជនបទនៃខេត្តបាត់ដំបង ភាគពាយព្យនៃប្រទេសកម្ពុជា។ លទ្ធផល បានបង្ហាញថា ប្រាក់ចំណូលពីការងារកសិកម្មមានប្រមាណ ៦៨% នៃប្រាក់ចំណូលសរុបរបស់គ្រួសារដែលរស់នៅក្នុងឃុំនោះ។ ចំណែកឯប្រាក់ចំណូលដែលបានមកពីប្រភពផ្សេងក្រៅពីការងារកសិកម្មមានចំនួនតិចតួចប៉ុណ្ណោះ។ អ្នកភូមិដែលមានប្រភពប្រាក់ចំណូលក្រៅពីកសិកម្ម ច្រើនប្រកបមុខរបរក្រៅប្រព័ន្ធដូចជាការលក់ដូរតូចតាច និងការងារសំណង់។ មានអ្នកភូមិតែមួយចំនួនតូចប៉ុណ្ណោះ ដែលប្រកបការងារផ្លូវការដូចជាពេទ្យភូមិ គ្រូបង្រៀន ឬទាហាន។ លទ្ធផលទាំងនេះបង្ហាញថា ការខិតខំលើកកម្ពស់ជីវភាពប្រជាពលរដ្ឋនៅជនបទត្រូវផ្តោតលើការបង្កើនតម្លៃចំពោះផលិតផលកសិកម្ម តាមរយៈការលើកកម្ពស់ផលិតភាព ឬបង្កើន

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តម្លៃបន្ថែម តាមរយៈដំណើរការកែច្នៃចំណីអាហារ ឬសកម្មភាពឧស្សាហកម្ម ដ៏ទៃទៀត។ មិនតែប៉ុណ្ណោះ ការធ្វើពិពិធកម្មប្រភពចំណូលផ្សេងៗក្រៅពី ការងារកសិកម្មតាមរយៈការបង្កើតការងារដែលមិនទាមទារជំនាញខ្ពស់ក៏ សំខាន់ដែរ។

Abstract

Poverty in Cambodia is largely a rural phenomenon. Thus, creating sources of rural income to address rural poverty is required to reduce national poverty. This study used a structured questionnaire to explore the sources of income and the factors affecting income generation of a rural commune in Battambang Province, in the northwest of Cambodia. It was found that 68% of total household income in the commune was from agricultural sources, while there were very few sources of non-agricultural income. Villagers who sourced non-agricultural income, generally worked informally conducting activities such petty trade or manual labor for construction projects. Very few villagers engaged in formal employment, and those who did were in occupations such as doctors, teachers, or soldiers. These results suggest that efforts to improve rural livelihoods should focus on adding value to agricultural production via food processing or other industrial activities. Additionally, it is important to create diversified sources of alternative, non-agricultural income via low- or semi-skilled employment.

Keywords: rural livelihoods, agricultural income, non-agricultural income, poverty, Cambodia

Introduction

Rural households in developing countries are generally worse off than their urban counterparts, with respect to many indicators such as access to education, healthcare, markets and infrastructure. They also tend to control fewer assets (Jazairy et al., 1992; Alkire et al., 2014; Macourse and Swinnen, 2008). As a result, rural poverty reduction can be difficult endeavor, with no

one-size-fits-all solution (FAO, 2017). However, poverty reduction is part of the global development agenda. It was specifically targeted as part of the Millennium Development Goals (MDGs), which committed to halving the number of people living on less than 1.25 USD per day by 2015. Poverty reduction is also a feature of the post-2015 development goal, i.e., the Sustainable Development Goals (SDGs), which UN member states committed to achieve by 2030. The first goal, "No Poverty: end poverty all its forms everywhere", includes seven targets. The first target is to eradicate poverty, currently measured by the 1.25 USD poverty line, and the second target is to reduce at least by half people who live in poverty in all its dimensions according to national definitions. Cambodia has also made a commitment to meet the SDGs.

Different national policies have produced different outcomes, with respect to poverty reduction. For instance: China was able to reduce poverty by 2.5 % per annum between 1999 and 2015; Vietnam managed a 1.9% annual reduction in poverty between 1998 and 2016; and Pakistan realized a 1.8% average annual reduction between 2001 and 2015 (World Bank, 2019). Nonetheless, a common approach to poverty reduction is to develop a detailed understanding of the socio-economic conditions of the country, then to seek to eliminate poverty through formulating effective policies (Engvall et al., 2008). Data on how the poor generate income, and the assets they own are important for policy makers to this end. For instance, if the poor possess limited skills, a policy of creating labor-intensive industries may be adopted; whereas if the poor are heavily engaged in agriculture production, a policy of developing food processing industries may be promoted (Khan, 2000).

Cambodia has sustained an annual average growth in GDP of 7.8% between 2000 and 2018 (ADB, 2019). Despite this, the country remains one of the poorest in Southeast Asia (World Bank, 2020) and has only recently graduated from low-income to lower-middle-income country status (World Bank, 2016). Poverty in Cambodia is more prevalent in rural areas and in 2014, it was estimated that 90% of the people living below the poverty line in the country lived in rural areas (World Bank, 2020). By 2018, the overall national poverty rate had been reduced to 12.8% (ADB, 2020). However, the most up-to-date rural poverty rate (20.8%) was shown to be more than three times the urban poverty rate (6.4%) (World Bank, 2020).

It is vital for policy makers who aim to reduce poverty to understand the context of poverty and recognize that the poor are not homogenous. Different categories of poor require specific policy interventions (Khan, 2000). For instance, information about the sources of income generation by the poor is often important for informing policies that reduce monetary poverty (Stewart et al., 2007). This study explores the socio-economic conditions of rural Cambodian households using a case study in Kdol Tahaen Commune in Bavel District, Battambang Province. It considers the range of income sources found in the commune and the factors that affect household incomes.

Study area and research methods

This study used data obtained from a household survey conducted in seven villages in Kdol Tahaen commune in Bavel District, which is one of 14 districts in Battambang Province. There are 24 provinces in Cambodia, as well as the capital, Phnom Penh. Each province is sub-divided into districts and communes. Communes are the lowest administrative hierarchy and unlike

officials at the provincial and district level, a Commune Council is elected by citizens for a term of five years. Battambang province was selected for the study on the basis of its importance to the Cambodian economy and the range of economic activities present, including agriculture, trade, tourism and fisheries. The province is known as Cambodia's rice bowl and produces a significant proportion of the country's rice (Chon & Thet, 2011; Gartell, 2010). For instance, in the 1950's and 1960's following Cambodia's independence from France, Battambang alone produced sufficient rice to feed the entire population (Chon & Thet, 2011). The province is well-known for its fertile land, and rice produced in the province has a reputation for being of high quality. Farmers can usually obtain premium prices in both domestic and international markets for their rice output as a result (Chuon and Suzuki, 2005).

Battambang has a lot of other economic potential. It comprises part of the area surrounding the Tonle Sap, which is one of the most productive inland freshwater fisheries in the world (Lamberts, 2001). It also shares a border with Thailand and is a major route for trade and migration with Thailand. Many villagers from Battambang traverse the border to access alternative incomes through low-skilled jobs in Thailand. However, despite these favorable conditions, a relatively high proportion of provincial population (32.6%) had ID Poor 1 or ID Poor 2 status in 2017 (MoP 2018; cited in Sok and Chhinh, 2018). Bavel is one of the poorest districts in the province based on socio-economic indicators, such as access to electricity, housing type, and TV ownership (Provincial Department of Information, Battambang, 2016). Kdol Tahaen commune was selected as the site for the research, being a rural commune in this district.

Systematic sampling was used to select households for the study. Enumerators, upon selecting the first household to be surveyed, would then skip the next five households, meaning that every sixth household was included in the survey. This process was repeated until a quota for the number of households to be interviewed in each village was reached. Each enumerator was trained prior to data collection to ensure a consistent approach, before being assigned to conduct a pilot survey. Upon satisfactory results being obtained, the actual survey commenced. Although it is acknowledged that a larger sample size would have been preferable, resource limitations meant that only 150 households were surveyed over a period between the 1st and 3rd of November 2017. Following processing and cleaning of the data, only 116 households remained, after observations missing results for significant variables were excluded from the data set. This means that care should be taken when making generalizations using results from this survey. Beyond the limited sample size, the socio-economic conditions of people in Kdol Tahaen commune may vary from those located along the plain, or in mountainous or coastal regions.

As mentioned, the study comprises of two objectives. The first, to explore the income sources of rural Cambodian households, was assessed using descriptive statistics; whereas the second, to determine the factors that affect income generation, was assessed using regression analysis. A regression equation (1) was used to assess the significant determinants of rural household income. It included many factors outlined in the literature as influencing household income such as asset ownership, household socio-

economic conditions, access to local resources (Aikaeli, 2010), as well as government policies (Winters et. al., 2002).

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

A detailed explanation of the independent variables in this equation and their expected correlations with the dependent variable are presented in Appendix 1. Table 1, below, presents selected data from the field survey. It demonstrates that within the study site, the average age of a household head is 42-years, which is common in rural areas of Cambodia. Each household has on average 5 members, which is within the range of the 2013 national average of 4.6 members (National Institute of Statistics, 2013). Most household heads had only access a low level of education, with 67% of respondents educated to primary school level only. University qualifications were very rare among the survey cohort. The importance of agriculture to household income and the sparse population in the district is represented in the results that show that the average size of land owned is 2 hectares per household.

Bavel is known to be one of the poorer districts in Battambang, which is supported by the results of the survey. It indicates an average per capita income of 3,400 KHR, which is significantly lower than the 2009 rural poverty line of 3,503 KHR (4,500 KHR or 1.12 USD in 2017) (P-*value*=0.001) (MoP, 2013; ADB, 2017). There are four different poverty lines recorded in Cambodia. These are disaggregated for rural areas, Phnom Penh, as well as urban areas, and includes an aggregate national poverty line. However,

difficulties in accurately assessing rural incomes, due to their irregularity and multiple sources are worth noting.

Table 1. Demographic and socio-economic characteristics of households

Variable	Mean	Std. Dev.	Min	Max
Age of household head	41.920	12.687	20.000	80.00
Education level (HH head)				
Primary (dummy)	0.672	0.471	0.000	1.00
Lower secondary (dummy)	0.129	0.337	0.000	1.00
Upper secondary (dummy)	0.017	0.131	0.000	1.00
University (dummy)	0.009	0.093	0.000	1.00
Daily per capita income (KHR)	3,392	3,814	137	20,000
Household members (persons)	4.888	1.763	2.000	10.00
Microfinance access (dummy)	0.164	0.372	0.000	1.00
No. of dependents (person)	1.655	1.266	0.000	5.00
Agricultural land (hectare)	2.2	1.797	0.300	12.00

While an effort was made to encourage respondents to provide information about all sources of income, they may not have all been recorded. Another potential reason for low monetary income in the case study, is that many of the productive activities of rural households are not recorded through market transactions. For instance, household members, grow and consume vegetables, fish, chicken, and eggs self-sufficiently. Thus, while a low monetary income was recorded, this may not correlate with an insufficient calorie intake or an experience of poor wellbeing.

Results and findings

Rural sources of income

Agriculture remains to be the major source of income for the households interviewed. Figure 1 shows that agricultural activities account for approximately two-thirds of total household income. All households grow

rice; while some also grow corn to generate additional income. Some also engage small-scale vegetable production for household consumption. Figure 2 identifies seven non-agricultural income sources. This include four formal employment pathways, including the army, medical practice, teaching, and working in local administration as well as three informal income sources.

Figure 1. Income share of rural HH

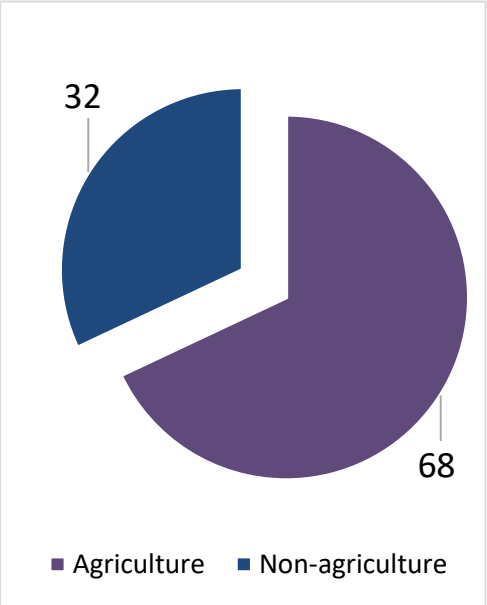
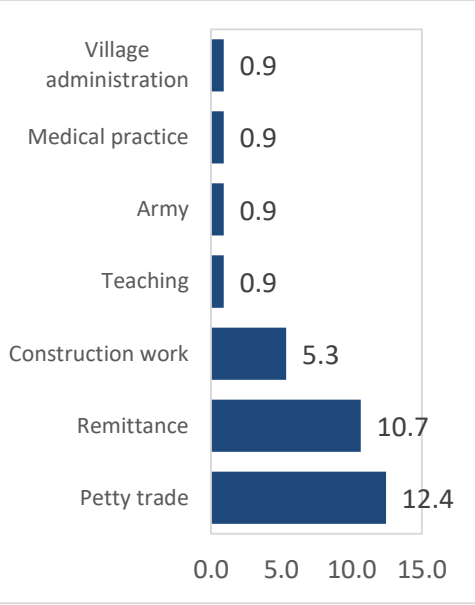


Figure 2. Non-agricultural income



While a variety of formal non-agricultural jobs were identified, the number of people working in informal roles was much higher, comprising about 90.0% of income generated from both within and outside of the agricultural sector. It is worth noting that one of the major sources of non-agricultural income was remittances from members of rural households working in urban centers or abroad. Due to an increasing numbers of household members, pressure on land resources coupled with low agricultural productivity, and shortage of off-farm employment; many younger people migrate to cities or foreign countries. Many villagers

identified that young people migrated as they did not have employment and had nothing else to do.

Ownership of rural assets

The average size of agricultural land of the households surveyed was 2.2 hectares. With an average household size of 4.9 persons, this corresponds to average land area per capita of 0.5 hectares. This result is larger than the national average as Battambang is relatively sparsely populated when compared to other provinces. The results of a t-test used to compare the ownership of other assets by both male and female-headed households is shown in Table 2. In most cases, there was no statistically significant difference in ownership.

Table 2 also provides data about the construction materials used in the homes of each household. It shows that most households had a corrugated zinc roof, while a much smaller proportion had a roof made with leaves, or were constructed from concrete. However, it should be noted that while both better-off and the poorer households used the same construction materials and had the same type of house, the size of the house and quality of materials may differ. For instance, when corrugated zinc houses were constructed, the size of the house constructed by wealthier families were much larger, using better quality timber. Thus, the value of different houses of the same type may vary significantly in each village.

No statistically significant difference in the size of landholdings by male and female-headed households was found (P-*value*=0.701). However, when the type of construction materials used in houses was compared with respect to the gender of the household head, there were some minor differences. For example, more female-headed households owned leaf-roof houses and fewer

owned houses with a corrugated zinc roof. Although it is apparent that more female-headed households owned concrete houses, the total number of villagers who owned these houses was negligible and this difference was not statistically significant.

Table 2. Land ownership, household construction materials, and access to electricity

Attributes	Overall	Male	Female	P-value
Land ownership (hectares per household)				
Agricultural land	2.2	2.1	2.2	0.701
Housing (%)				
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**
Assets (%)				
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
Power tiller	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
Sources of electricity power (percentage)				
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

Only 50% of the households surveyed had access to electricity and only 7.8% had access to solar energy. In terms of other asset ownership, 77.7% of households owned a mobile phone, followed by a bicycle (69%), cattle (59.5%), a motorbike (55.2%) and a TV (50%). It was also shown that there

was no statistically significant difference between the ownership of these assets and the gender of the head of the household. The one exception to this was that male-headed household were much more likely to own a power tiller. This asset is used for agricultural production and requires physical strength to operate. Power tillers are also used as a means of transportation and a substitute for tasks previously aided by cattle. Owners of these hand tractors could also often generate extra income renting them to other villagers.

Determinants of rural income

Although most of the independent variables examined in the study did not demonstrate any statistical significance, this was probably due to the limited sample size. Thus, these results mainly indicate the nature of the relationship between income and socio-economic status in rural households. The results of three regressions, with three different dependent variables are displayed in Table 3. For the first regression, a natural logarithm of total household income was the dependent variable. For the second regression, a natural logarithm of total non-agricultural income was used. For the third regression, natural logarithm of agricultural income was used.

The difference between the sign of the coefficient for mobile phone ownership in Regression 2 and Regression 3 should be noted. According to these results, mobile phone ownership tends to be associated with increased agricultural income but reduced non-agricultural income. This suggests that in rural areas, ownership of a mobile phone enables farmers to better access information about prices and contact middlemen to sell their products. As

expected, ownership of a power tiller was shown to be positively associated with increased agricultural income in the third regression.

Table 3. Determinants of income

Explanatory variables	Dependent variable: *Total income* (1)	Dependent variable: *Non-agricultural income* (2)	Dependent variable: *Agricultural income* (3)
Age	0.004	-0.003	0.019
	(0.008)	(0.062)	(0.049)
Gender	-0.310	-1.858	-0.188
	(0.221)	(1.578)	(1.284)
Edu_univ	1.321	12.760	3.864
	(1.157)	(8.267)	(6.715)
Edu_secondary	-1.108	-5.151	3.293
	(0.833)	(6.126)	(4.835)
Edu_lower secondary	-0.167	-1.005	1.520
	(0.392)	(2.817)	(2.278)
Edu_primary	-0.081	-0.632	0.0962
	(0.307)	(2.245)	(1.781)
Dependents	-0.359	-0.001	-0.976
	(0.463)	(3.364)	(2.688)
Cattle	-0.321		-0.966
	(0.230)		(1.335)
Power tiller	-0.273		2.429*
	(0.219)		(1.268)
TV	-0.234	-1.803	-0.948
	(0.242)	(1.779)	(1.402)
Motorbike	-0.023	0.968	-2.139
	(0.247)	(1.801)	(1.434)
Mobile phone	0.038	-3.539*	2.822*
	(0.265)	(1.924)	(1.536)
Electricity	0.262	1.677	-0.095
	(0.230)	(1.657)	(1.335)
Paved road	-0.053	-1.957	1.871
	(0.252)	(1.809)	(1.462)
Microfinance	-0.001	1.268	-1.210
	(0.288)	(2.118)	(1.669)
R-squared	0.114	0.086	0.137
Adjusted R^2	-0.023	-0.034	0.003
	F(15, 97) = 0.83	F(13, 99) = 0.72	F(15,97) =1.03
Observation	113	113	113

Note: **: P< 0.05, and *: P<0.1

Discussion

Sources of income for rural households

This study shows that income from agriculture accounts for a high proportion of total income in rural Battambang. While non-agricultural income sources exist, they are less available and restricted to informal employment in petty trade or construction work. Remittances have recently become a much more significant source of income for rural households. Battambang province shares a border with Thailand and it is easy for residents to migrate to access work. To increase the income of rural households, Winter et al. (2009) suggests that the improvement of three important rural assets, including agricultural land, rural infrastructure, and education is vital. In the study site, households were found to own a relatively large area of agricultural land due to a low population density. However, access to electricity infrastructure had not yet been provided, with only 49.1% and 7.8% of households having access to the electricity grid and solar energy, respectively.

Previous studies have shown that rural electrification tends to increase household income, improve household welfare (Kooijman-van Dijk, 2012; Rao, 2013), and increase the profitability of rural micro-enterprises (Akpan et. al., 2013). Electricity access also allows households to access better information through the use of televisions or mobile phones. Mobile phone ownership has been found to reduce the cost of marketing farm products and encourage farmers to actively participate in markets (Muto and Yamano, 2009). It also has been shown to strengthen the capacity of rural households to deal with emergencies and expand their social networks (Sife et. al., 2010).

Recently, as prices have decreased, mobile phones have become affordable for rural households in Cambodia, resulting in many benefits.

Electricity access has recently expanded in Cambodia, however there is a persistent gap in access between urban and rural households, which suggests that rural electrification programs should be prioritized. While 97.0% of Cambodia's urban population has access to electricity, this is true for only 49.0% of the rural population (Surrusco, 2017). Many rural households are restricted to using home solar systems, solar lanterns, and rechargeable batteries (World Bank, 2018), which provide less stable service at a higher cost.

A better outcome would be if rural households could access more reliable electricity sources, such as through a national grid. Prices should be set at a rate that enable poor households to afford access to electricity. Current tariffs in Cambodia are among the highest in ASEAN countries, and in rural areas, the cost tends to be higher than in cities. For instance, while in some parts of Phnom Penh residents pay 18 cents per kWh for electricity, some rural residents pay as much as 1 USD per kWh (Poch and Tuy, 2012). Higher electricity costs in rural villages are attributed to the fact that the national grid does yet reach many villages and electricity is often supplied by a private company in these cases. As a result, many rural households still cannot access electricity.

Besides enabling farmers to increase the size of their land holdings and improve the productivity of their labor, better access to education offers a chance for the rural poor to take advantage of opportunities for off-farm income-generation. However, the study shows that the average levels of

schooling accessed by household heads in the study site is mostly limited to primary education. This makes it difficult for farmers to understand and apply modern agricultural techniques, let alone find a formal job outside of agriculture.

Despite this, providing formal education to adult farmers would be both time-consuming and impractical. Many of the rural poor are not likely to be able to invest time in participating in formal education. An alternative would be to provide training opportunities on agricultural methods and other practical skills that may be applied locally to generate income. Beyond this, it is vital to provide quality education in rural areas so that children in rural households will be able to better access off-farm income-generating activities and participate in higher value labor opportunities in the future. Households with more highly educated members may also benefit indirectly via the transfer of new knowledge and technologies. Although education was not found to significantly affect income in this study, it is still considered to be an important factor in improving and diversifying the income sources of rural households. Poorer and lower educated households (Escobal, 2001), particularly those from more remote villages tend to be less diversified (Abdulai and CroleRees, 2001). Additionally, when they do diversify their income sources, it tends to be with low-paid employment (Rahut & Micevska Scharf, 2012; Woldenhanna, & Oskam, 2001).

Diversifying and increasing sources of rural income

The main sources of income in this study were found to be dominated by agricultural activities and informal jobs such as petty trade and construction. Thus, policies that either add value to agricultural production or

create new sources of income are most likely to improve household incomes among the rural poor. However, agricultural production in Cambodia tends to be less diverse, with most farmers growing only rice. While a few farmers grow corn and other vegetables on a small-scale, rural people are not generally encouraged to diversify further as there is little demand for products. This introduces higher levels of risk for those who try. Yet, not diversifying production leads to an oversupply of commonly grown crops, while there is a shortage of other produce. Oversupply occurs frequently, which makes it harder for the rural poor to access profitable markets.

This tends to cause indebtedness among farmers, who generally borrow money to invest in agricultural inputs such as seeds, fertilizer, and gasoline. Tan (2017) outlines how farmers tend to access microfinance for paying for inputs that they will not be able to repay. Many Cambodian agricultural products, including rice and corn, are often sold to neighboring countries such as Thailand and Vietnam, in a fashion that gives middlemen the power to set prices at a lower rate than what is reasonable for local farmers (Chan, 2014b). This may be attributed to the lack of a food processing industry in Cambodia, where there are very few factories available to process and market raw agricultural products. Meanwhile, it is easy to find imported processed foods in the country.

While crops like rice and corn are frequently in oversupply with depressed prices, there is also substantial volumes of agricultural products imported from neighboring countries. Currently, Cambodia imports 200 million USD worth of vegetables from Vietnam, Laos and Thailand annually (VOV, 2016). Farmers will be able to benefit substantially if they are able to

meet local demand for these products that are currently imported. However, this requires support to be provided to the rural poor, as vegetable farming can be more difficult than rice cultivation, which has been practiced for centuries in Cambodia (Chan, 2014a).

Diversified agriculture production will help farmers to reduce the oversupply of agricultural commodities and increase rural incomes via high value crops. Moreover, if food and other processing industries are developed, farmers will be able to benefit from more stable demand from markets. A viable food processing industry enables products to be stored for longer periods and enables them to be retained when market demand is low. Additionally, processing industries will create low or semi-skilled jobs, suitable for a large number of rural laborers in Cambodia. Thus, it is important to promote food processing businesses and the diversification of crops in areas with similar socio-economic conditions to the study site. Importantly, the national government has identified the importance of the food agribusiness sector and incorporated the promotion of this sector into the Industrial Development Policy (Chan, 2015).

Increasing off-farm income sources

One reason the income of rural households is low because they are engaged in activities that have low productivity with little value added. Additionally, there is a shortage of alternative income sources. This research identified very few informal sources of off-farm income, and only a few formal sources in the study area. This employment is not sufficient to meet the employment demand. The shortage of alternative employment in rural areas occurs from both a demand and supply perspective. On the demand side,

companies and factories are not interested in setting up facilities in the rural areas due to a lack of infrastructure. For instance, electricity is expensive, and the supply is unstable, resulting in higher costs of production. Roads are not well paved, so the transportation of products is not efficient. Thus, operating costs tend to be much higher for factories in rural areas. On the supply side, there is a lack of a skilled labor force. In the study site, the average level of schooling accessed is less than 6 years. Many people with this level of education cannot be employed in local government or on factories demanding pre-requisite skills.

An educated labor force is a key factor in being able to attract private firms to set up facilities. However, rural households should not be blamed for their low education. Rural villagers may perceive higher education to be unnecessary due to the current nature of their employment. Based on their experience of working in the agricultural sector as their family has done for multiple generations, many think that it is not necessary to access more than a primary education, as basic literacy is all that is required to access many rural jobs.

In this situation, government interventions to increase the level of education of the rural population is important if off-farm employment opportunities are to be increased. The government needs to encourage the people to either enroll in formal schooling or informal training centers. For most adult villagers, the former is not practical, thus, informal training needs to be provided. It is the role of government to encourage private firms to locate themselves in rural areas by supplying them with physical infrastructure required, as well as a skilled workforce and other preferential

treatment. In the short-to-medium term, creating a low-skilled employment that matches the available labor supply in rural areas via agricultural diversification and food processing will be necessary to absorb a large number of workers that have only had access to a primary-level education. However, in the long term, the next generation of rural villagers may be able to diversify into other higher value-added industries such as manufacturing and tourism.

Conclusion

Improving the income and welfare of the population is a priority for all governments. Concerted efforts have been made globally to mobilize resources and formulate policies to reduce poverty. However, this task is difficult and still far from complete. Hundreds of millions of people still live below the poverty line globally, despite substantial improvements since the inception of the Millennium Development Goals. To formulate effective poverty reduction policies, questions must be asked such as: Who are the poor? What resources do they have access to? And how do they make a living? This knowledge is vital as it provides policy makers with clear targets to meet. The rural poor face different challenges to their urban counterparts and require different support. This is also true for rural poor citizens who are landless compared with small-scale farmers who own land resources.

In Cambodia, majority of the poor live in rural areas. Most own at least a small plot of agricultural land, albeit decreasing in size. This is due to an increasing number of members in each household and the need to sell land in emergencies, such as when family members get sick. The rural poor are relatively low-skilled, with access to education in most cases limited to primary school. Primarily, they generate income from agriculture and other

informal sources such as petty trade or working on construction sites. Therefore, if incomes are to be increased to reduce rural poverty, it is necessary to diversify agricultural production and create sources of non-agricultural employment, at least in the short and medium term. Diversifying agriculture will result in farmers growing a broader variety of cash crops to avoid oversupply. Meanwhile creating non-agricultural employment in rural areas will enable households to access alternate sources of income during the off-season, potentially reducing the need for younger family members to migrate for work. The promotion of the food processing industry will provide opportunities through adding value to agricultural production, as well as providing employment for low-skilled labor in rural areas.

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Appendix 1. Regression variables and their explanation

Variable	Variable Name	Coefficient Sign	Explanation
Y	Natural log of household income (total income, agricultural income and non-agricultural income)		
Age	Age of household head	+	Age is expected to have a positive impact on income.
Gen	Sex of household head	+	A household headed by men is expected to generate higher income.
Edu	Education of household head	+	Education is expected to have a positive impact on income.
Dep	Dependency ratio	-	Dependency ratio is expected to have a negative impact on income
Catt	Ownership of a cattle (cow or buffalo)	+	Cattle can be used for agricultural activities such as plowing or transportation, so it is expected to be positively related to income.
Ht	Ownership of hand tractor	+	Power tiller is one of the most important machinery in rural areas. It is expected to be positively related to income.
TV	Ownership of Television	+	TV is a source of information including weather forecasts, prices of crops, and so on. Thus, it is expected to positively correlate with income.
MB	Ownership of motorbike	+	A motorbike can be used as a means of transportation

			and contact, so it is expected to be positively correlated with income.
MP	Ownership of mobile phone	+	Mobile can be used for long distant contact and to access information about prices etc. So, it is expected to be positively correlated with income.
ELE	Access to electricity	+	Electricity allows households to use machinery and other tools, thus it is expected to be positively corrected with income.
PR	Paved road in the village	+	Paved road enables households to access to the market, so it is expected to be positively correlated with income.

Appendix 2. Correlation Matrix

Attribute	Log_ Income	Age	Gender	Edu_Univ	Edu_ Secondary	Edu_lower secondary	Edu_Primary	Dependence	Cattle	Hand tractor	TV	Motor-bike	Mobile phone	Elec-tricity	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)	1