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Changing Livelihoods in Rural Cambodia:  
Evidence from panel household data in Stung Treng



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# **Changing Livelihoods in Rural Cambodia**

## **Evidence from panel household data in Stung Treng**

Rasadhika Sharma, Thanh Tung Nguyen, Ulrike Grote, Trung Thanh Nguyen

## **Abstract**

Analysis of livelihood strategies can aid to understand and resolve problems associated with vulnerability to poverty and food security. This paper aims to identify and describe the changes in rural livelihood activities by using household data for 2013 and 2014 collected in Stung Treng, Cambodia. We use the same variables and estimate different clusters for both the years. The paper concludes that despite the lag of only one year, there are noticeable changes in livelihood strategies. Firstly, we find a group of transition farmers in 2014 that is composed of households that are witnessing a shift towards commercialization. They invest and consume more than subsistence farmers. Secondly, there is a greater diversification in activities amongst the groups. Most households practice multiple activities. Lastly, with regards to self-employment, there has been a shift from agriculture and the production sector to services and crafts. All of the above changes can be deemed as positive as there is a gradual movement away from more vulnerable sectors. Accordingly, households that participate in livelihood activities related to agriculture and natural resource extraction are most affected by shocks and face the highest vulnerability to poverty. The paper additionally highlights some concerns such as a decline in availability of extracted products such as the fish stock which are expected to negatively impact on these more vulnerable rural households in the medium and longer term. Furthermore, the state of education is dismal and needs attention. Therefore, policy makers need to consider these issues while addressing rural poverty.

Keywords: Livelihoods, Rural poverty, Diversification, Cluster Analysis, Cambodia

JEL classification: Q57, Q20, Q12

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# 1 Introduction

## 1.1 Problem statement

The World Bank lists Cambodia in the group of Least Developed Countries. Though deemed as one of the fastest growing economies in Asia with an annual growth rate of 7.8% on average between 2000 and 2014, the country still has a relatively low Gross Domestic Product per capita of \$1,095<sup>1</sup>. The poverty rate has declined significantly from 48% in 2007 to 18% in 2012 (ADB, 2015). However, most Cambodians are still vulnerable to fall into poverty. According to the World Bank (2014), a vast majority of the population that escaped poverty was able to do it only marginally and hence, there is a huge share of near poor in the country.

Interestingly, most of these near poor and poor households are concentrated in specific livelihoods that relate to either agriculture or natural resources. Therefore, analyzing livelihood strategies could provide great insights and aid to resolve problems that are associated with vulnerability to poverty and food security. Also, it is important to understand the drivers of households adopting certain livelihood strategies and the opportunities of livelihood diversification.

Agriculture employs more than half of Cambodia's labor force while contributing only 37% to its GDP (FAO, 2014). Productivity of the sector is a big concern (Siphana et al., 2011) and there is presence of vulnerability as the production and trade portfolio is highly skewed towards rice. Production of paddy rice increased to 9.3 million tons in 2013 from 4.3 million tons in 2003. A net exporter of rice, Cambodia exported around 4 million tons alone in 2013. Also, Cambodia faces great competition from Vietnam and Thailand in rice production. Though the production cost is comparatively lower, the processing costs are much higher than for its counterparts. Additionally, while most farmers in the neighboring countries possess formal land titles, the same is not true for Cambodia (Nguyen et al., 2016).

Rural livelihoods are also greatly reliant on Cambodia's natural resources. Nguyen et al. (2015) establish in their study that environmental resources contribute significantly to the household income in Cambodia. It should be mentioned that while 60% of the land is under forest cover, there are many water resources. The Mekong River that runs from North to South is navigable for most of its course and along with the Tonle Sap provides excellent fishing and aquaculture opportunities. However, there has been a gradual decline in natural resources over the last few years. This could be attributed to many factors such as illegal and unsustainable fish and timber harvesting, that is carried out by military and local authorities and commercial enterprises (McKenny and Tola, 2002). Furthermore, the natives have a heavy dependence on these resources not only to supplement their income but also to fulfill nutritional needs.

Our case study site, Stung Treng is a remote province in Cambodia that is characterized by a huge presence of poverty and food insecurity. It is considered to be richer in natural resources than most of the other provinces (NIS, 2013). Generally, farming is small-scale and there is an absence of business opportunities other than logging and fishing. To add to this, the area has very poor infrastructure. There is no railroad and roadways do not cover a large part of the province. On the educational front, the dropout rate is 80% majorly comprising girls (Hungry for Life, 2014).

There are very few studies that have focused on rural Cambodia to analyze livelihood strategies (McKenny and Tola, 2002; FAO, 2010). By using livelihood activities to cluster households, it becomes easier to delineate households that are more prone to poverty. This study is a follow up of the paper by Bühler et al., 2015 which provided many interesting observations with relation to

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<sup>1</sup> According to the World Bank website, Vietnam had a growth rate of 6 % between 2011 and 2015 with GDP per capita of \$2,052. While, Thailand registered a growth rate of 0.9% during 2011 and 2015 and has GDP per capita of \$5,997.

livelihood strategies. The current study endeavors to add to the existing knowledge. While the first paper was based on data from only 2013, we analyze panel data available for 2013 and 2014. Though the time period is not long yet there are certain factors that could have encouraged changes in livelihoods. Firstly, there has been a noticeable drop in the number of fish extracted by the households between the two years which indicates a decline in fish stocks. Secondly, there are possible anticipation effects associated with the construction and opening of dams such as the Stung Treng dam and the Lower Sesan Dam 1 and 2 on the perceptions of people<sup>2</sup>. Thirdly, the number and severity of shocks experienced by the households vary between 2013 and 2014. Analysing this feature could add a strong dynamic aspect to the study. Lastly, there have been some minor infrastructural improvements in recent times. For example, a bridge was constructed on the Mekong in 2014<sup>3</sup>. Therefore, an in-depth analysis of the available data is pertinent and could pave way for further research.

## 1.2 Research objectives

The discussion paper aims to add to the existing knowledge on livelihood strategies with respect to households in rural Cambodia. Additionally, the paper also provides basic insights into the demographic dividend situation in the province along with shocks and coping strategies.

Specifically, it tackles the following two objectives:

- (1) To identify and describe the changes in rural livelihood strategies between 2013 and 2014,
- (2) To analyze selected livelihoods and their determinants.

The paper is organized as follows: section two describes the study site and the data collection methods. Section three describes the process of clustering. It also gives an overview of the clusters and the changes in livelihood strategies between 2013 and 2014. Section four analyses selected livelihood strategies and their determinants. Section five provides some insights into demographic dividend and shocks. Section six presents the summary and concludes.

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<sup>2</sup> Stung Treng Dam will be opened in 2016 while the Lower Sesan 1 and 2 are proposed to open in 2019

<sup>3</sup> Observation made by enumerators while surveying.



## 2 Data

### 2.1 Study site and data collection

Stung Treng is a province located in North-eastern Cambodia and is 481 km from the nation's capital, Phnom Penh. It borders Lao PDR to the North. Covering an area of 12,061 km<sup>2</sup>, it comprises 5 districts with 34 communes and 129 villages. There are 95,000 inhabitants belonging to 17,900 households. The Mekong divides the state roughly into two halves and has traditionally served as the main channel of migration from North to the South (Try and Chambers, 2006).

Stung Treng has high incidence of poverty and food insecurity. Also, there is a relatively high dependence on natural resources. Hence, the province was selected as a study site to collect household data to measure the vulnerability of rural households to poverty and food insecurity.

A sampling procedure similar to Hardeweg et al. (2013), as used in the DFG FOR 756 project<sup>4</sup>, was designed. This is based on the guidelines provided by the UN Department of Economic and Social Affairs (UN, 2005). At the village level, data on number of households, population and rural-urban classification was available. A self-weighted sample with clustering on village level was drawn with an assumption of agro-ecological and socio-economic homogeneity

The sample of 600 households was generated in two steps. First, from the list of villages, 30 villages were sampled as Primary Sampling Units (PSUs) proportional to size (PPS). Data from Census 2008 (NIS, 2008) was used to define a listing frame in the first step. For the second step, a random draw was made from the village level listing frame to select 20 households of each PSU. The number was kept at 20 and not more due to the low number of villages in the province. Under this method, each household has a probability of 3% of getting selected. Additional replacement households were also sampled to ensure availability of extra data in case a surveyed household was deemed ineligible. However, this was observed for less than 5% of the total households that were surveyed originally.

### 2.2 Questionnaire design

A questionnaire was used for the survey to measure vulnerability to poverty following Hardeweg et al. (2013). To obtain information at the household level, household heads were interviewed. This questionnaire contains 89 pages and 616 variables. It includes not only basic data on household individuals but also covers various sections such as agriculture, investment, food consumption, off farm employment, shocks and borrowing and lending behaviors of the household.

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<sup>4</sup> For more information: <https://www.vulnerability-asia.uni-hannover.de/6681.html>

## 3 Livelihood clusters and their characteristics in Stung Treng

### 3.1 Identifying relevant livelihood clusters

In order to describe the changes in livelihood strategies, a separate cluster analysis was performed for both the years. A decision was made not to merge the data sets for 2013 and 2014 to control for any loss of information. The overall analysis for each year was undertaken in two steps. First, a Principal Component Analysis (PCA) was performed to reduce the number of input variables into major factors and then Cluster Analysis was used to group households according to their livelihood inputs.

Our approach makes use of input variables to map input factors for livelihood strategies. This is in contrast to studies such as Babulo et al., 2008 and de Sherbinin et al., 2008 that use income shares to identify livelihood strategies. As stochastic nature of income could induce variations in dependency upon income for different years (Nielsen et al., 2013), the input allocation approach is given a preference.

Based on the collected data, the same 22 variables are used for both the years. These refer to investment, cost, land and labor. The sample size is 563 and 575 households for 2013 and 2014, respectively, which is obtained after excluding the outliers from the analysis. The PCA analysis reduces the input variables into seven factors for 2013 and eight factors for 2014 using the Kaiser (K1) criterion.

After the PCA, Ward linkage (Garson, 2012) is used to group households into clusters while the Duda/Hart index and Calinski-Harabaz criterion are applied as the stopping rule (Costello and Osborne, 2005). We obtain four clusters for both the years.

Table 3-1 Classification of livelihoods by cluster

Cluster	No. of households (%)	Main livelihood activities
<b>2013</b>		
1	280 (49.7)	Farmers
2	146 (25.9)	Natural resource extractors
3	82 (14.5)	Government office with livestock and remittances
4	55 (9.7)	Self-employed and non-agriculture employee
<b>2014</b>		
1	250 (44)	Subsistence farmers and hunting, collecting and logging (HCL) extractors
2	42 (7)	Transition farmers
3	186 (32)	Fish extractors and Government employees
4	97 (17)	Self-employed and non-agriculture employees who receive remittances

Source: Own calculation.

For 2013, Cluster 1 comprises farmers who constitute about 50% of the households. Cluster 2 constitutes 26% of the households and includes natural resource extractors. These households practice fishing, logging, hunting and collecting. Cluster 3 which forms 14.5% of the households, contains households where at least one of the members is a government official. Also, the cluster receives remittance and transfers from friends and relatives and rears livestock. The last cluster,

cluster 4 includes self-employed and non- agricultural employees. This group has both low skilled and high skilled off farm employees.

For 2014, Cluster 1 constitutes 44% of the households. It includes small farmers who are involved in low-skilled agricultural activities and rear livestock. They also practice hunting, logging and collecting. The second cluster, cluster 2 comprises transition farmers who display characteristics of agricultural commercialization. It forms 7% of the households. Cluster 3 contains households that extract fish and have at least one member who is employed by the Government. Lastly, cluster 4 consists of self-employed and non-agricultural employees and covers 17% of the total households. These households also receive remittances or transfers from friends or family. It can be seen that most of these households (cluster 1 and 3) practice natural resource extraction as incomes from their main occupation are not enough for sustenance.

### 3.2 Changes in livelihood strategies

As evident from the table above, we have a case of identical units and different clusters. This is a unique opportunity as the existing literature does not contain many panel data cluster analysis. Most studies focus on the ‘different units, identical cluster’ analysis (Van den Berg, 2009). Therefore, our study offers a great chance to identify households that changed clusters and hence livelihood strategies. The information can be used to understand the elements that prompt these shifts. However, it can be seen that though all the clusters are not completely alike, clusters 1 in both the years consist of farmers and also clusters 4 include self-employed and non-agriculture employees in both 2013 and 2014. This makes comparison between the two years more comprehensible.

Table 3-2 Changes in clusters and their livelihood strategies (No. of households and in %)

	2014					Total
	1	2	3	4		
2013						
1	151 (55)	26 (10)	62 (23)	34 (12)		273 (100)
2	71 (51)	3 (2)	48 (35)	17 (12)		139 (100)
3	4 (5)	7 (9)	56 (74)	9 (12)		76 (100)
4	9 (17)	4 (8)	9 (17)	31 (58)		53 (100)
Total	235 (43)	40 (8)	175 (32)	91 (17)		541 (100)

Source: Own calculation.

It can be seen in table 3-2 that 55% of the farmers from Cluster 1 in 2013 stayed in the same cluster in 2014. However, it should be mentioned that in 2014, Cluster 1 fairs much worse in terms of all parameters as compared to Cluster 1 in 2013. This implies that the households that did not change clusters contain small scale farmers with the minimum farm areas, least education, investments and transfers. On the other hand, the 10% of the farmers that moved from Cluster 1 in 2013 to the transition farmer cluster (Cluster 2) in 2014 have the highest investment figures out of all the clusters, largest area under cash crop production and better education. They form 65% of Cluster 2 in 2014.

Cluster 2 from 2013 witnessed an interesting redistribution in 2014 which has no distinct cluster comprising just natural resource extractors. Rather, these households moved to Cluster 1 and Cluster 3 in 2014 manifesting diversification of livelihood strategies. Diversification has been identified as a self-insurance mechanism by studies such as Barrett and Reardon, 2001. The facts that either income from just one livelihood strategy might not be enough or with the gradual natural resource degradation, households cannot rely completely on income from natural resource extraction, could have prompted this phenomenon.

Cluster 3 and 4 did not witness a big change with most of the households holding on to their existing livelihood practices. However, again there is evidence of diversification.

### 3.3 Characteristics of the clusters

#### 3.3.1 Income and consumption

Table 3-3 illustrates the total income per capita and total consumption per capita for each cluster in 2013 and 2014. It can be seen that the average income and consumption level of households are just around 1000 USD PPP. Although, there is an increase in the income and consumption levels in 2014, yet the figures are much lower than the national income level.

Table 3-3 Income and consumption by cluster (in USD PPP)

<b>Cluster 2013</b>	1	2	3	4	Whole sample
Total consumption per capita	814	1001	1204	1151	952
Total income per capita	864	1082	1297	1504	1046
<b>Cluster 2014</b>	1	2	3	4	Whole sample
Total consumption per capita	824	963	1146	1149	993
Total income per capita	893	991	1307	1441	1126

Source: Own calculation.

In Stung Treng, households mainly participate in income generating-activities such as farming, rearing livestock, natural resources extraction, self-employment, and wage employment. Of these, households whose main activities are not related to agriculture are better off than the remaining groups. Particularly, in 2013 households from Cluster 3 (government officials and livestock feeders), Cluster 4 (self-employed and non-agriculture employees) and Cluster 2 (natural resources extractors), have income and consumption levels higher than the average. Amongst these, Cluster 3 and Cluster 4 boast the highest consumption and income levels, respectively. Only Cluster 1 (farmers) has income and consumption levels under the average.

In 2014, households from group 3 (government official and fishers) and group 4 (self-employee and non-agriculture employment) have income and consumption levels higher than the average with both the highest income and consumption belonging to group 4. Meanwhile, households from the

group of subsistence farmers and forest extractors (Cluster 1) have the lowest income and consumption levels.

### 3.3.2 Poverty

Poverty is a chronic challenge in rural areas in Cambodia. Although the country has experienced unexpectedly strong progress with a decrease in the poverty rate, the rate of poverty alleviation between areas is unevenly distributed. Meanwhile though the living standard in urban areas is considerably enhanced, the progress in rural areas is still quite modest (Engvall et al., 2007).

Table 3-4 Poverty (headcount ratio) based on income/consumption by cluster

Cluster	2013		2014	
	Income poverty (%)	Consumption poverty (%)	Income poverty (%)	Consumption poverty (%)
<b>US \$1.25 PPP</b>				
1	24.6	15.4	28	15.2
2	28.1	11	26.1	4.7
3	18.3	2.4	17.2	3.7
4	14.5	3.6	17.5	2
Average	23.6	11.2	22.2	6.4
<b>US \$2 PPP</b>				
1	46.8	48.6	50.4	49.6
2	50.7	33.6	40.4	40.4
3	34.1	19.5	29	20.4
4	25.5	25.5	32.9	25.7
Average	43.9	38.2	38.1	34

Source: Own calculation.

As illustrated by table 3-4, in 2013 the income and consumption poverty ratios were registered at 23.6% and 11% respectively at \$1.25 PPP. In 2014, there was a significant decrease in the statistics that fell to 22% and 6.4%. The change is also visible at the \$2 PPP level. Regarding livelihood strategies, households from clusters whose main livelihood activities are related to agriculture and natural resources have the highest poverty ratio in terms of both income and consumption.

In 2013, clusters 3 and 4 that contain households with government employees and self-employed members had the lowest income and consumption poverty ratios compared to clusters 1 and 2, farmers and natural resource extractors that had higher poverty ratios. However, there is an anomaly that can be observed. Though income poverty is highest amongst natural resource extractors, consumption poverty is not the highest. This could be attributed to the direct consumption of extracted products. Rayamajhi et al. (2012), in their study of livelihood strategies in Nepal also find that natural products may not always contribute to income but act more as an addition to subsistence.

By comparison, in 2014 the cluster having the highest income and consumption poverty ratio was Cluster 1 with subsistence farmers and forest extractors followed by transition farmers (Cluster 2). Similar to 2013, clusters with government employees and self-employed people had the lowest income and consumption poverty ratio. It must be mentioned that though Cluster 1 and Cluster 2

differ only by a few percentage points in terms of income poverty, the difference is more pronounced in case of consumption.

Interestingly, though the trend in poverty ratio is similar at both the levels of poverty line, the ratio increases significantly, more than 10% for all groups when estimated at \$2 PPP. The effect is more noticeable for clusters whose main livelihoods activities are related to agriculture and natural resources. For example, the consumption poverty headcount ratio of Cluster 1 in 2013 increases more than 30% and for Cluster 2 in 2014 increases more than 37%, compared to their estimates at \$ 1.25 PPP. This indicates that households that are involved in activities pertaining agriculture and natural resources not only have higher poverty rate, but also have higher probability of vulnerability.

## 4 Selected Livelihood Activities and their Determinants

### 4.1 Agriculture

#### 4.1.1 Farming

Agriculture is the most important sector in Cambodia. According to a fact sheet published by the FAO (2014), it contributes 37% to the GDP and employs about 67% of the total population. Around 3.7 million hectares of land is cultivated, however, it is argued that better production can be achieved by foreign investment in the sector (Saing et al., 2012). The overall yield per hectare is stated as 3 tons for rice (NSDP, 2013) and the public investment in agriculture has been around 13% between 2009 and 2012 (Siphana et al., 2011).

Though the cultivation of cash crops is expanding, yet 75% of the land is still devoted to rice. Production of rice has witnessed improvement not only in terms of productivity but also with respect to quality. According to the World Bank (2014), there has been a noticeable shift towards high quality white rice. This could work in the favor of the country by increasing its international competitiveness which is struggling with problems such as poor quality seeds, lack of technical know-how and high transportation costs. Cambodia processes only a small part of its rice production and most of it is exported to neighboring countries such as Vietnam and Thailand. The FAO (2014) estimated that in 2013, a record level of 1.2 million tons of paddy was exported from the country.

In Stung Treng, on average every household possesses agricultural land of about 2.8 hectares. However, land security is still a major problem which is evident in our sample as well. In 2013, about 55% of the households had no land documents while 38% had obtained documents from local authorities. The situation witnessed no change in 2014. Another concern is the high dependence on rainfall for irrigation purposes. Only 12% of the surveyed households have proper irrigation facilities in 2014 which is exactly the same as in 2013. Furthermore, in accordance with the national trend, rice still maintains its dominance covering around 40% of the cultivated land. Table 4-1 lends more insight into the agricultural changes with respect to rice.

Table 4-1 Average agricultural characteristics for rice (mean)

Parameter	2013	2014
Land Size (ha)	1.4	1.7
Productivity per ha (kg)	2385	1928
Total Production (kg)	2708	2663
Production lost after harvest per ha (kg)	41	45
Consumption (kg)	1909	2040
Give away (kg)	44	26
Household processing (kg)	12	18
Animal Feed (kg)	30	20.1
Payment in kind (kg)	36	27
Seed (kg)	159	147
Sale (directly after harvest) (kg)	399	224
Sale (3 months later) (kg)	40	75

Source: Own calculation.

Though the overall land size has not altered much, there is a significant increase in the land size holding of cluster 4, self-employed and non- agricultural employed households, of 1 ha between 2013 and 2014 (see Appendix 8-3 for cluster wise statistics). Also, Cluster 2 of transition farmers in 2014, on average has bigger land size than their subsistence agricultural counterparts. Furthermore, the production declined by 1.6% between the two years. This could be attributed to the following. Firstly, the productivity decreased from 2.3 tons/ha in 2013 to 1.9 tons/ha in 2014. The biggest decline is observed for Cluster 1, the small scale farmers. Secondly, an increase in loss of production of about 1% was recorded between 2013 and 2014. This also led to a decline in the proportion of produce used for other purposes such as household processing, animal feed and seeds. A noticeable fall of 40% and 27% is seen in terms of rice production being used as a giveaway and payment in kind, respectively. 70% of the produce was consumed in 2013 while the figure augmented to 76% in 2014 with the biggest increase for cluster 4. Additionally, while about 15% of the produce was sold directly after harvest in 2013, only 8% is sold in 2014. The figures for sale after three months of harvest also witness only a slight increase in percentage terms.

#### 4.1.2 Livestock

Livestock can be viewed as a source of protein, additional income and an asset. Therefore, it is no surprise that in Cambodia, about 90% of the total livestock is produced by smallholder farmers (Pen et al., 2009). Rather, in Stung Treng 82% of the households rear livestock such as chickens, ducks, beef cattle, buffalos and pigs. Chickens are more popular and the number of households breeding chicken has witnessed an increase of 15% between 2013 and 2014. This can be due to the minimal investment that is associated with chicken rearing (Burgos et al., 2008). Also, buffalos are seen as assets and are widely reared. The number of households with buffalos increased by 12% in 2014. Generally, oxen are used for fieldwork and buffalos act as savings for the future. Recently, beef cattle has also experienced an increase following a growing demand for beef in neighboring countries such as China. According to Pen et al. (2014), this could provide great opportunity for income expansion to the rural population if they shift from cattle keeping to cattle production. Between 2013 and 2014, 19 more households participated in beef cattle rearing.

Table 4-2 Livestock rearing in Stung Treng (mean)

Livestock	Rearing Households (No.)		Expenditure/HH (mean USD PPP)	
	2013	2014	2013	2014
Buffalo	261	293	18	6
Beef Cattle	106	125	12	7
Pig (fattening)	187	212	80	62
Pig (piglet production)	47	56	68	67
Chicken	324	372	40	17
Duck	56	69	45	23

Source: Own calculation.

Interestingly, the expenditure incurred by the households on buffalos, beef cattle, chicken and duck decreased manifolds between 2013 and 2014. The same is not visible in case of pigs. Cluster wise, in 2013, Government employees who reared livestock (Cluster 3) had the highest livestock value and, also, realized the highest average sales value. The situation is different in 2014, where Cluster 2 that comprises transition/commercial farmers, has the biggest stock and, also procure the highest average sales value. This corroborated the fact that some households are seeking to commercialize



their livelihood activities. Also, there is a noticeable increase in the overall average sale value. To see statistics for clusters refer to appendix 8-4.

## 4.2 Fishing, hunting and logging

Natural resources play a significant role in supporting livelihoods of rural households in Cambodia. They not only provide households a means for diversifying income and optimizing their labor resources but also act as a valuable “safety net” against adverse shocks (McKenney and Tola, 2002).

Similarly, in Stung Treng a large proportion of the population participates in natural resource extraction, related to both forest and water. The number of households involved in natural resource extraction increased from 79% in 2013 to 89% in 2014. Extracting grounds in Cambodia are generally either open access or community/Government owned. Most of the extraction activities are carried out in open access areas which either have no regulations or ineffective enforcement. For example, 88% of fishing and 98% of small animals are hunted in these areas (Appendix 8-5). This could be termed as one of the potential causes of over exploitation of natural resources that is evident in Cambodia.

### 4.2.1 Extracted products

A variety of products are extracted in Stung Treng which can be divided into five main groups: (i) fish, (ii) wood, (iii) game, (iv) vegetables and fruits, and (v) small animals.

Table 4-3 Extraction of natural resources

Product	Output value (USD PPP) (mean)		For sales (USD PPP) (mean)		For consumption (USD PPP) (mean)	
	2013	2014	2013	2014	2013	2014
Fish	1945	1286	1199	630	746	656
Wood	609	910	447	811	162	98
Game	944	1121	651	749	293	472
Vegetables and fruits	296	346	198	257	98	89
Small animals	354	165	256	34	98	132

Source: Own calculation.

Table 4-3 shows that on average, fish brings the highest benefit to households followed by game and wood. However, the output value from fishing experienced a significant decrease in 2014 with a fall of nearly one third of the output value in 2013. This could be explained by the over exploitation of water resources especially in the Mekong River which has been impaired in recent years leading to a great decline in fish stock being extracted. More than 80% of the surveyed households reported that there are lesser tree and forest covered areas, while more than 90% of the surveyed households declared that there are lesser fish. Remarkably, on average 495 kg of fish per household was extracted in 2013 whereas only 260 kg of fish was extracted in 2014. In contrast, the output value from extracting wood, vegetables, fruits and game increased between 2013 and 2014.

The extracted products can be used either for consumption or for sale. In 2013, the value of sale exceeded the value of consumption in all types of extracted products. This further emphasizes the

importance of natural resources as a source of cash income for rural households. The pattern remained almost the same in 2014, except in the case of fish and small animals. The value of consumption from extracted fish exceeded the sale value in 2014. An explanation for this could be derived from the fact that generally in times of decreased fish output, consumption is given priority. Therefore, when the quantity of extracted fish decreases, households are more likely to decrease the quantity available for sale.

#### 4.2.2 *Income contribution*

Table 4-4 highlights the contribution of income from natural resources to the annual household income for each cluster in 2013 and 2014. It accounted for a significant 25% of the total household income in 2013 and decreased slightly to 23% in 2014. However, the decrease was not a consequence of the decline in the absolute value. A growth in total income higher than the growth of natural resources income resulted in this phenomenon.

Table 4-4 Contribution of natural resources to annual household income

Cluster	Household Income (USD PPP (mean))	Contribution of environmental income (%)		
		Total	Water resources (Fish)	Forest resources (Wood, game, fruits and small animals)
<b>2013</b>				
1	4138	24	16	8
2	4720	31	18	13
3	5920	16	11	5
4	6519	13	11	2
Total	4781	25	16	9
<b>2014</b>				
1	4308	30	10	20
2	5515	22	7	9
3	5897	15	10	5
4	7292	14	6	9
Total	5442	23	9	13

Source: Own calculation.

The income from natural resources can be derived from two sources: forest and water resources. In 2013, the contribution of water resources was much higher (16%) to the household's annual income than forest resources (9%). However, in 2014 the contribution of water resources decreased to 9% while forest resources formed 13% of the total household income.

With reference to clusters, as expected, natural resources played a more significant role for Cluster 2 (natural resource extractors) in 2013 and Cluster 1 (subsistence farmers and forest extractors) and group 2 (transition farmers) in 2014. Interestingly, despite of having main livelihood activities related to fish extraction, the contribution of natural resources to the annual income of households from Cluster 3 (government office and fish extractors) in 2014 is just 1% higher than the contribution of natural resources in Cluster 4 that contains households with self-employed individuals.

## 4.3 Business and wage employment

The employment structure in Cambodia has not witnessed much change over the past years. Most of the employment is concentrated in rural areas that have lesser productivity. Furthermore, though the unemployment rate is around 3% and most of the poorer households have a job, these are concentrated in the informal sector and, hence, possess neither security nor a decent income (Dalis, 2014). According to the Labor Force Survey that was last conducted in 2012, the labor force participation rate was 69% with 34% and 46% of the population engaged in businesses and wage-salaried jobs, respectively.

### 4.3.1 Self-employment

In 2013, 22% of the total households were engaged in self-employment. The number increased to 26% in 2014. However, this growth is only limited to the males as the number of business women decreased (refer to Appendix 8-6). The sectors included in the study are: (i) agriculture – various forms of agricultural and livestock trading, (ii) production – industrial production and value upgrading of agricultural products, (iii) trade – retail, transportation and small scale trading, (iv) hotel and food – hotel, restaurants, food processing and sales, and (v) crafts and services – handicrafts, repair shops and service related activities. Table 4-5 shows that while agricultural and production sector businesses experienced a decline between 2013 and 2014, there was an increase in the trade sector (8%) and crafts and services (30%).

Table 4-5 Self-employment by sector

Sector	2013 (%)	2014 (%)
Agriculture	8.5	5
Production	8.5	5
Trade	57	62
Food/Hotel	14	13
Crafts & Services	10	13
Others	2	2

Source: Own calculation.

Breaking the figures into clusters, it can be seen that clusters 1 in 2013 and 2014 that comprise farmers have the same proportion of households (17%) engaged in self-employment. A similar trend is visible for clusters 4 for both the years that contain self-employed and non-agricultural employees where the proportion of households changes only by a percentage point (31% to 32%). In 2014, Cluster 3 has the highest number of self-employed households (43%) while only 7% of the transition farmers group in Cluster 2 are engaged in self-employment.

Sector wise, clusters 3 that include government employees in 2013 and government employees along with fish extractors in 2014, have the highest number of households involved in agriculture related self-employment for 2013 and 2014. However, there has been a significant decline in the numbers. The production sector has also faced the same situation. Clusters 4 contain the highest production related self-employed households for both the years but have decreased. The trade sector along with the other sectors, has witnessed more equitable distribution across the clusters in 2014. However, it can be noticed that though the 'poorer' clusters of 1 and 2 are expanding their business areas, they are still more concentrated in low-skill activities such as rice mill operators, small food store operators or taxi drivers. Sectors requiring medium skill levels such as trade, communication and high skilled activities such as teaching, doctors are still dominated by the richer clusters of 3 and 4. This picture is very similar to that observed in 2013.

When analyzing the socio-demographic figures, the role of education as one of the determinants of self-employment can be easily observed. Both, males and females that are self-employed, have higher levels of education than their non-self-employed counterparts. This is noticeable in 2013 as well as 2014.

### 4.3.2 Off-farm employment

The number of households engaged in agricultural off farm employment has gone down by 4% between 2013 and 2014. This could be the result of a decrease in mean salary being offered which is much lower compared to other sectors.

Table 4-6 Off-farm employment by sector

Sector	Households (N)		Mean Monthly Salary (PPP USD)	
	2013	2014	2013	2014
Agriculture	331	371	175	137
Factory	28	19	257	304
Construction	49	89	285	296
Service	40	55	236	245
Public	107	131	208	288
Others	6	3	216	375

Source: Own calculation.

As illustrated by table 4-6, the mean salaries for a worker in a factory, or in the construction and service sector, experienced a positive change. At the country level as well, there has been a gradual output growth in the industrial and service sectors while agriculture has remained stagnant (Dalis, 2014). It should be mentioned that 60% of the agricultural off-farm laborers came from the poorest cluster of farmers while households from the richest two clusters, Cluster 3 and Cluster 4 dominated the service and public sectors off-farm employment.

## 4.4 Migration

Migration is considered as one of the livelihood strategies that households in vulnerable communities pursue to increase and smooth household income, overcome poverty as well as the constraints in their places of origin. Factors such as personal characteristics, wealth, employment opportunities, culture, and political, social, or economic conditions affect the decision to migrate (Nguyen et al., 2014).

In Stung Treng, the number of migrants account for 12% of the whole sample with 60% from the young age group of 15 to 35-year-olds. The average education status of migrants is quite low, with most individuals having no education or primary qualification (Appendix 8-6).

#### 4.4.1 Destination of migrants from Stung Treng

Table 4-7 Migrant distribution by destination

		2013 (%)			2014 (%)		
		Male	Female	Total	Male	Female	Total
Rural	In province	68	52	63	70	61	67
	In another province	14	6	11	8	8	12
Urban	In province	8	15	10	11	12	8
	In another province	3	3	3	3	2	3
	Phnom Penh	2	11	5	2	6	3
	Abroad	5	14	8	6	11	7

Source: Own calculation.

As visible in table 4-7, most of the migrants in Stung Treng moved to rural areas with no significant difference between the two years. This could be explained by the fact that their education status is quite low. Therefore, most of the individuals do not have a great likelihood to obtain work in urban areas where most jobs may require higher education. With reference to gender, it can be seen that the proportion of female migrants in urban areas, Phnom Penh and abroad was higher than the males, which is worth mentioning.

#### 4.4.2 Types of jobs in destination areas

Table 4-8 Types of occupation in destination areas

Types of occupation	2013 (%)	2014 (%)
Agriculture	45	48
Factory	9	5
Construction	9	16
Service	22	16
Public Sector	14	15

Source: Own calculation.

As can be seen in table 4-8, the common trend of job distribution between 2013 and 2014 is that most migrants work in the agriculture sector whereas factories employ the least number of migrants. The low education levels of migrants could also explain this. However, by comparison there has been a remarkable increase in the proportion of the migrants who work in service and construction sectors. Their number increased in construction sector significantly from 9% (one of the least popular occupation) in 2013 to 16%, becoming the second popular occupation in 2014. There was also a considerable increase in the number of migrants employed in the service sector.

#### 4.4.3 Migrant remittances and household welfare

Table 4-9 Migrant remittances and household welfare

	2013		2014	
	Non-migrant households	Migrant households	Non-migrant households	Migrant households
Migration remittances and transfer (USD PPP)	-	330	-	133
Total household income (USD PPP)	4274	5485	5306	5868
Total household consumption (USD PPP)	4440	4643	4750	4971

Note: The t-test shows insignificant differences between migrant households and non-migrant households for all welfare indicators.

Source: Own calculation.

In contrast to findings of Jampaklay and Kittisuksathit (2009) in Cambodia, Laos and Myanmar, our study shows that contribution of remittances and transfers to the total income and consumption plays an insignificant role. It equaled just 6% and 7% of the total household income and consumption in 2013 and dropped further to 2% and 3% of the total household income and consumption, respectively in 2014. This is corroborated by the results of t-tests between the welfare indicators of migrant and non-migrant households.

## 5 Demographic Dividend and Shocks

The livelihood strategies of households are largely influenced by the surroundings, the economic system, socio-political changes, or diverse shocks. As rural households have to adjust to these changes over time, it is pertinent to consider these dynamics over time. In the following, we highlight some of these drivers which influence the livelihood system of rural households. While some of these drivers (such as shocks) are specific to our sample households in Stung Treng, others (e.g. demographic aspects) are more of general nature and apply to Cambodia in general.

### 5.1 Demographic dividend

Since the 1990s, Cambodia has been experiencing a fall in population growth rate and fertility. This coupled with increasing longevity, has led to surplus labor. The annual population growth rate halved to 1.6% while growth rate for labor force has been 2.7%, between 2001 and 2013. This demographic dividend window that opened in 1995 is expected to close around 2045 (Beyene, 2015).

However, this unique opportunity comes with a fair share of problems, most of which could be attributed to its turbulent history. First the schools were closed during the Civil War and then, during the Khmer Rouge, the education system completely collapsed. According to Ayres (1999), classrooms were seen as a symbol of imperialism and, hence, about 75% of the teachers and 96% of higher education students were murdered under the regime. The high and selective mortality not only altered the current socio-demography but also the educational standing of the population (de Walque, 2006).

Since then, the education system has made progress but the youth has not benefitted as expected. The average age of leaving school is 16 years and half of the young population has just primary education. Though unemployment is very low, yet higher unemployment rates are concentrated amongst the educated strata. This implies a clear skill mismatch. Furthermore, the quality of employment is not high for those who are employed.

In Stung Treng, too, the picture is very similar. The mean age of the sample was 25.5 in 2013 and 26 in 2014. More than 50% of the population is between the ages of 16 and 60 for both the years. While there were 891 females and 909 males in the working age bracket in 2013, the number increased to 928 females and 979 males in 2014. Around 65% of these are married and 30% unmarried, for 2013 as well as 2014. There has been a noticeable increase in social involvement in 2014, with 13% more people involved in organizations compared to 2013.

In resonance with the national figures, about 65% of the people between 16-60 years are employed in agriculture. However, between 2013 and 2014, there has been a slight increase in people engaged in non-farm owned business and non-farm employment.

Table 5-1 Educational statistics (16-60 years)

Education received	2013 (%)	2014 (%)
Less than primary	60.5	55.4
Primary/pagoda	23.6	26.7
Secondary school	4.3	5.4
Completed University/Vocational Training	1.50	2

Source: Own calculation.

On the education front, average years of school attended are 5.6 and 5.8 for 2013 and 2014, respectively. 34% of the population between 16 to 60 years had never been to school in 2013 while

the figure decreased to 32% in 2014. Around 23% people had completed primary education in 2013, this increased to 26% in 2014. While there is a visible increase in educational attainment at the lower levels, there is no progress in terms of higher education. Only 10 people in the sample have a Bachelor's degree and 1 person has a Masters. Financial problems are cited as the main cause of leaving school by 43% of the population followed by family problems which forced around 18% people to quit school (2013 and 2014).

According to a recent report published by the ADB (2015), there is ample opportunity but the youth of Cambodia are not well prepared. The Government launched the nation's first National Employment Policy in October 2015 to address the problems of skill gap and educational inadequacy. However, in order to harness the full potential of the demographic dividend, much more is needed. Promoting vocational training and diversifying industrial production could be a start. This would also prove beneficial for natural reserve of the country, which has been exploited due to non-availability of other viable employment options.

## 5.2 Shocks

Households in Stung Treng have been affected by extreme weather conditions, macroeconomic instability as well as unexpected social adverse events. Due to lack of sustainable food production systems as well as social and economic constraints, they are highly likely to be vulnerable and face difficulties to adapt to such adverse events (Turunen et al., 2011). Adverse events could have been categorized into four main types of shocks: agricultural, economic, health and social shocks. Agricultural shocks refer to floods, droughts, livestock disease and crop pest. Economic shocks refer to rise (fall) in price of input (output), job loss, etc. Health shocks refer to death and illness of household members. Social shocks refer to theft, conflicts with neighbors, ceremony, etc. (Gloede et al., 2015; Van, 2015).

Table 5-2 Shocks by categories

Type of shocks	No. of shocks		No. of affected households		Severity		Average loss and extra expenditure (PPP USD)	
	2013	2014	2013	2014	2013	2014	2013	2014
Health	276	383	241	309	1.92	2.36	425	267
Social	69	55	67	51	1.81	2.13	624	760
Agricultural	408	568	301	369	1.93	2.40	389	351
Economic	28	21	23	19	1.57	2.24	393	248
Total	802	1045	421	474	1.92	2.37	423	342

Source: Own calculation.

As can be seen in table 5-2, the number of shocks and the number of households affected increased significantly, except in the case of social and economic shocks. However, the severity of shocks decreased for all types. In both years, agricultural and health shocks were the most common and affected most of the households in this area. On the other hand, social shocks rarely occurred and affected just under 10% of the households, but their severity was perceived to be the most extreme and caused the highest loss to the households.



Table 5-3 Shocks by cluster

Cluster	No of shocks	Loss (PPP USD)	Time to recovery (month)
<b>2013</b>			
1	1.5	601	2.5
2	1.2	521	2.3
3	1.2	551	1.5
4	1.1	693	1.6
Whole sample	1.4	582	2.2
<b>2014</b>			
1	1.7	506	2.4
2	1.8	1010	2.5
3	1.7	566	1.9
4	1.6	719	2.3
Whole sample	1.7	598	2.2

Source: Own calculation.

Table 5-3 illustrates the overview of shocks between main livelihood strategies. In 2013, households in Cluster 1 were affected by the highest number of shocks. This is an expected result as the most common shocks in this area are droughts, floods and storms. On the other hand, despite the fact that Cluster 4 was affected by the smallest number of shocks, the cluster lost the most in terms of value. As social shocks and health shocks that cause the highest loss value occur more often to households in Cluster 4 (appendix 8-7), this can be expected.

In 2014, households in Cluster 2 were most affected by shocks. Not only the number but also the severity and the value of loss were the highest. Amongst the remaining clusters, households in Cluster 4 lost more than households in Cluster 1 and Cluster 3. Also, though households in Cluster 1 and Cluster 3 reported similar number of shocks and the value of loss, the time to recover from shocks of households was higher for Cluster 1.

## 6 Conclusion

Cambodia is characterized by a high proportion of near poor and hence a huge part of the population faces vulnerability. As households' welfare and vulnerability is highly associated with certain livelihood strategies, an analysis of livelihood activities could entail important results. The current paper endeavors to work in the same direction while contributing to the existing literature. Our case study site, Stung Treng is relatively poorer than other Cambodian provinces despite being endowed with ample natural resources. Using data from 2013 and 2014, we perform separate cluster analyses for both years that enables us to not only determine but also track changes in livelihood strategies. This is a step further compared to existing studies dealing with rural livelihoods that generally do not have panel data.

The first objective of the paper was to identify and describe the changes in rural livelihood strategies in Stung Treng. We find four clusters in both 2013 and 2014 that are not identical but have a common pattern. Clusters that have households engaged in activities pertaining to agriculture or/and natural resources are the poorest while clusters that contain self-employed individuals are the richest in both years. However, in 2014, a unique cluster that contains transition farmers is obtained. These farmers have greater land area and invest much more than any other cluster. With regards to change in strategies, we observe greater movements in the poorer households. While in 2013, we found a distinct cluster for natural resource extractors, these households moved to clusters that practiced additional livelihood strategies in 2014. This indicates a larger diversification. The richer two clusters did not witness considerable shifting.

Income and consumption poverty ratios fell between 2013 and 2014 when calculated at both \$1.25 PPP<sup>5</sup> and \$2 PPP. Interestingly, the ratios increased significantly for all clusters when the poverty line was changed from \$1.25 to \$2. Again, the vulnerability is higher for households with agriculture and natural resources related livelihoods. This further emphasizes the vulnerability perspective that was mentioned earlier.

The second objective of the paper was to analyze selected livelihood strategies and their determinants. Agriculture in Stung Treng is still highly dependent on natural rainfall with only 12% of the households possessing proper irrigation facilities. There was a decrease in production between 2013 and 2014. This could be attributed to lower productivity or/and greater loss of production. In terms of livestock, chicken and buffaloes are still the most popular with an increase in number of rearing households in 2014. However, the expenditure on buffaloes, ducks, beef cattle and chicken declined manifold between the two years. With reference to natural resource extraction, there was a remarkable decline in the stock of fish extracted by households. Also, the contribution of water resources to annual income was lesser than in 2013. There was a visible shift in labor force from agriculture and production to the services sector. However, the poorer households are still engaged in self-employment that requires low level of skills. The richer clusters continue to dominate high skilled activities.

Additionally, the paper also delves into some specific aspects that are important to understand the livelihood scenario in Stung Treng. Migration has assumed importance with an increase in the total number of migrants between 2013 and 2014. However, still most migrants are single males and move to rural areas. Also, though the households experienced more shocks in 2014 as compared to 2013, the severity was less. This may indicate the better adaptability of households against shocks. Poorer clusters that deal with agriculture and natural resources were affected by higher number of shocks than the richer clusters. The loss and extra expenditure value were more marked in the case of farmers and self-employed households. Furthermore, only 26% of the population between the age

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<sup>5</sup> At \$1.25 PPP, there was a decrease of 1.6 and 4.6 percentage points in income and consumption poverty ratio between 2013 and 2014.

group of 16 to 60 years has completed primary school in Stung Treng that has a mean age of 26. Most of the youth is employed in agriculture.

Overall, although the paper does not have a huge time lag between the two surveyed years, we are able to make some remarkable observations. Firstly, we found a unique group of transition farmers in 2014 (Cluster 2). They are mainly composed of households that moved from the farmers' cluster (Cluster 1) of 2013. However, they differ from their subsistence counterparts in many dimensions. They have higher income and lower consumption poverty than subsistence farmers. Amongst all the obtained clusters, they have the largest area under cash crop production on average and invest the most. This could be attributed to a more 'investment congenial' environment, prompted by improvement in infrastructure that could entail possible expansion opportunities. Also, on average households in this cluster are more educated than small-scale farmers, which could have encouraged engaging in commercial activities. Secondly, households in 2014 display a greater range of diversification. As diversification mitigates risk, this could also explain the decreased severity of shocks in 2014 despite an increase in the number of overall shocks. Lastly, there was a considerable decline in households with self-employment in agriculture and production sector. More households are engaged in crafts and services and trade. All of the above changes can be deemed as positive as there is a gradual movement away from more vulnerable sectors.

However, the analysis also put forth some more concrete evidence with respect to existing issues. Foremost, there has been a considerable decrease in the availability of extracted products, which indicates the worsening of the natural resource problem. For example, the extracted fish output between 2013 and 2014 has also shown a significant decline. This might indicate a potential vulnerability in the future, especially to those who have higher income dependence on natural resources. The deterioration of fish stocks could be attributed to the changes of environment in the Mekong basin. The construction and management of hydropower plants in the Mekong basin changes the volume of water flows, the water quality and the hydrological conditions downstream. This negatively impacts the ecology of the river, fish habitat and migration. In addition, illegal fishing, using destructive fishing methods such as electrocution, poisons or fishing in spawning areas have put fish stock at danger (Coates et al., 2003). Secondly, as emphasized earlier, households that engage in agriculture and natural resources are still the most affected and the longest exposed to shocks. This shows that the vulnerability scenario has not undergone any change. Lastly, the state of education is dismal in the province. Hence, the proposition of achieving a more prosperous and sustainable future for Stung Treng through the educated youth is not in near sight. . However, the promotion of education is most important as it opens up new opportunities for rural households to further diversify their livelihood activities and thus decrease their vulnerability in the longer run.

To sum up, it can be stated that by understanding the various livelihood strategies undertaken by rural households and their changing surroundings, we can garner useful information for rural development initiatives. The current study makes an effort to provide an overall insight with regards to rural Cambodia. Further research is required to analyze the more complex relationship that exists between specific livelihood activities and their determinants.

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## 8 Appendix

Table 8-1 Variable list and summary statistics for clusters 2013

Variable	Cluster			
	1	2	3	4
No. of members involved in agriculture	2.8	2.5	1.7	.42
No. of members in natural resource extraction	.3	.8	.2	.1
No. of members in own business	.05	.1	.3	.9
No. of members in agri. employment	.52	.13	.09	.15
No. of members in non-agri. employment	.18	.17	.19	1.26
No. of members in government sector	.03	.05	.92	.18
Investments in Agriculture (PPP USD)	986	166	518	229
Investments in Business (PPP USD)	17.4	174	570	610
Investments in Natural resource extraction (PPP USD)	143	1310	904	347
Days per year for Forest Extraction	35.7	127	22.2	18.1
Days per year for Fishing	70.4	167	48.8	30.8
Cost for Forest Extraction (PPP USD)	13.6	109	19.8	6.3
Cost for Fishing (PPP USD)	46.2	301	72.7	18.4
Land area for Cash Crop (ha)	.73	.34	.57	.27
Land area for Staple Crop (ha)	1.25	1.24	1.11	.16
Cost for Farming (PPP USD)	96.8	37.9	44.4	5.8
Cost for Business (PPP USD)	38.4	43.6	243	3211
Costs for Livestock (PPP USD)	33	53.6	160	20
TLU	1.88	2.32	3.96	.79
Transfers and remittances (PPP USD)	5	20	109	6.1
Years of education household head	2.7	2.6	6.6	3.6

Table 8-2 Variables and summary statistics 2014

Variable	Cluster			
	1	2	3	4
No. of member involved in agriculture	2.7	2.9	2.2	1.6
No. of members in natural resource extraction	0.7	0.6	0.5	0.3
No. of members in own business	0.08	0.2	0.3	0.7
No. of members in agri. employment	0.5	0.3	0.13	0.06
No. of members in non-agri. employment	0.03	0.08	0.18	1.08
No. of members in government sector	0.03	0.21	0.45	0.14
Investments in Agriculture (PPP USD)	60.97	3696	109	319.6
Investments in Business (PPP USD)	13	1714	25.7	36.7
Investments in Natural resource extraction (PPP USD)	186	637	42	216
Days per year for Forest Extraction	164	107	67.1	58.2
Days per year for Fishing	85.4	70.7	106	44.1
Cost for Forest Extraction (PPP USD)	235.3	147.8	39.6	113
Cost for Fishing (PPP USD)	22.4	67.5	171.9	40.4
Land area for Cash Crop (ha)	0.4	1.4	0.2	0.07
Land area for Staple Crop (ha)	1.12	1.7	1.17	1.15
Cost for Farming (PPP USD)	5.9	9.1	27	5.9
Cost for Business (PPP USD)	588	921	1909	8663
Costs for Livestock (PPP USD)	18.3	28.8	81.1	5.9
TLU	1.4	2.2	2.9	3.4
Transfers and remittances (PPP USD)	14.1	14.9	96.3	11.5
Years of education household head	1.9	4.5	5.3	3.4



Table 8-3 Average agricultural characteristics by cluster for rice (mean)

	2013				2014			
	1	2	3	4	1	2	3	4
Land size(ha)	1.41	1.46	1.95	1.26	1.41	1.86	2.01	2.26
Total Production (kg)	2560	2863	3162	2192	1796	1729	2218	1819
Productivity per ha (kg)	2617	2158	1924	1882	2260	2509	3042	3353
Production loss after harvest per ha (kg)	37	40	65	40	36	37	39	104
Consumption (kg)	1862	1996	1961	1718	1851	2090	2173	2387
Give away (kg)	38	39	91	15	21	4	28	59
Household Processing (kg)	15	3	25	4	14	9	27	13
Animal Feed (kg)	25	31	58	34	14	11	27	33
Payment in kind for labor, machine rental (kg)	35	48	14	35	8	12	48	56
Seed (kg)	144	161	221	190	127	155	162	18
Sale (directly after harvest)	358	465	480	155	114	137	370	331
Sale (3 months later) (in kg)	39	21	103	0	44	32	120	110

Table 8-4 Average value (mean) of livestock rearing for households by cluster

Cluster	Stock at the beginning (USD PPP)	Stock at the end (USD PPP)	Value of animals sold (USD PPP)
<b>2013</b>			
1	2623	2399	555
2	3415	3647	604
3	5132	4977	1391
4	1566	1260	642
<b>2014</b>			
1	1790	1984	508
2	3788	2638	1677
3	3137	3367	801
4	3202	3393	822

Table 8-5 Property rights enforcement status of the extracting grounds

Product	No of HH		Open Access (%)		Community and Government (%)		Others (%)	
	2013	2014	2013	2014	2013	2014	2013	2014
Fish	369	408	88	79	11	21	1	1
Wood	248	444	92	78	6	21	2	1
Game	18	10	95	100	5	0	0	0
Vegetables and fruits	234	413	97	82	3	18	0	1
Small animals	35	89	97	98	3	2	0	0

Table 8-6 Selected socio-demographic characteristics of migrants (%)

	2013			2014		
	Male	Female	Total	Male	Female	Total
<b>Education Level</b>						
Less than primary	58	45	53	45	42	45
Primary/pagoda	21	34	26	31	32	31
Secondary school	18	21	19	20	22	20
Completed university	0	0	0	2	2	2
Vocational training	3	0	2	2	2	2

Table 8-7 Shocks frequency by cluster

Cluster	No. of Health shocks	No. of Social shocks	No. of Agricultural shocks	No. of Economic shocks	No. of shocks	Loss (USD PPP)	Time to recovery (months)
<b>2013</b>							
1	0.5	0.12	0.8	0.05	1.5	601	2.53
2	0.39	0.09	0.68	0.03	1.2	521	2.34
3	0.40	0.12	0.62	0.04	1.2	551	1.51
4	0.49	0.2	0.33	0.09	1.1	693	1.55
Whole sample	0.46	0.14	0.7	0.04	1.4	582	2.24
<b>2014</b>							
1	0.67	0.06	1.02	0.02	1.7	506	2.4
2	0.64	0.19	0.93	0.02	1.8	1010	2.48
3	0.56	0.1	0.99	0.04	1.7	566	1.88
4	0.71	0.1	0.77	0.06	1.6	719	2.32
Whole sample	0.65	0.09	0.96	0.03	1.7	598	2.23

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