

Final report



International  
Growth Centre

# Electrifying growth in Sierra Leone

Energy access for  
productive use

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## 1. Introduction

The United Nations Office for Project Services (UNOPS) is supporting the Government of Sierra Leone's (GoSL) goal of universal access to electricity by implementing the US\$40+ million Rural Renewable Energy Project (RREP). RREP – funded by the UK Department for International Development (DfID) – is an ambitious electrification project that will provide access to off-grid solar electricity to up to 94 communities in Sierra Leone by 2020.

Sierra Leone is one of the world's poorest countries, ranking 179th out of 188 countries in the Human Development Index in 2016. In Sierra Leone, only 2.5 percent of the population in rural areas have access to electricity. Poor access to electricity is recognised as a binding constraint to long-term economic growth in Sierra Leone.

RREP is expected to improve Sierra Leone's economic development through an increase in access to rural energy resources. Increased access to sustainable energy is expected to increase welfare in rural communities by improving income, health, and education and lowering fuel expenses and Green House Gas emissions.

Whilst electricity could enable welfare improvements, evidence on the transformative role of rural electrification is mixed. On the one hand, more macro study on the effect of electrification show that electrification can improve agricultural yields, income and a range of human development indicators (Lipscomb et al., 2013; Dinkelman, 2011; Khandker et al, 2012; Kassem, 2019). However, more micro-experimental results suggest that access to electricity has modest effects on people's welfare (Aklin et al., 2017; Lee et al., 2016; Khandker et al, 2012). For instance, Lee et al. (2016) found no medium-run impacts on economic, health, and educational outcomes.

As such, there appears to be a paradox in the literature between beliefs at a macroeconomic level and what can be identified through micro-level impact evaluations. There are many reasons why this paradox may exist.

This study is based on the assumption that simply providing access to electricity may be insufficient to drive welfare improvements and hypothesizes that, to be effective, access to electricity should be complemented with productivity-enhancing technology in conjunction with interventions meant to development a value chain.

As part of the study, the research team has conducted:

- A full household census in 94 villages benefitting from the RREP project and situated across the 16 districts in Sierra Leone. The census included questions on head of household, household size, occupation, and access to electricity.
- Two rounds of data collection where 30 to 43 respondents were interviewed in each of the 94 villages. The entire duration of the data collection- from full household census to baseline surveys (including training for the surveys), was 5-6 months.
- A comprehensive baseline survey was conducted, with the survey instrument focusing on dimensions of income, agricultural practices, business practices, health and education, and electricity access.

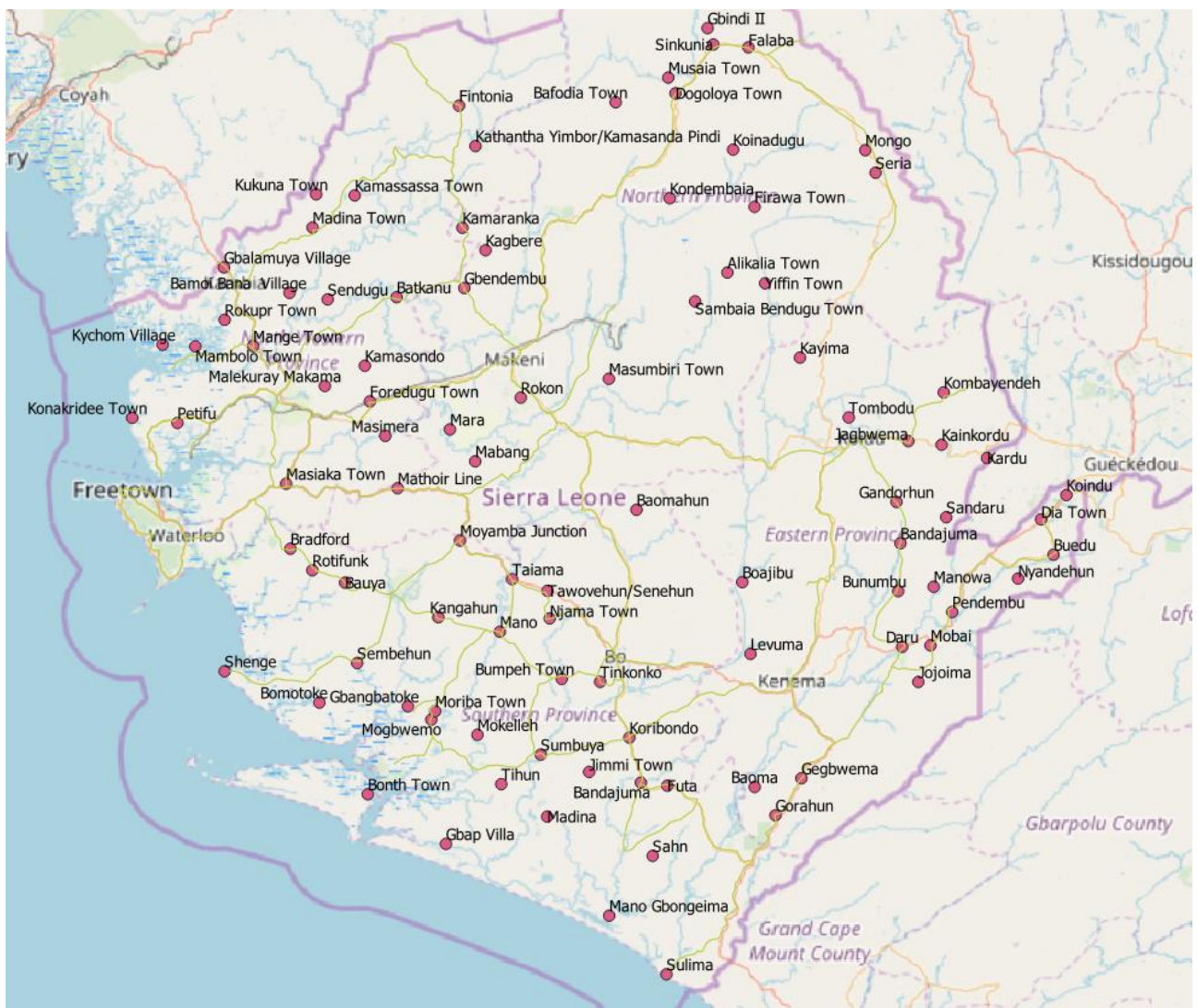
## 2. Overview of Census and Baseline Data Collection Process:

The field research consisted of a full household census in 94 communities benefitting from the RREP project and situated across the 16 districts in Sierra Leone. The census included questions

about, household size, occupation, and access to electricity (see questionnaires attached). Enumerators were instructed to capture this information for all households in the community.

After the census was completed, a representative sample of respondents was drawn for each community. Each of the 94 communities had 30 to 43 respondents that were interviewed. During this field exercise, enumerators were instructed to follow protocols surrounding respondent consent, sensitive personal information, and how to locate the respondents who were sampled from the census. A comprehensive baseline survey was conducted, with the survey instruments (attached) focusing on dimensions of income, agriculture, business practices, health and education, and electricity access. Including training for each of the surveys, the entire duration of the data collection was 5 to 6 months.

Figure 1: Map of RREP Mini-Grid Sites



**FIGURE 1: MAP OF 94 RREP BENEFICIARY COMMUNITIES**

Results from data collected were used to obtain a baseline measure of outcome indicators of interest and validate assumptions needed for the implementation of an intervention meant to test core hypothesis (currently ongoing).

### 3. Insights from the Census Data:

The full census attempted to capture the entire population of the community so a truly representative sample could be drawn for the baseline surveys.

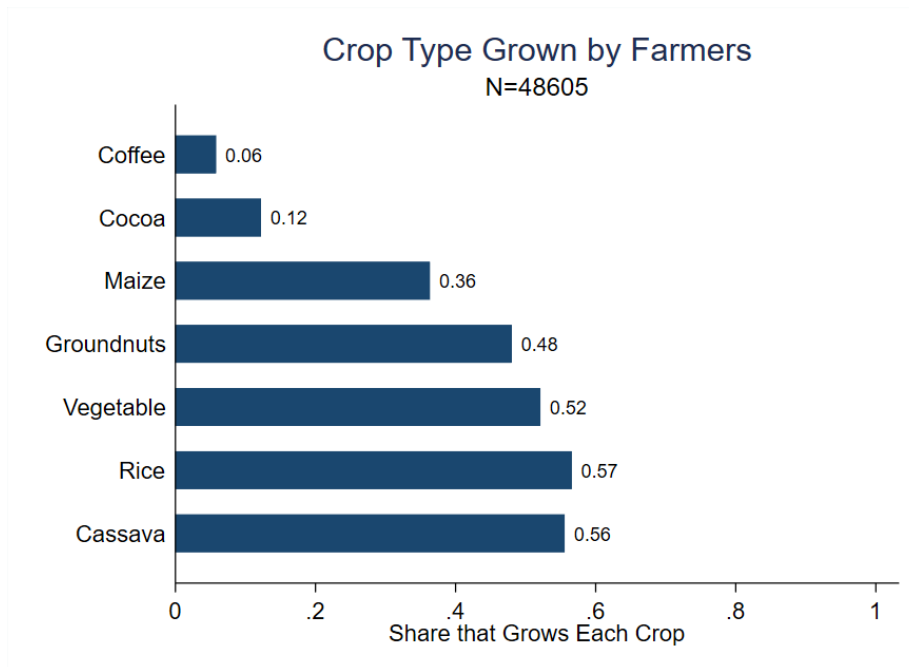
Presented below are some key characteristics of the population in the 94 communities benefitting from the RREP.

Household Members Summary Table

	(1)					
	count	mean	sd	p50	min	max
Number of Household Members	49094	6.15	3.18	6.00	1.00	17.00
Number of Men	49094	1.50	1.26	1.00	0.00	6.00
Number of Women	49094	1.62	1.10	1.00	0.00	6.00
Number of Children	49094	3.02	2.05	3.00	0.00	10.00

The total number of households in our population is 49,094 with a median household size of 6 members. A median household in our population has 1 male member, 1 female member, and 3 children.

#### i. Agriculture:

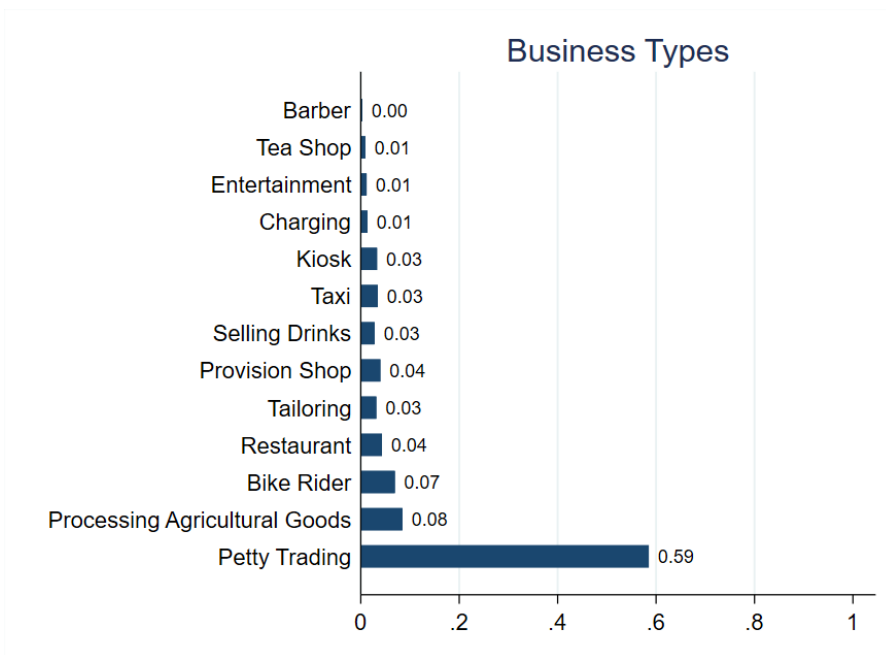


**FIGURE 2 CROP TYPE: CENSUS**

We see that a large share of households in our population report growing staple crops -rice (57%) and cassava (56%). A small share grow cash crops like cocoa and coffee. Maize is grown by a 36 percent of our respondents. From our observations in the field, maize is grown on a smaller scale in 'backyard gardens' and used as a product for pretty trading. Maize is also grown in all districts of

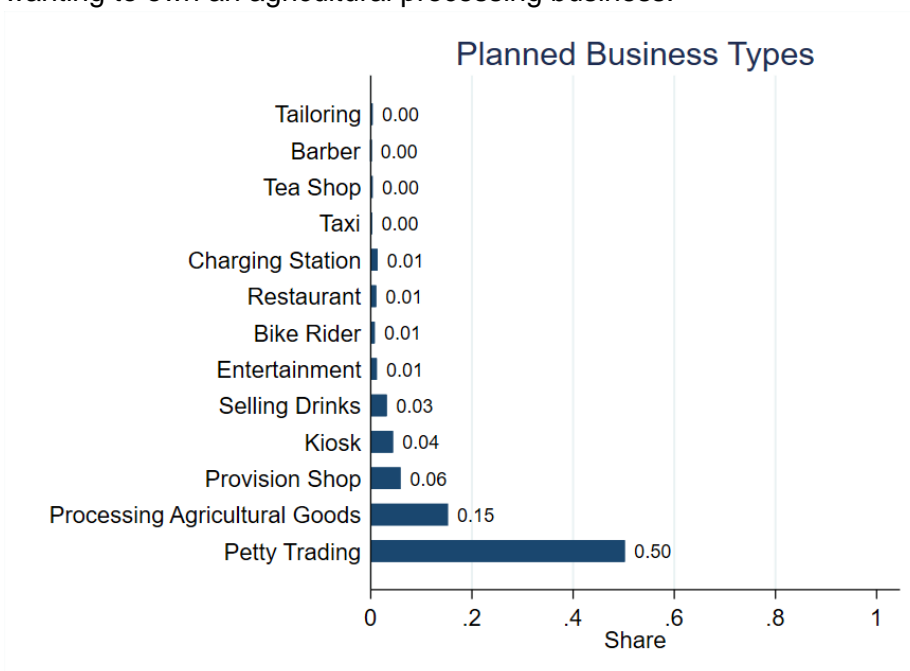
the country. This shows that maize could potentially be grown at scale and used as both a staple and cash crop.

ii. Business:



**FIGURE 3: BUSINESS TYPE: CENSUS**

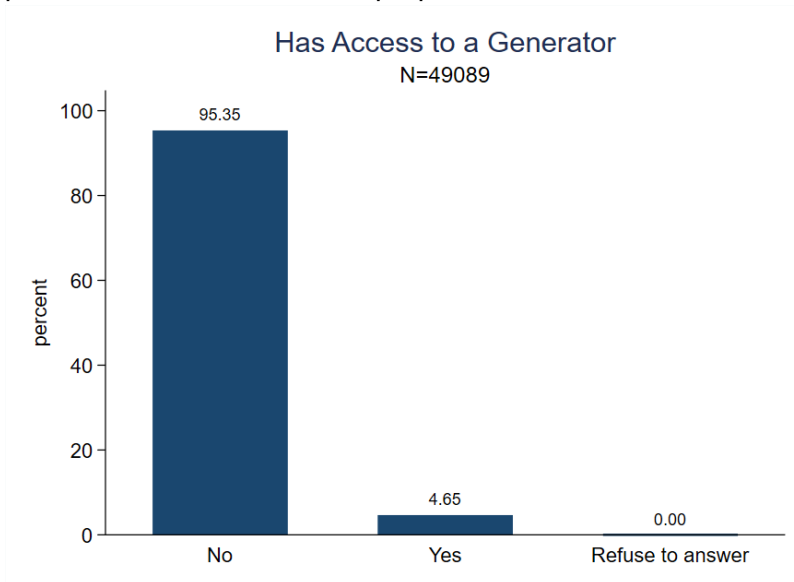
The most common business type is petty trading (59 percent of business-owners). This is followed by 8 percent owning an agricultural processing business (drying cocoa/coffee, processing cassava into foo-foo/gari, etc). Looking at potential entrepreneurship among non-business owners, 78 percent (38,833 respondents) said that they planned to start a business. When asked what type of business they want to start, 50 percent said “petty trading”. This was followed by 15 percent wanting to own an agricultural processing business.



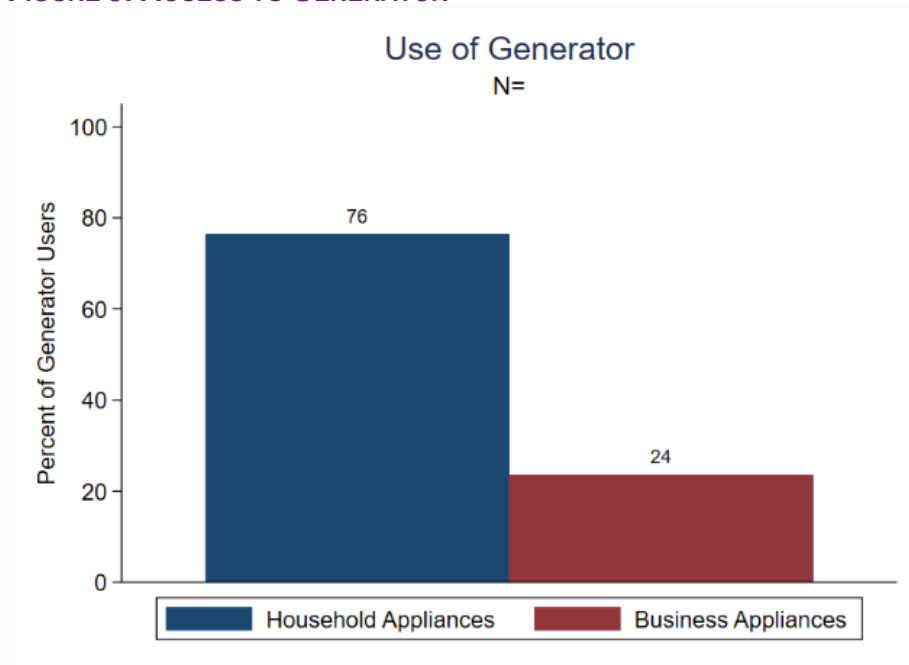
#### FIGURE 4: PLANNED BUSINESS TYPE: CENSUS

##### iii. Electricity Access:

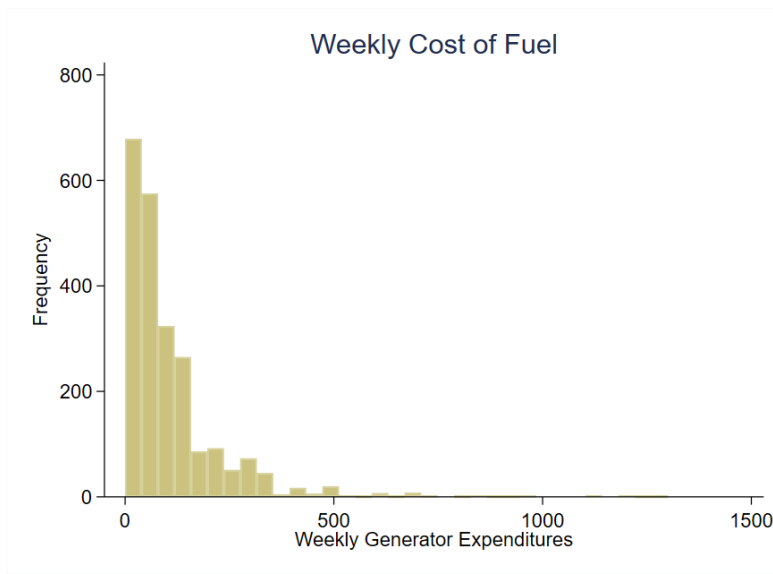
From our census, we found that a majority of our sample does not have access to electricity. Only about 5 percent of our sample has access to electricity in the form of generators. Out of these, 24 percent use the generator for business purposes and 76 percent use it for household purposes.



#### FIGURE 5: ACCESS TO GENERATOR



**FIGURE 6: USE OF GENERATORS**



**FIGURE 7: WEEKLY COST OF FUEL FOR GENERATOR**

The average weekly expenditure on fuel to power the generator is 120,000 SLL and a majority of our population spends less than 250,000 SLL on fuel every week.

The census provides the background for coming up with a complementary intervention design for electricity access through the RREP. A large number of our respondents also aspire to be entrepreneurs, which is promising for an entrepreneur level intervention design. While a large part of our observed population does not have access to any form of electricity, the small share that uses generators mostly use it for household purposes.

## 4. Baseline Survey

The comprehensive baseline survey was administered to 30 to 43 households that were randomly selected from the full census. The survey focused on domains of income- agricultural and non-agricultural, health, education, and electricity usage. In each community, enumerators took about 3 days to complete all the surveys. In addition to the household surveys, town chiefs, schools, and health facilities were also surveyed.

Given below are key results about the income and agricultural practices of households.

### 1. Agriculture:

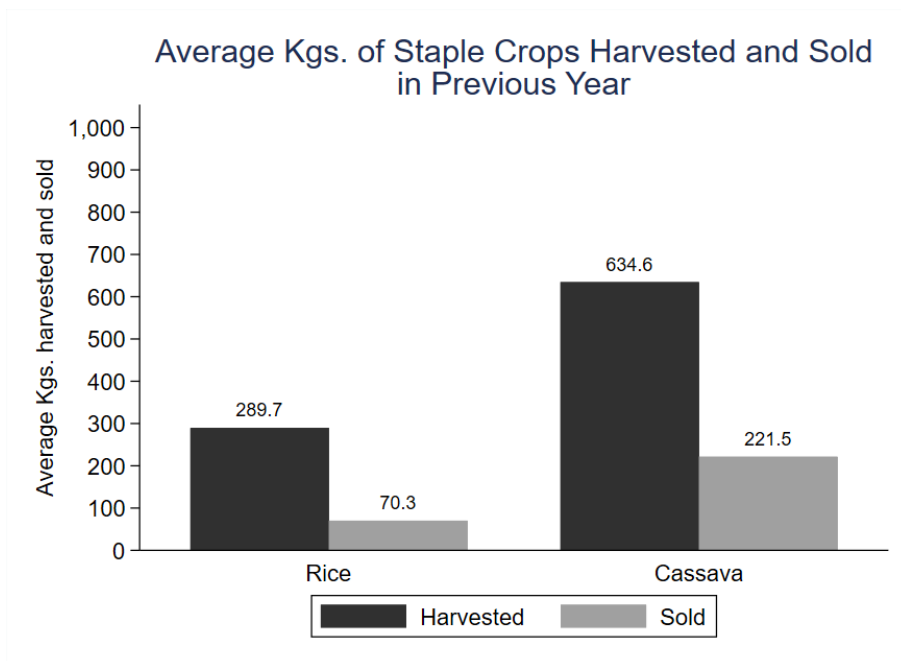
The baseline survey asked respondents about their farming practices and income from farming. It included question on plot size, plot type, types of crops grown, amount planted, amount harvested, and amount sold. While the survey had question on many types of crops, presented below are baseline estimates of staples – rice and cassava, and cash crops- coffee and cocoa.

## Agricultural Variables Summary Table

	(1)				
	Count (Households)	mean	sd	min	max
Sowed any rice last year	3075	0.58	0.49	0.00	1.00
Kgs of rice harvested last season by rice farmers	1780	289.74	406.35	0.00	7500.00
Kgs of rice sold last season by rice farmers	1771	70.28	244.85	0.00	5000.00
Sowed any cassava last year	3073	0.35	0.48	0.00	1.00
Kgs of cassava harvested last year by cassava growers	1042	634.56	1028.82	0.00	7300.00
Kgs of cassava sold last year by cassava growers	1040	221.54	598.82	0.00	5000.00
Sowed coco trees last season	3075	0.11	0.31	0.00	1.00
Kgs of cocoa harvested last season	1790	13.45	65.41	0.00	840.00
Sowed any coffee last season	3075	0.05	0.22	0.00	1.00
Kgs of coffee harvested last season by coffee growers	1708	4.60	28.06	0.00	450.00

Most households grow staple crops at subsistence levels, as opposed to higher valued cash crops. Out of the households surveyed, 58 percent grow rice and 35 percent grow cassava. Comparatively the proportion of households who grow cocoa is 11 percent, and an even lower proportion grow coffee, at 5 percent. Out of those growing staple crops, less than 10 percent of the rice harvested is sold at market, and roughly 35 percent of cassava produced is sold at market (Refer to figure below)





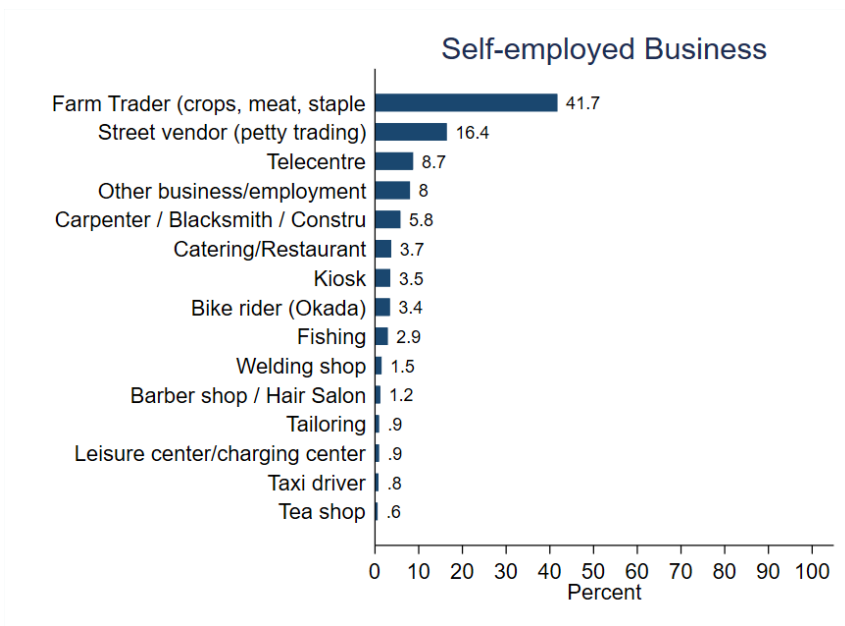
**FIGURE 8: STAPLE CROPS: HARVEST AND SALE**

2. Non-agricultural employment:

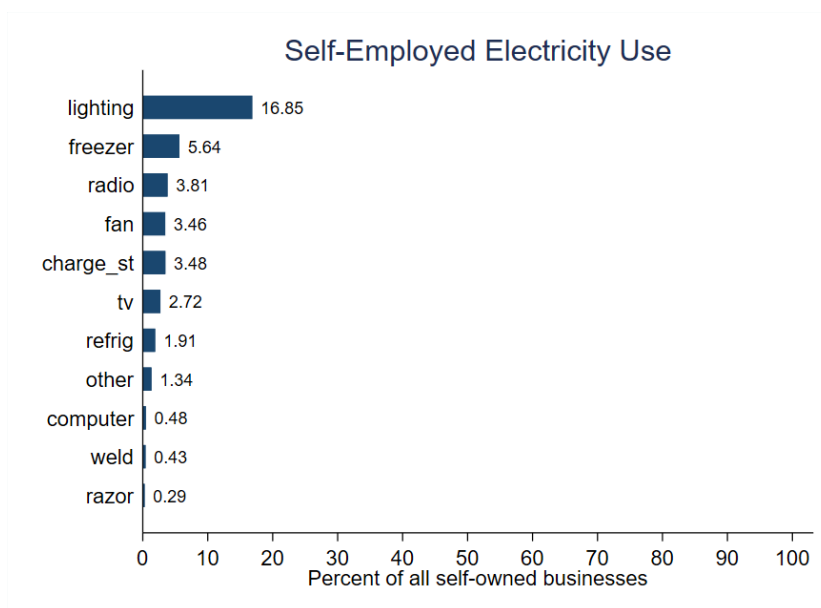
When broken down to individual adult respondents from our baseline, 26% of our sample is self employed and own their own business. Of these, 19 percent own a business that requires usage of electricity and they work an average of 40.59 hours per week on their business. Only 6 percent of our sample works in the formal sector.

The main type of self-employed business owned by our sample is agricultural processing (41.7 percent) followed by petty trading (16.4 percent). Agricultural processing might require the usage of electricity (machines to husk rice/mill flour, etc). But a large share (16.85 percent) report using electricity for lighting purposes in their self-owned business.

(1)					
	n	Mean	Median	Min.	Max.
Self-Employed and owns a business	17145	0.26	0.00	0.00	1.00
Hours worked at own business in a typical week	4366	40.59	36.50	0.00	112.00
Own business requires electricity	4474	0.19	0.00	0.00	1.00
Employed in a formal organization with salary	17121	0.06	0.00	0.00	1.00
Observations	17165				



**FIGURE 9: SELF-EMPLOYED BUSINESS TYPES**

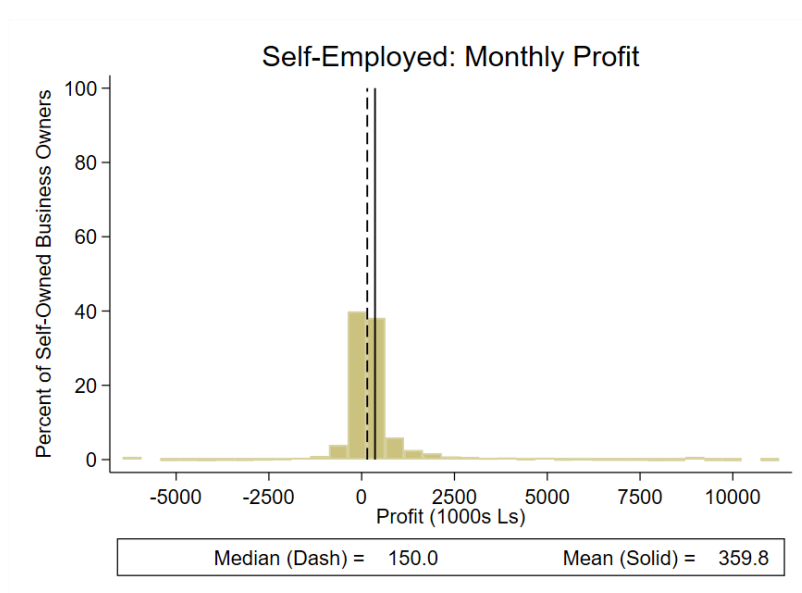


**FIGURE 10: SELF-EMPLOYED ELECTRICITY USAGE**

- Profits from Self-owned businesses:  
 The average monthly cost of running a business for our sample is 757,140 SLL and the average revenue obtained is 1,028,390 SLL. Our sample reports making an average monthly profit of 359,830 SLL. But when we look at the distribution of profits across our sample, the median profit is much lower at 150,000SLL and a big share of negative profits.

(1)

	n	Mean	Median	Min.	Max.
Self-Employed and owns a business	17145	0.26	0.00	0.00	1.00
Monthly Cost from own business	4014	757.14	250.00	0.00	20000.00
Monthly Revenue from own business	3982	1028.39	387.50	0.00	20000.00
Profit (revenue - costs)	3923	359.83	150.00	-6440.00	11250.00
Observations	17145				



**FIGURE 11: MONTHLY PROFITS OF SELF-EMPLOYED BUSINESSES**

## 5. Discussion and Recommendations

1. The most common type of business is self-owned businesses. These businesses are mainly agricultural processing and petty trading. We see that business owners report using electricity mainly for lighting purposes. A very small fraction of respondents consumes fuel for generators to help power their businesses. Substituting this expenditure after access to electricity from mini-grids might not be enough to help boost businesses. Capital necessary to purchase a productivity-enhancing asset seems to be required to increase firm productivity and potentially improve welfare.
2. Agriculture is the most prevalent activity, however farmers seem not to have a diversified crop rotation. Our data shows that the most prevalent crops across the country are rice and cassava, which are staples in the Sierra Leonean context. Maize is grown in all regions of

the country, including the historically rice-growing southern districts (Kailahun grows 20% of the maize share). These findings were presented to a team of agronomists, and they explained that maize has the potential to boost agricultural productivity by being introduced in rotation with rice, thus giving two maize seasons in a year in addition to a rice season. However, before being processed and commercialized, maize needs to be processed and dried. As it is harvested during rainy season, it cannot be sun-dried and would need to be dried using electric machineries. The availability of electricity through RREP in these 94 communities promotes this process, and maize processing units can be set up to enable the creation of an agricultural value chain around maize

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