BASELINE REPORT

CREATING LINKAGES FOR EXPANDED AGRICULTURAL NETWORKS (CLEAN) PROJECT IN LAO PDR

December 2019

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This survey would not have been possible without the contributions from several parties during project planning, fieldwork, analysis and report preparation. The Project Team would like to acknowledge several individuals, groups and organizations whose contributions were instrumental to making the survey a success.

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CONTENTS

LIST OF ACRONYMS

CAPI	Computer Aided Personal Interviewing
CLEAN	Creating Linkages for Expanded Agricultural Networks
DAFO	District Agriculture and Forestry Office
DOA	Department of Agriculture
ESOMAR	European Society of Marketing Research
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
FFPr	Food for Progress
GIEWS	Global Information and Early Warning System
GMS	Greater Mekong Subregion
Ha	Hectare
HH	Household
Kg	Kilograms
KII	Key Informant Interview
Lao PDR	Lao People's Democratic Republic
LEA	Linkages for Expanded Agriculture
MAF	Ministry of Agriculture and Forestry
MAFAP	Monitoring and Analysing Farming and Agricultural Policies
MEL	Monitoring, Evaluation and Learning
MOE	Margin of Error
MT	Metric Tons
PAFO	Provincial Agriculture and Forestry Office
PPS	Population Proportional to Size
SDC	Swiss Development Corporation
SPS	Sanitary and Phytosanitary
USDA	United States Department of Agriculture
USAID	United States Agency for International Development

LIST FIGURES AND TABLES

EXECUTIVE SUMMARY

Overview of the baseline study

In 2017, the United States Department of Agriculture (USDA) under the Food for Progress (FFPr) initiative awarded funding to Winrock International (Winrock) to design and implement a four-year project with the focus of increasing agricultural productivity and expanding trade of agricultural products in Lao PDR. Winrock started implementation of the Creating Linkages for Expanded Agricultural Networks (CLEAN) project in September 2017, with an end date of September 2021. The project is being implemented in five provinces of Laos, including Champasak, Sekong and Salavan Provinces in the southern region and Vientiane Capital and Vientiane Province in the central region of Laos.

An initial baseline survey was carried out in December 2018, covering five cash crops. This baseline extension survey was carried out to capture complimentary data on selected indicators for two additional commodities: coffee and cassava.

Evaluation, purpose and objectives

The CLEAN project has seven principal activities and their respective outputs and outcomes contribute to the following USDA Food for Progress Strategic Objectives (SO):

> FFPr SO1: Increased agricultural productivity by building the capacity of producers in improved productivity and profitability; training producers in improved production techniques; post-harvest handling, marketing, sanitary and phytosanitary practices; and providing grants and loans for equipment and agriculture inputs.
>
> FFPr SO2: Expanded trade of agriculture products by developing both domestic and export market linkages; facilitating trade relationships, researching exports opportunities; promoting a coordinated and strategic approach to building market share by associations and promoting food safety issues and requirements.

The project will be evaluated against 21 performance indicators (see Table 1 below). For the majority of CLEAN performance indicators, the baseline will be zero at the project start. However, the baseline extension indicators such as yield per hectare (Ha) per target commodity type, volume of commodities (metric tons) sold by project beneficiaries, value of sales by project beneficiaries had to be determined through the baseline extension survey. Therefore, in line with the USDA evaluation policy, Winrock contracted Rapid Asia to undertake the baseline extension survey for the project. The primary goal of the survey was to collect complimentary information for coffee and cassava in the project target areas and use the results for the following purposes:

- Establish baseline indicators for additional commodities; coffee and cassava as points of comparison to support measurement of program impacts as part of future project evaluation activities;
- Guide realistic and feasible target setting for performance indicators;
- Support program design;
- Identify and recommend responses to risks and constraints that may pose challenges to plan project implementation.

The baseline extension field survey took place from November 4th to 20th, 2019 in four districts of the four project target provinces. The beneficiary-based survey included a quantitative, which applied representative beneficiary-based survey to collect data for the CLEAN performance indicators; and a

qualitative study to gather additional information to add context, richness, and in-depth insights to the findings from the survey with farmers. The survey sample was designed to be statistically representative of the villages selected in all four project target areas. The two-stage clustered sampling design yielded a household sample size of 500 households in 25 randomly selected villages.

Table 1: Village sample size

	Source	# of villages
Number of villages producing coffee in target provinces	PAFO and DAFO of respective provinces	54
Number of villages producing cassava in target provinces	PAFO and DAFO of respective provinces	31
Village level sample size (villages actually surveyed)	Sampling guide method	25

The sample size was calculated using the following formula (utilizing a similar methodology recommended by USAID[1]):

- $n = N^2 * z^2 * s^2 * MoE^2$.[2]
- Considering a 95% Confidence level and 5% Level of Precision, the calculated sample size for 14,877 farmers is to 500 (20 households per village) for the study. To cater for potential non-response, an additional 10 farmers were included, which after non-response resulted in a final sample of 501.

The qualitative study was conducted during the same timeframe in parallel with the field survey. In all, 20 key informant interviews (KII) were held with various value chain actors including district government officers, producers, traders, input suppliers, and wholesalers.

Key findings

The following is a summary of the main findings of the baseline extension survey. However, it must be noted that the quantitative analysis at the household level, specifically on land holding, production, and sales are based on farmer recall. They are, however, the best estimates that could be generated for this baseline extension field survey and have been deemed sufficient for this baseline extension.

Areas under improved technologies

The results on improved technologies for coffee reveal that one-quarter of the land used for coffee is subject to some form of soil cover and organic fertilizer. Soil conservation to prevent soil erosion covers 10 percent of farmed land and improved irrigation is almost non-existent.

For cassava, while 17 percent of land utilizes improved soil cover, a much smaller portion utilizes organic fertilizer (5%) or soil conservation (7%). Improved irrigation is applied to less than one Ha in total. The limited use of improved technologies shows there is potential to improve farming knowledge and conditions for both coffee and cassava.

Number of farmers applying new techniques or technologies

For coffee, just over 20 percent of farmers use improved soil cover and organic fertilizer. This result highlights that larger coffee farms more commonly use such techniques. Soil conservation is less common

[1] USAID/ Feed the Future, Sampling Guide for Beneficiary-Based Surveys, February 2016.

[2] Where N represents the farmer population, Z is the confidence level (i.e. 1.96), s is the standard deviation, and MoE is the margin of error.

with 9 percent of farmers using such techniques and irrigation is almost not used at all. Overall, some 42 percent of farmers applied at least one or more techniques.

Improved farming techniques are less commonly applied in cassava production. Some 11 percent of farmers use some kind of soil cover and less than 10 percent use organic fertilizer or soil conservation techniques. Overall, 21 percent of farmers applied at least one or more techniques.

Value of sales by project beneficiaries

Most coffee farmers (68%) only produce one variety of coffee, the most popular varieties being Catimor (50%) followed by Robusta/Arabusta (37%). Other varieties were found to be very limited, less than 10 percent. The vast majority of farmers produce and sell fresh cherries, and these are sold at an average price of 2,520 Kip or 30 cents per Kg resulting in an average farmer gross income of 19,080,000 Kip or USD 2,170. Dry cherries fetch a higher average price of 12,337 Kip or USD1.40 per Kg, however, the average farmer income is only marginally higher at 20,370,000 Kip or USD2,310.

The vast majority of cassava farmers (86%) only produce one variety of cassava, the most popular varieties being Rayong (from Thailand), other Thai species or Vietnamese varieties. One quarter (24%) of farmers did not know what variety they produced. The value of sales per farmer household for cassava was determined in a similar way by looking at the type of cassava sold (i.e. fresh or dry), total volume sold in Kg, and the average price per Kg. Fresh cassava is sold at an average price of 556 Kip per Kg resulting in an average farmer gross income of 15,501,000 Kip or USD1,760. Dry cassava can be sold at an average higher price of 1,218 Kip per Kg, however, average farmer income is marginally lower at 14,019,000 Kip or USD1,590. The price range for cassava varies from 300 up to 1,200 Kip for fresh cassava and 620 up to 2,400 Kip for dry cassava.

Volume of commodities sold by project beneficiaries

Given that coffee and cassava are sold in different forms, the volume sold between both crops is greatly affected, and its value cannot be combined. The fragmented nature of these two crops means it is not possible to break down results by district with any level of accuracy. Instead, the overall result for farmers selling a particular type has to be considered. In summary, the average volume of sales per HH, for coffee is as follows:

- Fresh cherries (n=284) 7.54 MT
- Dry cherries (n=241) 1.65 MT
- Parchment (n=104) 3.57 MT
- Green beans (n=104) 1.39 MT

The average volume of sales per HH, for cassava is as follows:

- Fresh cassava (n=48) 27.88 MT
- Dry cassava (n=89) 11.51 MT

Yield per Ha

Data from the baseline extension survey was used to compute crop productivity expressed in Kg/Ha. The average land size used for coffee (in Ha) and production (in Kg) were used to determine an average yield. Fresh cherries had an average yield of 3,100 Kg/Ha followed by parchment with 1,110 Kg/Ha. Dry cherries and green beans produced an average of 730 and 640 Kg/Ha respectively. It is important to note that while parchment produced a higher average production volume, those producing parchment also, on average, had larger land size compared to other farmers. This in part explains their higher income.

For cassava, the resulting yields revealed the following. Fresh cassava had an average yield of 27.88 MT/Ha and for dry cassava, being lighter in weight, it was 11.51 MT/Ha. Fresh cassava had an average yield of 10.8

MT/Ha and a dry cassava 6.1 MT/Ha. Farmers producing fresh cassava had a larger average land size of 2.57 Ha, but were only able to produce a marginally higher income compared to farmers producing dry cassava. This is because dry cassava is sold at more than double the price, 1,218 Kip vs. 556 Kip. Overall, the yield is considered below average and shows potential for improvement.

Having considered farmer income and production yield, it is also worth looking at production costs. Given that some farmers produce both coffee and cassava, some production costs are likely to overlap and hence, farmers who only produce coffee and/or cassava were included in this analysis. The major cost for coffee is labour cost (51%), most likely during the harvest season, for picking the cherries. Other major costs are land preparation (15%), equipment hire and fuel (11%), and seedlings (10%). Other costs are generally low. The average coffee farmer will have costs around 15 million Kip (USD1,715) which translates into 3.68 million Kip (USD420) per Ha. For cassava farmers the largest cost by far is land preparation representing 42 percent of production costs on average. Other significant costs are labour (16%), transportation (15%), seedlings (13%), and equipment and fuel (10%). Overall the average cost for cassava is lower at just over 10 million Kip (USD1,190). However, due to the average smaller land size, the cost per Ha is nearly 30 percent higher than for coffee, just under 5 million Kip (USD540).

The results of the key indicators for coffee and cassava can be summarized as follows:

No.	Coffee indicators	Unit	Result
SI-14	Volume of fresh cherries sold	Metric tones	7.5
SI-14	Volume of dry cherries sold	Metric tones	1.7
SI-14	Volume of parchment sold	Metric tones	3.6
SI-14	Volume of green beans sold	Metric tones	1.4
SI-13	Value of fresh cherry sales	USD/Ha	900
SI-13	Value of dry cherry sales	USD/Ha	1,020
SI-13	Value of parchment sales	USD/Ha	1,870
SI-13	Value of green bean sales	USD/Ha	910
CI-1	Yield per Ha – fresh cherries	Kg/Ha	3,130
CI-1	Yield per Ha – dry cherries	Kg/Ha	730
CI-1	Yield per Ha – parchment	Kg/Ha	1,110
CI-1	Yield per Ha – green beans	Kg/Ha	640
No.	**Cassava indicators**	**Unit**	**Result**
SI-14	Volume of fresh cassava sold	Metric tons	27.9
SI-14	Volume of dry cassava sold	Metric tons	11.5
SI-13	Value of fresh cassava sales	USD/Ha	685
SI-13	Value of dry cassava sales	USD/Ha	837
CI-1	Yield per Ha – fresh cassava	Tones/Ha	10.8
CI-1	Yield per Ha – dry cassava	Tones/Ha	6.1

1. INTRODUCTION

Project background

The CLEAN project uses a value chain approach to increase the production and reduce post-harvest losses of clean horticulture to improve quality compliance and certification systems and to develop linkages and increase demand in domestic, Greater Mekong Subregion (GMS), and global markets for clean produce from Lao PDR. An initial baseline survey was carried out in October 2018, covering five cash crops. This baseline extension was carried out to capture complimentary data on selected indicators for two additional commodities: coffee and cassava.

Baseline study aim and objectives

The supplementary baseline study objectives are to:

1. Establish a baseline as points of comparison to support measurement of program impacts as part of future project evaluation activities;
2. Guide realistic and feasible target setting for performance indicators.

The relevant indictors include:

No.	Indicator title	Type
SI-14	Volume of commodities (metric tons) sold by project beneficiaries	Outcome
SI-13	Value of sales by project beneficiaries	Outcome
CI-1	Yield per Ha per target commodity type	Output

For more context, additional information around agricultural inputs were also collected. This helped to provide input for an additional two indicators (i.e. SI-1 and SI-2) looking at farm areas under new technologies and proportion of farmers applying new technologies.

The study delivered two main outputs

1. The supplementary baseline report, consisting of the farmer-based quantitative study and the qualitative information and analysis collected during field work;
2. Recommendations to the project, including Risk and Constraints Analysis.

2. BACKGROUND

2.1 Agricultural context

Agriculture employs 68% of the labor force but arable land only covers 6.6% of the total country area and arable land per capita is about 0.2 Ha (The World Bank[3], 2018). Laos remains an agrarian society that is undergoing a sharp transition from subsistence to commercial production. Laos is now considered a lower-middle-income country with a per capita income[4] of $2,460 in 2018, a 9.82% increase from $2,240 in 2017. The latest Lao Expenditure and Consumption Survey in 2012 estimated that 23.2% of the population lives under the poverty line. Poverty incidence is even more acute in remote areas, and tackling food and nutrition insecurity are difficult challenges to overcome. In particular, access to land for food production or commercial farming is a key constraint for smallholders, operating on 3 Ha or less.[5]

2.2 The Lao PDR's Government strategies

The Agriculture Development Strategy to 2025 and Vision to 2030 (MAF ADS, 2015), aims at "ensuring national food security through sustainable agriculture that contributes to national economic growth, industrialization, and modernization"[6] (Asian Development Bank, 2018).
The strategy's main targets primarily focus on:

i. Increasing agricultural production;
ii. Improving competitiveness in terms of quality;
iii. Enforcing standards and regulations and;
iv. Guaranteeing food security and safety by complying with basic SPS standards.

In addressing such targets, agricultural production will significantly contribute to creating employment opportunities, generating income, decreasing disparities between urban and rural areas, and integrating rural development.

In this transition context, providing support for the Lao farmers to undergo the current transition is critical. Extension service delivery through public agencies follows the Lao Extension Agriculture (LEA) approach, designed and promoted by the National Agriculture and Forestry Extension Service over 15 years (1999-2014) with support from the Swiss Development Corporation (SDC). The LEA promotes the establishment of agricultural production groups as the basis to encourage a learning process and deliver training and demonstrations.

Public extension services outreach capacity is limited to technical personnel posted at District Agriculture and Forestry Offices (DAFOs have around 4,200 staff nationwide including technical and administrative staff). Technical Service Centres at the local level are of particular importance to provide information,

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[3]The World Bank Data Bank, 2018. https://data.worldbank.org/country/lao-pdr?name_desc=false

[4] The World Bank, GNI per capita, Atlas method, 2018.

[5] There is no legal definition of smallholder farmers but the article 17 of the Land Law (2003) defines the area that the Government allows households to use (expressed in Ha per unit of family labor): for paddy or livestock: not more than 1ha, for industrial or annual crops: not more than 1 Ha, fruit trees: not more than 3 Ha, forage grass on degraded land: not more than 15 Ha.

[6] Agriculture, Natural Resources, and Rural Development Sector Assessment, Strategy, and Road Map: Lao People's Democratic Republic, December, 2018. https://www.adb.org/sites/default/files/institutional-document/480141/lao-pdr-agriculture-assessment-strategy-road-map.pdf

inputs, and technical advice to farmers in their vicinity. Shortcomings are acknowledged in performing key functions such as "promotion, support and extension activities, as well as monitoring". Other channels of extension, through private sector for instance, remain limited to the occasional situation where investors provide technical guidance on specific products they intend to buy from the farmers.

Priority crops are defined in the Agriculture Development Strategy with paddy rice as the main focus for food production. As of 2018, rice accounts for 50% of the country's national agricultural output with an estimated 960,000 Ha allotted for wet season rice cultivation. Most rice cultivated is for basic subsistence. The target determined by the government of Lao PDR is to produce 5 million tons of paddy rice by 2025, while national output in 2019 is estimated at around 4.3 million tons by the Food and Agriculture Organization of the United Nations (FAO) Country Brief issued in July 2019[7]. Significant surplus has been produced due to massive investments in irrigation infrastructure over the last 20 years. However, paddy produced under irrigated conditions in dry seasons represents only 13% of the national output. Under the second goal of Agricultural Commodity Production (Program 2), production of commercial commodities, agricultural diversification, development of Agriculture Production Group/Agriculture Cooperatives, private sector investment, and market linkages are promoted.

Besides a paddy rice surplus target of 1.5 million tons by 2015, priorities are also set for major tradable commodities (namely animal feed corn, coffee, sugar cane, cassava, and rubber), as well as crops referred to as "other potential cash crops that are special and unique in the local areas" with existing production, including: Job's tears, sesame, tea, tobacco, legume / beans, and fruit trees.

Finally, the strategy also mentions crops "which have production potential for export to neighboring countries such as sacha inchi (Mak Nam Manh, Plukenetia volubilis), Mak Kao (Tung fruit) and some non-timber forest products (NTFPs) such as cardamom.

2.3 Priority value chains

The CLEAN project selected the value chains to be supported in Lao PDR using the following criteria:[8]

- Proven market potential and potential comparative advantages;
- Opportunities and comparative advantages for smallholder households to graduate from traditional markets into high-end, export-quality value chains or higher value local markets (including internal value chain opportunities and external forces such as an enabling environment and support services);
- Risk associated with the selection of a specific value chain (e.g. potential to achieve volumes, buyer willing to work with farmer associations, and investment readiness of firms within the chain);
- Potential impact on farmer employment, return on investment, and short- and long-term profitability;
- and environmental impacts, including water and natural resource management, land stewardship, and reduced fertilizer and pesticide use.

[7] Food and Agriculture Organization of the United Nations (FAO), GIEWS Country Brief: Lao PDR, July 2019. http://www.fao.org/giews/countrybrief/country/LAO/pdf/LAO.pdf

[8] Request for Proposal for CLEAN baseline study (page 3)

The CLEAN project selected five commodities for the previous baseline survey including cabbage (white cabbage and Chinese cabbage), pepper, sacha inchi, citrus (lime and orange), and cardamom. For this extension baseline two additional crops were selected; coffee and cassava.

3. STUDY METHODOLOGY

3.1 Overview

The study methodology, described in detail in the baseline design plan, was organized in three phases:

1. The preparation phase included sampling design, tool development, scripting and testing of the survey tools, training of enumerators and obtaining an official authorization from Department of Agriculture, Ministry of Agriculture and Forestry to conduct the study. Rapid Asia team conducted field visits and enumerator training during October 30th – November 1st, 2019.
2. The field survey phase took place between November 4th and 20th, 2019. To cover the study areas in a reasonable timeframe, two teams were organized with one supervisor for each team. Two moderators were also mobilized in parallel to conduct key informant interviews with other value chain actors (e.g., traders, wholesalers, inputs dealers and district government officials).
3. The third phase involved data analysis and drafting of the study report carried out from the end of November to December 24th.

3.2 Study tools

Two study tools were developed to collect both qualitative and quantitative information and inform the baseline indicators and the situational analysis for coffee and cassava:

3. The survey questionnaire was developed to collect quantitative information, include a general section on the respondent and the farm management aspects and two specific crop sections.
4. The Key Informant Interview guides were prepared to gather more in-depth information from key stakeholders. The study tools are provided in Annex 3.

3.3 Training and survey administration

The training of enumerators was conducted on November 1st, with participation from the project's local Monitoring, Evaluation and Learning Specialists. The enumerators were provided with a project overview and trained on how to carry out the interviews on computer tablets, sampling procedures, quality control routines and conducting role plays to become familiar with the survey questions. The field team tested the questionnaire on November 2nd - 3rd, 2019 in Vientiane Capital, one of the target areas. The field survey was conducted from November 4th to 20th per the detailed schedule provided in Annex 5.

3.4 Data capture using CAPI

Data collection was done using computer-assisted personal interviewing (CAPI). The CAPI system used was Survey Solutions developed by the World Bank Group. The questionnaire was translated, and the translation was checked for accuracy before scripting and uploading on the CAPI system, which has secure servers to which all data is uploaded. A test link was set up so that the online survey could undergo testing and to ensure that it was free from errors. The CAPI system also has a supervisor function, allowing supervisors to check interviews for accuracy and completeness before submitting to the administrator. This allowed for ongoing checking of data quality, and in cases where mistake or inconsistencies were found, interviewers would be notified so they could re-contact the respondent and make corrections.

Local language show cards and colour pictures were also used for some questions to ensure respondents could fully understand and provide more accurate answers.

3.5 Data quality control

Data quality control measures were applied at each stage of the process:

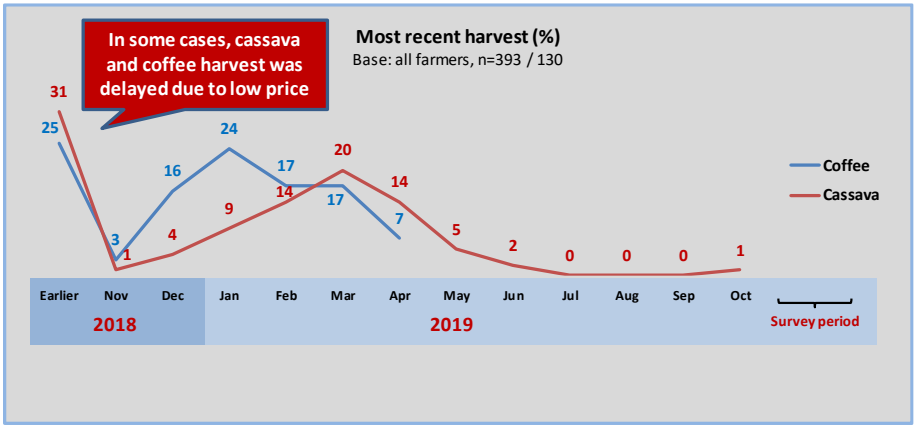
- on-the-spot control in the target village by the team supervisors,
- ongoing online monitoring of completed interviews,
- all data stored on a secure World Bank server,
- analysis checks by Data Management Specialist.

3.6 Study limitations and constraints

Several factors have affected the study:

- The majority of farmers are coffee farmers. Using the population proportional to size (PPS) sampling method means farmers will be represented in proportion. This was overcome to some extent by stratifying the sample based on crop. However, since sample size was estimated based on criteria for coffee and cassava farmers taken together, the sample size for cassava farmers ended up rather small, resulting in larger sampling errors compared to coffee farmers when calculating estimates for the set indicators.
- The government decided that Phonhong district would not be included in the project areas and meant one selected village in Phonhong had to be replaced by convenience selection as the survey process would have been delayed if the entire sampling plan had to be adjusted.
- Cassava farmers in the Vientiane Capital province had experienced a flood in the last harvest and so it was not possible to complete the number of interviews set. Instead, additional interviews were carried out in one village in Salavan province.
- Given that most farmers are located in the Paksong district (Champasak province), the sample size for some districts is very small and limits analysis by district with any level of accuracy.
- The sampling design targets existing farmers and while the findings will be representative of farmers as a whole, there is no information about incidence, and hence, overall production size cannot be determined from the data alone. Estimates of total number of farmers will therefore be needed in order to extrapolate the results.
- Due to low price, some farmers decided to delay the harvest in 2019, hence, the most recent harvest was back in 2018 (see Figure 1 below, showing the most recent harvest for coffee and cassava farmers as a percentage per month). As some results, like price of produce sold rely on the farmer's recall, this prolonged time frame may impact on the accuracy of some results.

Figure 1: Most recent harvest



3.7 Ethical considerations

Rapid Asia is a member of the European Society for Opinion and Market Research (ESOMAR) and is thus obliged to follow well-established, international best practices for professional conduct for data collection and data management. The guidelines, norms, standards and code of conduct under ESOMAR cover:

1. Ensuring that those involved with collecting data are independent and act with integrity and honesty when interacting with all target groups and stakeholders.
2. Ensuring that all participants in the survey understand the purpose, objectives and the intended use of survey findings.
3. Being sensitive to social and cultural norms and gender roles during interactions with participants and their families.
4. Respecting the rights and welfare of participants by ensuring informed consent and rights to anonymity and confidentiality before the interview, that consent is freely volunteered, and they can withdraw at any time without any negative consequence.
5. Limiting storage of any personal data to maximum of six months, keeping such information secured to avoid access by any third party.

In addition, the survey teams have applied a Do-No-Harm principle throughout the village-level survey process in order to avoid raising expectations or introduce messages that can be confusing for farmers. The study team also ensured that all participants and stakeholders had an equal access to information and equal opportunity to express their concerns and ideas.

3.8 Sampling design

For coffee and cassava, the CLEAN target area covers four provinces (shown in the adjoining map), six districts with a total of 429 villages. Based on the National Housing and Population Census conducted in 2015, the total population is about 467,000 persons in 90,000 households. The CLEAN project team had gathered information on villages producing coffee and cassava within the project's target areas. The results revealed that 54 villages produce coffee and 31 produce cassava within the set CLEAN target areas. Table 2 below provides details on the number of villages where farmers produce at least one of the two value chains commodities.

CLEAN target provinces

Table 2: Number of villages producing coffee and cassava in target areas

Province name	District name	Number of villages	Number of households	Population (2015 Census)	Project target areas[9]	
					# of villages producing coffee	# of villages producing cassava
Vientiane Capital	Xaythany	104	39,400	196,565	0	4
	Pak Ngum	53	10,090	49,211	0	6
	Sangthong	36	6,411	29,509	0	3
Champasak	Paksong	88	15,304	81,244	35	0
Sekong	Thateng	51	6,597	38,622	13	11
Salavan	Lao Ngam	97	13,040	71,454	6	7
4 provinces	**6 districts**	**429**	**90,842**	**466,605**	**54**	**31**

For the beneficiary-based survey, the sample size of households was determined based on the Sampling Guide for Beneficiary-Based Surveys (USAID, Feb 2016), following a two-stage cluster sampling design. The first stage was random selection of 25 villages that produce coffee and/or cassava and based on conducing 20 interviews in each village (like the first baseline survey), a final sample of 500 households could be produced.

In the second stage, households were selected randomly in each target village, based on a list obtained from PAFO/DAFO that specified the number of farmers at the village level. The CLEAN project aims to reach 14,877 small holder farmers over the life of the project in selected target areas. The sample size was calculated using the following formula (utilizing a similar methodology recommended by USAID[10]): $n= N^2 * Z^2 * s^2 * MoE^2$.[11] Considering a 95 percent confidence level and 10 percent level of precision, the calculated sample size against 14,877 farmers equalled to 500. The villages were stratified based on coffee and cassava and were selected using population proportional to size (PPS) sampling method, using a calculated interval and a random starting point. One selected village, Phousan in Phonhong district, Vientiane Province, had to be replaced due to government instructions that Phonhong was no longer included in target districts. The target sample in Vientiane Capital could not be achieved as many farmers had experienced floods in 2019, and hence, had not produced a harvest. To compensate for this a replacement village, Lavad in Salavan province, was selected. The selected villages from the first stage and the resulting actual sample is shown in the Table 3 below.

[9] Source: Based on estimates provided to the CLEAN project from PAFO/DAFO, 2019

[10] USAID/ Feed the Future, Sampling Guide for Beneficiary-Based Surveys, February 2016

[11] Where N represents the farmer population, Z is the confidence level (i.e. 1.96), s is the standard deviation, and MoE is the margin of error.

Table 3: Selected villages in which to survey coffee and cassava farmers

Village	District	Province	Coffee sample (n)	Cassava sample (n)	Actual Interview
Pak Kouang	Park Ngeum	Vientiane Capital		20	11
Xienglei Na	Park Ngeum	Vientiane Capital		20	10
Phousan	Phonhong	Vientiane Province		20	-
Nonglouang	Paksong	Champasak	-	-	20
Vatlouang	Paksong	Champasak	20		20
Paksong	Paksong	Champasak	20		21
Kapher	Paksong	Champasak	20		20
Lak 40	Paksong	Champasak	20		19
Nonghinkhao	Paksong	Champasak	20		20
Phoumone	Paksong	Champasak	20		20
Katuad	Paksong	Champasak	20		20
Huaysed	Paksong	Champasak	20		20
Lijueang	Paksong	Champasak	20		20
Nongsoung	Paksong	Champasak	20		20
Pakbong	Paksong	Champasak	20		20
Huaysoy	Paksong	Champasak	20		20
Sepian	Paksong	Champasak	20		20
Maisaisomeboun	Paksong	Champasak	20		20
Huaytao	Paksong	Champasak	20		20
Somsanouk	Paksong	Champasak	20		20
Huaydammai	Thateng	Sekong	20		20
Thatengtai	Thateng	Sekong		20	20
Chakamyai	Thateng	Sekong		20	20
Maimidsumphan	Thateng	Sekong		20	20
Kundone	Thateng	Sekong		20	20
Teme Sangthong	Laongam	Salavan		20	20
Lavad	Laongam	Salavan	-	-	20
Total			**360**	**140**	**501**

3.9 Data weighting

Since this was a complementary study to capture data related to set project indicators for two additional crops, coffee, and cassava, sampling was not based on the same household survey methodology used for the baseline survey. Instead, the sample was selected randomly from known coffee and cassava households. Because of this, there was no basis for weighting the data.

3.10 Farmer profile

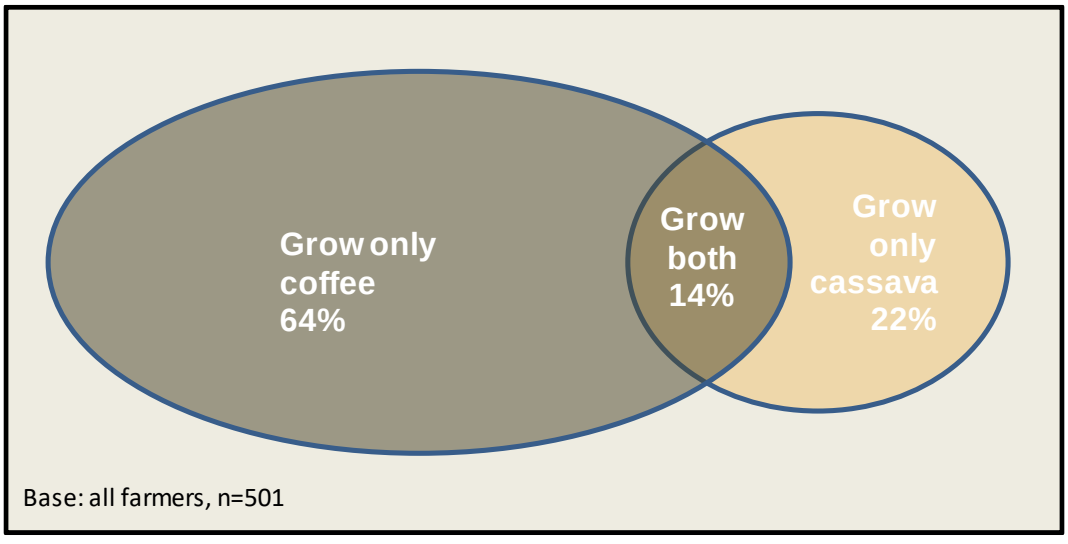
Three in four farmers are men (75%) and may be somewhat higher amongst coffee farmers (Table 4). Selected coffee farmers were on average a bit older compared to cassava farmers being in their forties compared to thirties for cassava. Coffee farmers grew mainly coffee but some also grow rice, cassava, vegetables and fruit. Cassava farmers on the other hand grow other crops to a greater extent, in particular rice, corn, vegetables and sweet potatoes.

Table 4: Farmer profile

Demographic profile Base: all farmers	Coffee farmers n=393 (%)	Cassava farmers n=177 (%)
Sex		
Men	78	70
Women	22	30
Age		
18-24	1	7
25-34	15	18
35-39	15	16
40-49	29	28
50 or older	40	32
Crops		
Coffee	100	39
Cassava	18	100
Rice	21	53
Corn	8	17
Cabbage	<1	9
Sweet potatoes	14	16
Soybeans	2	5
Vegetables	15	17
Fruits	11	10
Other	6	12

As shown in Figure 2 below, 78 percent of the farmers interviewed grow coffee (64+14 percent), 36 percent grow cassava (22+14 percent), and 14 percent of farmers grow both crops. This is not that surprising given the different farm conditions that are required and most farming systems on the Bolaven Plateau are predominantly coffee production systems.

Figure 2: Incidence of coffee and cassava growing in the survey area



There is an important distinction between coffee and cassava farmers, realized when looking at the overall proportion of land used for each crop. As shown in Table 5 below, coffee farmers use on average, 83 percent of their land to grow coffee. Relatively few coffee farmers grow cassava and result in the average land size used for cassava being rather small at 4 percent of the total land size. Cassava farmers use on average half their land (49%) to grow this crop. Hence, many cassava farmers also grow

other crops and in the case of coffee it represents 23 percent of the land size on average. This shows that for some farmers cassava may be a complimentary crop whereas coffee for most farmers can be considered their main crop.

Table 5: Land ownership and usage for coffee and cassava farmers

Land ownership and usage Base: all coffee and cassava farmers	Coffee farmers n=393 (Ha)	Cassava farmers n=177 (Ha)
Land title		
Total land used for growing crops	4.6	3.9
Land owned	3.8	2.6
Land rented	-	0.2
Land borrowed	0.8	1.0
Land usage - coffee		
Land used for coffee	3.8	0.9
Proportion of total land	83%	23%
Land usage - cassava		
Land used for cassava	0.2	1.9
Proportion of total land	4%	49%

Table 6 presents the production profile for coffee and cassava farmers. Most of the coffee farmers operate in the Paksong district and have been growing coffee for 17 years on average. Most of the trees, 72 percent, are within the prime producing age of 7-20 years. However, many farmers in Thateng (55%) were found to have young trees aged 0-6 years which means production may not have reached full capacity. Most farmers sell to middlemen or collectors (77%) and some sell directly to processors (17%). Most coffee farmers also produce their own seedlings (71%) whereas some obtain them from the government (17%).

Along similar lines, most of the cassava farmers operate in the Thateng district and have been growing cassava for 3 years on average. This indicates that cassava growing is rather new for many farmers and indeed, over one quarter of farmers (26%) were producing cassava for the first time and had not yet had a first harvest. Most farmers are selling directly to processors (67%) followed by middlemen or collectors (9%). Most farmers obtain their seedlings from family and friends (42%) who also have started to grow cassava, however, mobile middlemen (27%) and seedling companies (18%) supply seedlings as well.

Table 6: Coffee and cassava production profile

Coffee production Base: all coffee farmers	Total n=393
Experience	**#**
Average years growing coffee	17
Age of coffee trees	**%**
0-6 years	45
7-20 years	72
20 years or older	29
Buyers	
Processors	17
Middle men / collectors	77
Cooperative	10
Other farmers	5
Seedling suppliers	
Produce myself	71
Cooperative or Association	5
Government	17
Private sector	7
Seedling company	9
Other	10

Cassava production Base: all cassava farmers	Total n=177
Experience	
Average years growing cassava	3
Buyers	**%**
Processors	67
Middle men / collectors	9
Other farmers	1
Have not started to produce yet	26
Seedling suppliers	
Produce myself	9
Cooperative or Association	5
Government	1
Private sector	5
NGO	1
Seedling company	18
Mobile middle man	27
Other (mainly family and friends)	42

5. BASELINE DETAILED FINDINGS PER INDICATOR

SI-1 Area under improved techniques or technologies as a result of USDA assistance

This indicator measures the area (in Has) of land under improved techniques or technologies. The term 'improved techniques' has been defined by USDA, by providing examples of relevant techniques or technologies:[12] crop genetics (e.g. improved/certified seed), pest and disease management, soil-related fertility and conservation, irrigation, and water management. For this study, the selected improved techniques taken into account are:

- soil cover (crop residues, green mulching, plastic mulching and application of organic fertilizer),
- soil conservation measure (terrace, contour, bunds), and
- improved irrigation technology (sprinkler, drip, or pipe).

The total crop land used for coffee was 1,477 Ha. The results on improved technologies for coffee are shown in Table 7 below. Around one quarter of the land used for coffee is subject to some form of soil cover and organic fertilizer. Soil conservation to prevent soil erosion covers 10 percent of farmed land and improved irrigation is almost non-existent.

Table 7: Areas under improved technologies (coffee)

Coffee *Small sample size	Total land area n=393 (Ha)	Proportion of cropped area
Soil cover	359	24%
Organic fertilizer	392	26%
Soil conservation	150	10%
Improved irrigation	10	0.7%

The use of improved seedlings was not covered by the survey, however, the key informant interviews with local government officials in Champasak revealed the following:

"About 95% of the farmers have been practicing the seedling preparation method by growing seedlings in small black bags and ensure that the seedlings are strong enough before planting. The rest just re-used seedlings that already existed on the farms because it is more convenient, that is why they are still practicing the traditional method" (Government Official, Champasak province).

For cassava (Table 8), over a total cropped area of 330 Ha, some 17 percent is subject to improved soil cover but a much lesser proportion has organic fertilizer (5%) or soil conservation (7%). Improved irrigation is applied to less than one Ha in total.

Table 8: Areas under improved technologies (cassava)

Cassava	Total land area n=177 (Ha)	Proportion of cropped area
Soil cover	56	17%
Organic fertilizer	18	5%
Soil conservation	22	7%
Improved irrigation	3	0.8%

[12] USDA (2014) handbook: Food for Progress and McGovern-Dole Indicators and Definitions, page 10.

The limited use of improved technologies shows there is potential to improve farming knowledge and conditions for both coffee and cassava.

SI-2 Number of farmers applying new techniques or technologies

Number of farmers who are currently applying new techniques or technologies is measured by selecting the same technologies as for SI-1, namely: improved soil fertility (soil cover, crop residues, green mulching, plastic mulching, and application of organic fertilizer), soil conservation measures (terrace, contour, bunds), and improved irrigation technology (sprinkler, drip, pipe).

For coffee, just over 20 percent of farmers use improved soil cover and also organic fertilizer, see Table 9. This result highlights that such techniques are more commonly used by larger coffee farms. Soil conservation is less common with 9 percent of farmer using such techniques and irrigation is almost not used at all. Overall, 42 percent of farmers applied at least one or more techniques.

Table 9: Number of farmers applying improved techniques (coffee)

	Soil cover	Organic fertilizer	Soil conservation	Improved irrigation	Total Apply one or more
Total number of farmers	87	92	35	2	165
Proportion (%)	22%	23%	9%	<1%	42%

Improved farming techniques are less commonly applied in cassava production as shown in Table 10 below. About 11 percent of farmers use some kind of soil cover and less than 10 percent use organic fertilizer or soil conservation techniques. Overall, 21 percent of farmers applied at least one or more techniques.

Table 10: Number of farmers applying improved techniques (cassava)

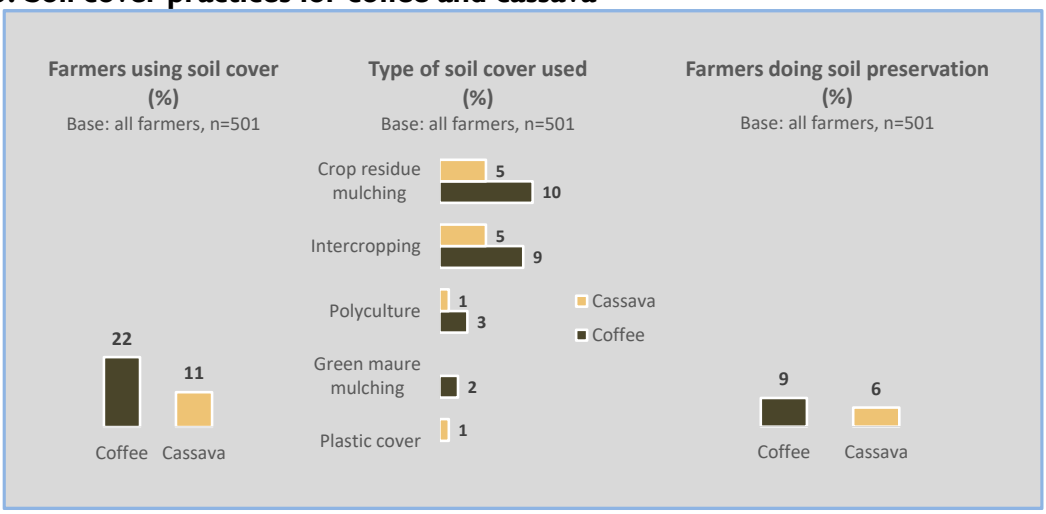
	Soil cover	Organic fertilizer	Soil conservation	Improved irrigation	Total Apply one or more
Total number of farmers	19	13	11	1	37
Proportion (%)	11%	7%	6%	<1%	21%

Technique/Technology: Soil cover and soil conservation practices

As indicated in Figure 3, relatively few farmers overall use any kind of soil cover. Coffee farmers use it more and mainly in the form of crop residue mulching or intercropping. Cassava farmers also use these techniques but to a lesser extent.

The vast majority of cassava farmers do not apply any soil conservation practice. Less than 10 percent of farmers practice this technique. Most farmers said they did not need to do it because no soil erosion occurs but some used bunds or contour farming.

Figure 3: Soil cover practices for coffee and cassava



The key informant interviews confirmed that soil cover is seldom used in coffee plantations, and one NGO official noted coffee farmers don't use soil cover as the weather conditions are already quite conducive.

"Farmers have not adopted the soil cover method as it is not necessary, because the weather here is always cold and humid" (NGO, Champasack province)

Cassava farmers also don't use soil cover as farmers believe the soil is already good and doing so would require more labour and cost. It was also mentioned that farmers have limited knowledge about how to apply soil cover.

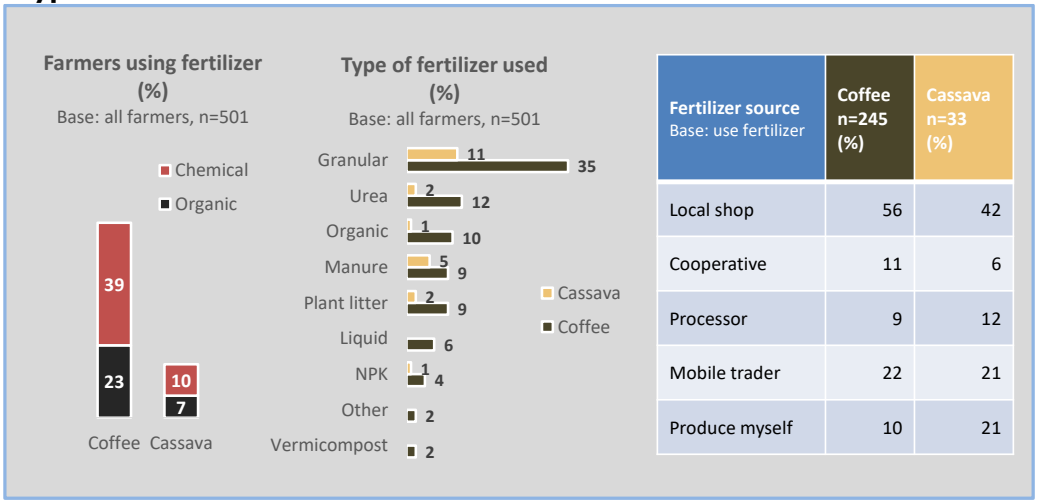
"Farmers have not adopted soil cover as they do not know this technique and have limited knowledge of how to apply it" (Collector, Sekong province)

Technique/Technology: Use of fertilizers

For coffee production, most farmers (63%) use some kind of fertilizers, granular being the most popular followed by Urea (Figure 4). Organic fertilizers are either animal manure, plant litter, and vermicompost. These are generally produced on-farm using available manure and biomass. Organic fertilizers are also quite prominent together with manure and plant litter. Overall, 23 percent of farmers use organic fertilizer. Fertilizers are mainly bought from the local market or from mobile traders (22%).

Fertilizer are less commonly used amongst cassava farmers, with 17 percent overall. They do use a mix of chemical and organic types of fertilizers, granular being the most common with 11 percent. Overall, 7 percent of farmers use some kind of organic fertilizer, mainly manure. Like coffee farmers, fertilizers are mainly bought from local shops and mobile traders.

Figure 4: **Types of chemical fertilizers used for coffee and cassava**



Fertilizer source Base: use fertilizer	Coffee n=245 (%)	Cassava n=33 (%)
Local shop	56	42
Cooperative	11	6
Processor	9	12
Mobile trader	22	21
Produce myself	10	21

Regarding organic fertilizers, there were different opinions among stakeholders. One expert at a coffee association in Champasak estimated that about 60% of the farmers use organic fertilizer, while the rest use chemical fertilizer to boost seedling growth. However, a government official in Champasak provided a much more conservative estimate that about 10 percent of farmers use organic fertilizer with the argument that producing fertilizer from waste and animal's manure takes time and requires labor. It could be that some farmers are transitioning as suggested by an NGO representative:

"Farmers are slowly adopting the use of organic fertilizers, but there is still doubt regarding its effectiveness" (NGO, Champasack province)

According to the coffee association in Champasak, demand for organic coffee from buyers has encouraged the adoption of organic fertilizers. Organic fertilizers for coffee can be produced from fermented bananas, papaya, and pumpkins where residuals from tobacco are added as a natural pesticide into the organic fertilizer mix.

When asked about organic fertilizers, some of the stakeholders explained that many cassava farmers don't use it as they think the soil is already of good quality. They also mentioned that farmers prefer to use chemical fertilizers as they are more convenient to use and produce better immediate results.

"The farmers don't use organic fertilizer because the soil quality is good" (Collector, Salavan province)

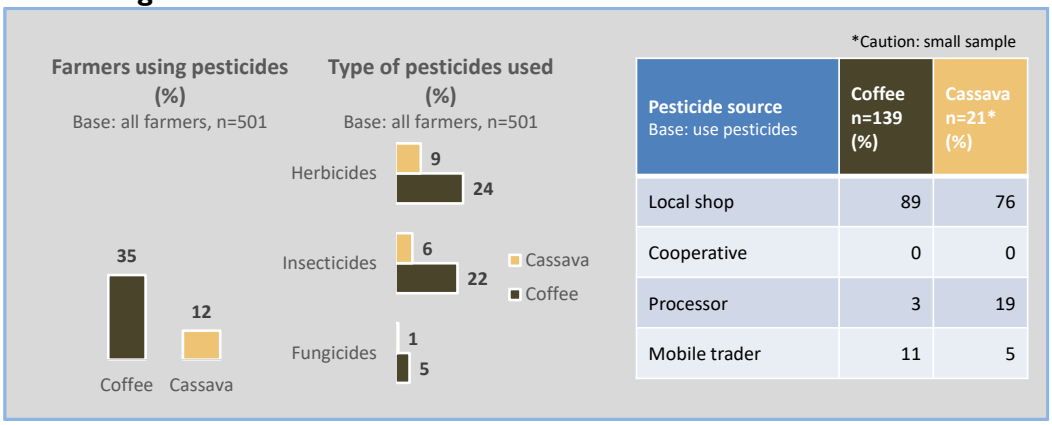
This highlights that some cassava farmers may be conflicted about what type of fertilizer to use. It was clear from the interviews that some farmers are sceptical about the efficacy of organic fertilizers and whether the time needed to use them are worth the effort.

Technique/Technology: Use of agrochemicals

As highlighted in Figure 5, just over one third of coffee farmers use some kind of agrochemical, mostly herbicides and insecticides and to a lesser extent fungicide. The vast majority buy them from the local shop (56%) and in some cases from mobile traders (22%). Interviews with government officials in Champasak support this, saying that farmers have been adopting agrochemicals (fertilizers) as it facilitates the growth of plants but noted that pesticides are not as widely adopted since coffee plants are not often affected by insects.

Relatively few cassava farmers use agrochemicals and those who do either use herbicides or insecticides. They also buy from the local market and in some cases from the processors. However, the sample size for this estimate is minimal, so may not be reflective of the market.

Figure 5: **Use of agrochemicals for coffee and cassava**

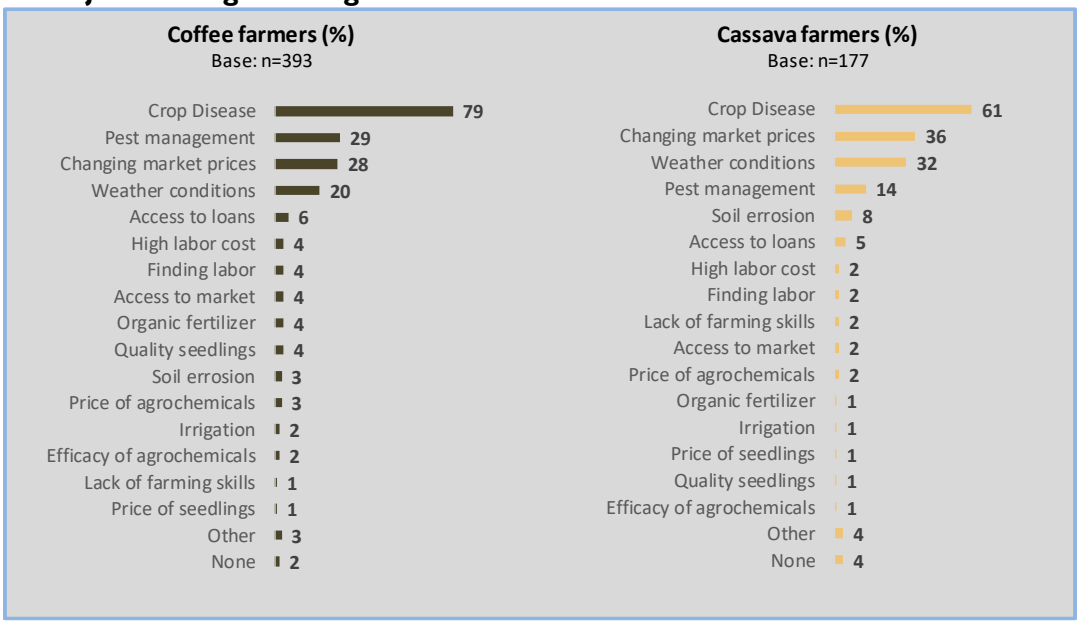


*Caution: small sample

Pesticide source Base: use pesticides	Coffee n=139 (%)	Cassava n=21* (%)
Local shop	89	76
Cooperative	0	0
Processor	3	19
Mobile trader	11	5

Farmers were asked about the most pressing challenges they were faced with, and results are summarized in Figure 6. Crop disease and insect pests are reported as standard by both coffee and cassava farmers. For both groups of farmers, they were in the top four categories together with changing market prices and weather conditions.

Figure 6: **Major farming challenges**



<u>Technique/Technology: Water management</u>

Irrigation was hardly used by any farmer. Cassava does not usually need extensive irrigation and rainfall at the Bolaven Plateau usually is plentiful and means most coffee farmers traditionally rely on rainfall. Only 2 percent of farmers, both coffee and cassava, use irrigation.

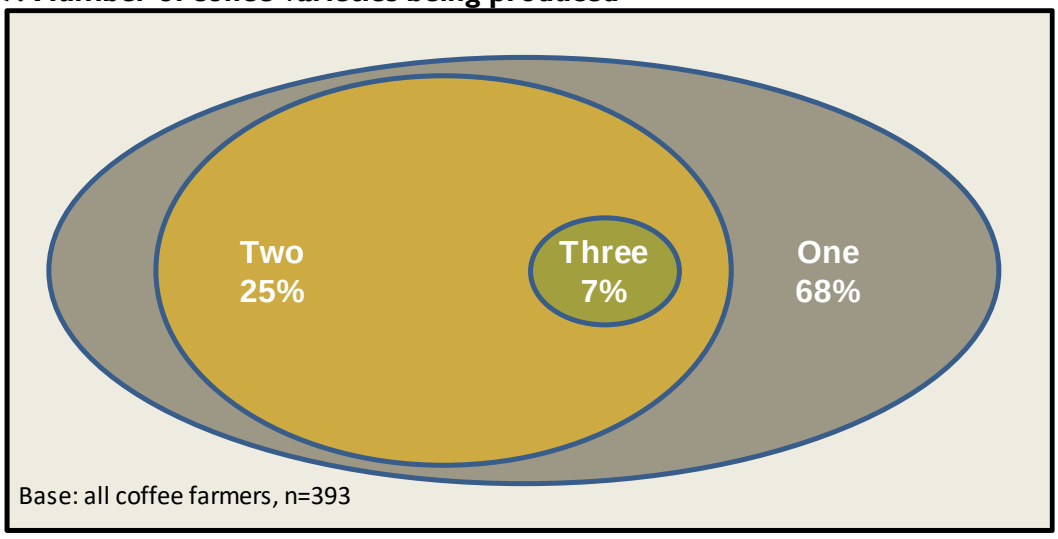
Interviews with most of the stakeholders revealed that soil erosion is not typical and not a significant issue for most coffee farmers. Further, irrigation is hardly used because it is subject to high costs, and farmers have traditionally relied on rainwater, which is regular and plentiful in the Bolaven plateau.

They also mentioned that soil erosion is not a major issue for cassava farmers unless there is a landslide or flood. For irrigation, cassava farmers rely on natural water sources. They also don't have much knowledge about different irrigation systems, and the high cost also makes it less attractive.

SI-13 Value of sales by project beneficiaries

Most coffee farmers (68%) only produce one variety of coffee, the most popular varieties being Catimor (50%) followed by Robusta/Arabusta (37%). Other varieties were found to be very limited, less than 10 percent. There are, however, almost one in three farmers who produce two or more varieties, although in most cases (25%) only two, see Figure 7 below. It is interesting to note that those who produce two varieties were found to have less production of Catimor (40%) and more production of Robusta/Arabusta (48%). The districts located in the Bolavan plateau have traditionally been growing Arabica varieties such as Catimor, but it seems there is a trend among some farmers to start growing Robusta varieties.

Figure 7: Number of coffee varieties being produced



The value of sales per farmer household for coffee farmers was determined by looking at the type of coffee sold (i.e. fresh cherries, dry cherries, parchment or green beans), total volume (in kg) sold in the last harvest and the average price per kg. The results are presented in Table 11 below. The vast majority of farmers produce and sell fresh cherries and these are sold at an average price of 2,520 Kip (30 cents) per Kg resulting in an average farmer income of 7,917,000 Kip (USD900) per Ha. Dry cherries fetch a higher average price of 12,337 Kip (USD1.40) per Kg, however, the average farmer income is only marginally higher at 9,013,000 Kip (USD1,020) per Ha. It should be noted that while indicator SI-13 looks at average farmer income, income per Ha has been included to allow for a direct comparison between the four coffee types. Some farmers also grow other crops so this may not represent their total income.

Table 11: Average value of sales by coffee type sold

Coffee type sold Base: all coffee farmers	Fresh cherries n=284	Dry cherries n=241	Parchment n=48	Green beans n=104
Production volume	#	#	#	#
Average kilos	7,544	1,651	3,571	1,386
Price				
Price range (Kip)	1,200 – 6,000	3,500 – 22,000	10,500 – 21,000	9,000 – 30,000
Average price per kilo (Kip)	2,529	12,337	14,782	12,452
Average price per kilo (USD)	0.30	1.40	1.70	1.40
Value of sales (SI-13)				
Average income (Kip)	**19,080,000**	**20,370,000**	**52,790,000**	**17,260,000**
Average income (USD)	**2,170**	**2,310**	**6,000**	**1,960**
Income per Ha				
Average income per Ha (Kip)	**7,917,000**	**9,013,000**	**16,445,000**	**7,991,000**
Average income per Ha (USD)	**900**	**1,020**	**1,870**	**910**

Relatively few farmers produce parchment or green beans. While farmers selling parchment have, on average a significantly higher income, the result is based on a rather limited sample of 48 farmers, so it may not be representative. It should also be noted that the land size for these farmers was on average much larger (see Table 15). It is interesting to note that green beans on average fetched only a marginally higher price than dry cherries. Green beans should, under normal circumstances, sell for around 25,000 Kip or more depending on grade. Further analysis of the price of different coffee varieties (Arabica, Robusta/Arabusta and Catimor) reveals why this is the case and results are shown in Table 12 below. It should be noted that the sample size for some cells are very small so results are only indicative and may not representative.

Table 12: Average coffee price by coffee type and variety

Coffee type sold Base: all coffee farmers	Fresh cherries	Dry cherries	Parchment	Green beans
Arabica all varieties	**n=260**	**n=119**	**n=46**	**n=15**
Average price per kilo (Kip)	2,479	12,972	14,843	14,979
Robusta/Arabusta	**n=24**	**n=122**	**n=1**	**n=90**
Average price per kilo (Kip)	3,073	11,717	12,000	12,059
Catimor only	**n=219**	**n=83**	**n=39**	**n=7**
Average price per kilo (Kip)	2,428	13,470	14,341	13,833

According to the agronomists interviewed, Arabica should ideally be de-pulped within 24 hours whereas the cherries from Robusta varieties can be dried to enhance the quality of the bean. Contrary to this, some farmers do quite the opposite, something which may well affect the quality of the beans that can be produced and hence the price. Even Catimor green beans, the most commonly produced coffee variety in the selected project districts, are sold well below market value at just under 15,000 Kip per Kg. But it

should be noted that most farmers don't sell Arabica green beans but cherries, mostly fresh. Instead, most of the green beans sold came from farmers that grow Robusta varieties, which normally commands a lower price and could explain why the average price for green beans is generally low.

The going market price was found to have an impact on how coffee is being harvested and, in some cases, even determined whether the farmer would harvest at all. Should the price be too low, farmers will choose not to harvest as the cost of labour may result in loss of revenue (see also section on production costs). Based on this there appears to be great potential for improving farming practices and resulting farmer incomes.

Based on discussions with stakeholders, there have been significant price fluctuations for coffee recently. There have been various reasons for this, but a significant one is demand for higher standards. This has resulted in exports going to Asia, mostly Vietnam, rather than Europe. Crop disease was also mentioned, which can severely affect the quality of coffee produced and hence, the price.

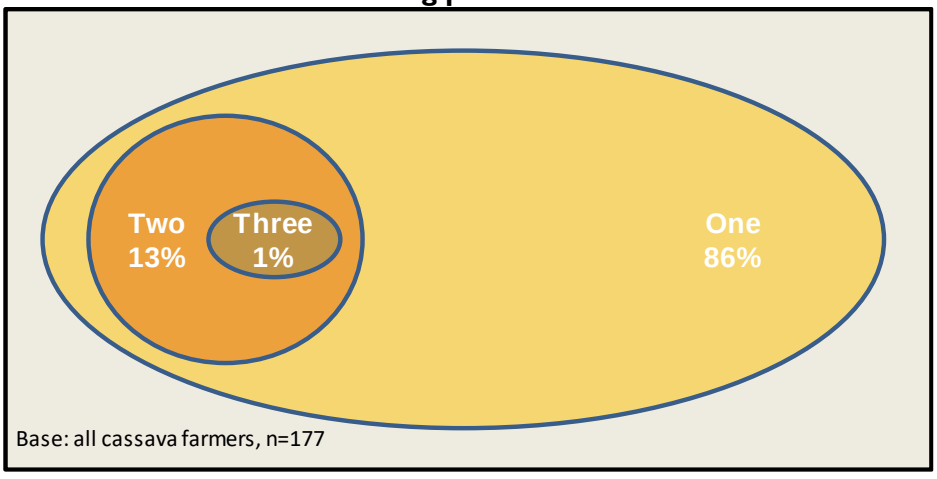
"Recently the coffee production has decreased because the impact of farm crop diseases and bugs in recent years. Another factor is that farming techniques are still limited among coffee farmers."
(Government official, Vientiane Capital)

"The price of coffee beans is not competitive and has resulted in farmers growing less coffee."
(Government official, Vientiane Capital)

Because of the nature of coffee farming and the resulting price, based on different varieties and types sold, it is not possible to create an accurate combined value of sales. Instead, the average price and volume by coffee type sold should be used. The total value of sales can be generated for each type of coffee sold by taking the average and multiplying by the estimated total number of farmers. However, the overlapping between coffee varieties and types sold should also be taken into consideration as this also has bearing on the potential income farmers can generate.

Most cassava farmers (86%) only produce one variety of cassava, the most popular varieties being Rayong (from Thailand), other Thai species or Vietnamese varieties (Figure 8). One quarter (24%) of farmers did not know what variety they produced. It should be noted that 27% of cassava farmers grew cassava for the first time and had not yet had a harvest. These farmers were consequently excluded from the value of sales analysis.

Figure 8: Number of cassava varieties being produced



The value of sales per farmer household for cassava was determined in a similar way by looking at the type of cassava sold (i.e. fresh or dry), total volume sold in kg, and the average price per kg. The conversion factor between fresh and dry cassava depends on the water content but 2.5 is commonly used when natural drying practice is used.[13] That means one ton of fresh cassava would produce around 400 Kg of dry cassava. The results are presented in Table 13 below. Fresh cassava is sold at an average price of 556 Kip per Kg resulting in an average farmer income of 6,032,000 Kip (USD685) per Ha. Dry cassava can be sold at an average higher price of 1,218 Kip per kg resulting in a higher farmer income 7,378,000 Kip (USD837) per Ha. According to one of the cassava processors interviewed, fresh cassava needs to be processed quickly, ideally within 24 hours, in order to ensure good quality. The price range for cassava varies quite a bit from 300 up to 1,200 Kip for fresh cassava and 620 up to 2,400 Kip for dry cassava.

The stakeholders interviewed generally agreed that the selling price for cassava has been increasing as neighbouring countries have produced less cassava. Due to growing demand, farmers have expanded production for cassava in Lao PDR. Some of the stakeholders interviewed stated the following:

"Farmers have expanded their farms to produce more cassava and the price has also increased as the market is growing." (Collector, Sekong province)

"The cassava market has grown dramatically due to foreign direct investment and support to farmers to grow more. Farmers can almost not meet demand" (Government official, Vientiane Capital)

Table 13: Average value of sales for fresh and dry cassava

Sales Base: cassava farmers with sales	**Fresh cassava** **n=48**	**Dry cassava** **n=89**
Production volume	**#**	**#**
Average tons	27.88	11.51
Price		
Price range	300 – 1200 Kip	620 – 2400 Kip
Average price per kilo	556 Kip	1,218Kip
Value of sales (SI-13)		
Average income (Kip)	**15,501,000**	**14,019,000**
Average income (USD)	**1,760**	**1,590**
Income per Ha		
Average income per Ha (Kip)	**6,032,000**	**7,378,000**
Average income per Ha (USD)	**685**	**837**

The total value of sales can be generated by taking the average and multiplying by the estimated total number of cassava farmers, split by those estimated to sell fresh and dry cassava. However, given the rather limited sample size for fresh cassava, any estimate produced will be subject to a larger sampling error.

[13] Asante-Pok A., 2013. Analysis of incentives and disincentives for cassava in Nigeria. Technical notes series, MAFAP, FAO, Rome.

SI-14 Volume of commodities sold by project beneficiaries

Table 14 below shows the average volume of sales per HH, for coffee and cassava, disaggregated by type of coffee and cassava sold in the last harvest. Because both coffee and cassava are sold in different forms, the volume sold is greatly affected and cannot be combined. The fragmented nature of these two crops means it is not possible to break down results by district with any level of accuracy. Instead, the overall result for farmer selling the type has to be considered.

Table 14: Average volume of sales for coffee and cassava

Farmers producing the particular crop and type	Coffee (Metric tons)	Cassava (Metric tons)
Fresh cherries (n=284)	7.54	NA
Dry cherries (241)	1.65	NA
Parchment (n=48)	3.57	NA
Green beans (n=104)	1.39	NA
Fresh (n=48)	NA	27.88
Dry (n=89)	NA	11.51

CI-1 Yield per Ha

Data from the baseline extension survey was used to compute crop productivity expressed in Kg/Ha. The average land size used for coffee (in Ha) and production (in Kg) were used to determine an average yield, as summarized in Table 15 below. The computed average yields are calculated for each coffee type. Fresh cherries had an average yield of 3,100 Kg/Ha followed by parchment with 1,110 Kg/Ha. Dry cherries and green beans produced an average of 730 and 640 Kg/Ha respectively. It is important to note that while parchment produced an average higher production volume, those producing parchment also had larger land size on average compared to other farmers. This in part explain their higher income.

Table 15: Estimated crop productivity of coffee (Kg/Ha)

Production yield Base: all coffee varieties	Fresh cherries n=284	Dry cherries n=241	Parchment n=47	Green beans n=105
Land				
Land size (Hectares)	2.41	2.26	3.21	2.16
Production volume (SI-14)	#	#	#	#
Average kilos	**7,544**	**1,651**	**3,571**	**1,386**
Yield (CI-1)				
Kilo / Hectare	**3,130**	**730**	**1,110**	**640**

For cassava, the resulting yields are shown in Table 16 below expressed as Metric Tons per Ha. As with coffee, the computed average yields are calculated for fresh and dry cassava separately. Fresh cassava had an average yield of 27.88 MT/Ha and for dry cassava, being lighter in weight, it was 11.51 MT/Ha. Fresh cassava had an average yield of 10.8 MT/Ha and a dry cassava 6.1 MT/Ha. Farmers producing fresh cassava had on average larger land size with 2.57 Ha, but were only able to produce a marginally higher income compared to farmers producing dry cassava. This is because dry cassava is sold at more than double the price, 1,218 Kip vs. 556 Kip. The yield overall is considered below average and shows the potential for improvement.

Table 16: Estimated crop productivity of cassava

Production yield Base: cassava farmers with sales	Fresh cassava n=48	Dry cassava n=89
Land	**Ha**	**Ha**
Average land size per household	2.57	1.90
Production volume (SI -14)	**#**	**#**
Average tones produced per household	**27.88**	**11.51**
Production range in tones	**1.8 – 180**	**1.0 – 50**
Yield (CI-1)		
Tones / Hectare	**10.8**	**6.1**

Having considered farmer income and production yield it is worth looking at production costs. Because some farmers produced both coffee and cassava, some production costs are likely to overlap and hence, only farmers who only produced coffee or cassava were included in this analysis as shown in Table 17. The major cost for coffee is labour cost (51%), most likely during the harvest season for picking the cherries. Other costs are land preparation (15%), equipment hire and fuel (11%), and seedlings (10%). Other costs are generally low. The average coffee farmer will have costs around 15 million Kip (USD1,715) which translates into 3.68 million Kip per Ha or USD420. For cassava farmers the largest cost by far is land preparation representing 42 percent on average. Other significant costs are labour (16%), transportation (15%), seedlings (13%), and equipment and fuel (10%). Overall the average cost for cassava is lower at just over 10 million Kip (USD1,190). However, due to the average smaller land size, the cost per Ha is nearly 30 percent higher than for coffee, just under 5 million Kip or USD540.

Table 17: Production costs for coffee and cassava

Production costs Base: farmers who produce coffee or cassava exclusively	Base	Average cost for coffee farmers n=324 (Kip)	Cost proportion	Base	Average cost for cassava farmers n=108 (Kip)	Cost proportion
Land preparation	52	2,288,000	15%	97	4,382,000	42%
Seedlings	31	1,439,000	10%	64	1,320,000	13%
Fertilizer	18	227,000	2%	14	80,400	1%
Agrochemicals (Pesticides)	39	850,000	6%	9	405,000	4%
Equipment hire and fuel	90	1,709,000	11%	86	1,060,000	10%
Irrigation	4	97,000	1%	-	-	-
Labor	78	7,679,000	51%	57	1,674,000	16%
Transportation	69	786,000	5%	85	1,535,000	15%
Other	1	28,000	<1%	-	-	-
Total		**15,103,000**	**100%**		**10,456,000**	**100%**
Cost in USD		**1,715**			**1,190**	
Average land size (Ha)	**324**	**4.1**		**108**	**2.2**	
Cost per hectare	**324**	**3,684,000**		**108**	**4,753,000**	
Cost in USD		**420**			**540**	

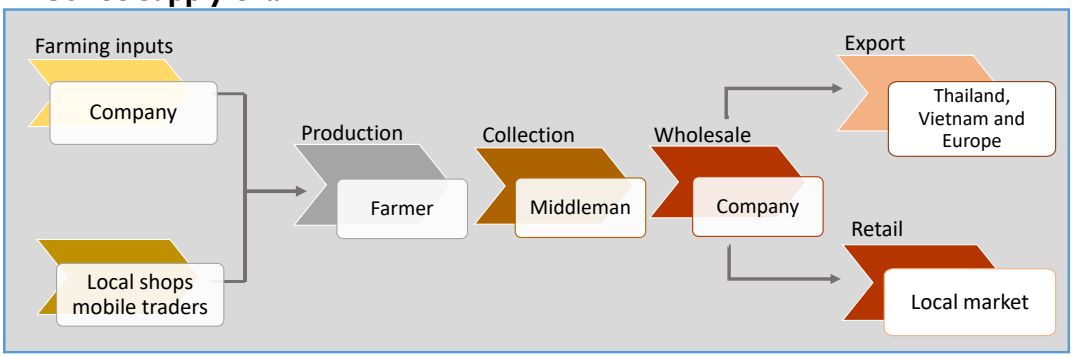
Based on the estimated production costs in Table 17 and the estimated income from Table 11 (coffee) and Table 13 (cassava), a rough estimate of net income can be calculated. It should be noted that income, being a key indicator for the CLEAN project, was calculated based on crop variety. Production cost, on the other hand, was estimated overall regardless of crop variety.

Coffee farmers earned a gross income of USD900 up to USD1,870 per Ha, depending on type of coffee sold. Taking into account the average production cost, the net income range would be USD480 up to USD1,450 per Ha. For cassava, the net income range was USD685 up to USD837 per Ha, resulting in a net income range of USD145 up to USD297 per Ha. Total net income would ultimately depend on the size of the land used for each crop and keeping in mind that many farmers also generate income from other crops.

Supply chain for coffee and cassava

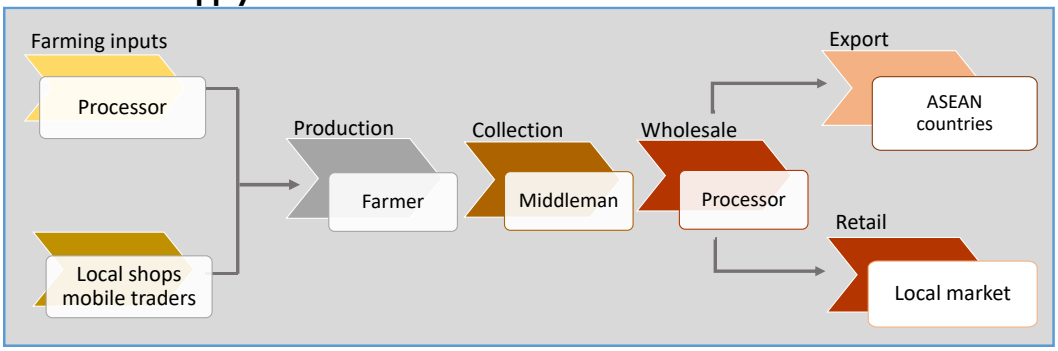
The supply chain for coffee, shown in Figure 9 below, reveals that farming inputs typically come from two sources, private sector companies as well as local shops and mobile traders. Following production, the farmers normally sell the coffee to a middleman who, in turn, takes the coffee to a private sector company (e.g. roasters). They, in turn, export or sell the coffee to the local market. Exports are mainly to Thailand, Vietnam and Europe.

Figure 9: Coffee supply chain



The supply chain for cassava turned out to be somewhat similar to coffee, as shown in Figure 10. They buy their farming inputs from processors, local shops and mobile traders. Cassava farmers also sell to a middleman (sometimes referred to as collectors) who, in turn, take the cassava to a private sector company or processor. They, in turn, export or sell the cassava to the local market. Exports are mainly to ASEAN countries.

Figure 10: Cassava supply chain



6. RECOMMENDATIONS

Relatively few farmers are using some form of improved technologies, in particular cassava farmers. Improved knowledge of soil cover and the use of organic fertilizer can help to improve farming techniques for both coffee and cassava. With support of local NGO's and local governments on the ground, there is an opportunity to standardize farming practices in these areas. Training can include access to information and best practices on the use of soil covers and organic fertilizers.

Crop disease, and to some extent pest management, were identified as significant challenges for both coffee and cassava farmers. This requires the use of improved farming techniques that many farmers may not yet be familiar with, such as the appropriate use of agrochemicals. Alleviating the problem will significantly improve the situation for farmers.

Whilst the market for cassava appears to be improving, there is evidence to suggest that some coffee farmers are facing challenges in terms of producing high quality coffee. Changing market prices forces farmers to sell to low cost markets like Vietnam as opposed to Europe. Most farmers sell cherries and may not have the right incentives to go the extra mile to produce coffee beans that can sell at a much higher price. As seen in the relatively low income generated from coffee, there is also evidence that farmers are not utilizing best practice to maximize the revenue they could have.

Changing weather conditions due to climate change is another challenge which in the longer term could have devastating effects. Almost no farmer was found to use any kind of irrigation system but only rely on rain fall. Whether some form of low-cost irrigation system should be implemented is therefore another area to explore further.

Labour costs were not mentioned as a major concern by farmers, though in the case of coffee, it represents half of the total production cost. For cassava, land preparation represents over 40 percent of total costs. In order to reduce these costs, microfinancing can be explored to support farmers to invest in machinery that can be used during land preparation or harvest. This would help to improve margins as well as productivity. Farming cooperatives/groups could also offer access to such equipment through a shared renting scheme.

Encouraging the production of dry cassava and coffee beans (or parchment) would be a more financially beneficial strategy in the long term. Farmers may often believe they can earn more money from selling fresh produce as fresh weighs more. They may also perceive that selling fresh is less labor intensive as no additional post-harvesting procedures are required. However, if farmers can learn the process to add value to their produce, they will be able to earn more money.

Farmer groups should be promoted, both for coffee and cassava farmers. In the case of cassava, which is a fairly new crop, efforts are needed to establish new farmer groups in areas where cassava farmers are operating. For coffee, promoting existing farmer groups and encouraging more farmers to join would be the best strategy.

7. APPENDICES

1. Baseline design plan
2. Study instruments (in English)

The annexes are available in separate attachment.

Winrock International

CLEAN Project

#429, Unit 41, 4th floor Green Building,

Naxay Village, Saysettha District

Vientiane Lao PDR