Evaluation of the TechnoServe East Africa Coffee Initiative

Final Report

Prepared by

IPE TRIPLELINE

Expanding Horizons. Enriching Lives.

29 March 2017

Table of Contents

List of Tables and Figures

1 USD=	**21.3 Ethiopian Birr**	**765 Rwandan Francs**	**Feb 2016**
1 GBP=	**29.6 Ethiopian Birr**	**1,062 Rwandan Francs**	

1. Executive Summary

Triple Line was contracted by TechnoServe (TNS) to quantify the long term impact of Phase One of the East Africa Coffee Initiative (2008-11) which was conducted in Rwanda, Kenya, Tanzania and Ethiopia with the objective of enabling smallholder farmers to improve their productivity and increase their household incomes. The overall conclusion of the evaluation is that four years after the completion of the programme, evidence of the gains in yield from the agronomy programme and the gains in price from the wet mill and coffee service provider model reported at the endline in 2012 have been maintained during the last four years.

The primary objective of the evaluation is to assess the extent to which the **financial gains** to smallholder farmers as a result of the agronomy and wet mill programme have been sustained since the completion of the programme. The evaluation assesses the extent to which the **agronomy** changes made by the programme in terms of farm productivity and yields have continued after the period of support and whether the changes made under the **wet mill** programme continue to serve farmers and enable the achievement of a quality price premium.

The analysis of **wet mill programme results** has been based on a desk review of TechnoServe data for all their supported wet mills in Ethiopia and data collected as part of the International Growth Centre (IGC) study on coffee competitiveness in Rwanda by Morjaria and Macchiavello. A site visit was undertaken in December 1-8 2015 to Rwanda and in January 2016 in Ethiopia to a total of 10 co-ops/mills.

In Rwanda, the TechnoServe model has contributed to a significant change from farm-produced **semi-washed** parchment coffee to the farmer selling coffee cherry to the Co-op owned wet mills to produce **higher quality fully washed** parchment coffee. There has been a rapid growth in the proportion of coffee that is going through the wet mills, increasing from virtually nil in 2004 to over 40% in 2014. TNS supported mills account for around 17% of the wet mill capacity in Rwanda.

The price premium for TechnoServe supported washed coffee over 'ordinary' semi-washed coffee at the end of the programme in 2012 was calculated as $0.99 per kg green coffee (USD$ 3.91 compared to US$ 2.92)[1] or 34%. This premium has broadly been maintained up to 2015 and a farm-gate price premium of 25% over and above what would have been achieved from semi-washed coffee has been sustained since the completion of the TNS programme. There are a number of factors in play, including the increasing proportion of quality washed Arabica being produced which is reducing its scarcity value as well as the cost and farmer payment structure of the wet mills.

In Ethiopia, TNS supported the creation of 89 mills accounting for 26,500 bags of green coffee in 2014/5. Whilst this is a relatively small proportion of total coffee exports (approx. 1%), it represents a very significant proportion of the total washed coffee production from the regions supported. For example, there were 119 wet mills in the Jimma/Illubabor region at the start of the programme and there are now 188, of which TechnoServe has supported 69.

The step change in the price received by the farmer has been very significant. The overall conclusion from the data is that the gains recorded at the end line survey by TechnoServe have been maintained over the last three seasons.The premium for TechnoServe supported washed coffee over unwashed coffee at the end of the programme in 2012 was calculated as $0.82 per kg green coffee (USD$ 4.16 compared to US$ 3.34) or 25%. This premium has increased by 31% to an average of $1.08 per kg green coffee over the past three seasons, representing a farm-gate price premium of 45%. There is

[1] The East Africa Coffee Initiative :Innovations, Lessons Learned and Results from TechnoServe (Dec 2013)

also a general trend towards a gradual increase in the profitability of the mills over the past four years although there is a large range in the performance of the mills.

In Rwanda, the **Coffee Service Provider** model has enabled farmers to have the potential for better access to markets and connection with exporters with improved market price transparency. The exporters can in some cases have traceability back to the origin and Co-op/mill, which is an important feature for some specialty coffees. In essence, the CSP model has worked and has solved the problems that it was intending to solve. There is good evidence of a major systemic change in the way the coffee market works for the benefit of smallholder coffee growers.

A survey of the **agronomy programme** was conducted in Rwanda. A structured sample of 765 unique households that had received TNS training was drawn, with a useable sample of 620 drawn from 3 of the 10 cooperatives in Rwanda that had undertaken Agronomy training during 2010-2011.

The survey results showed that although best practice adoption has fallen since the agronomy programme ended, it remains considerably higher than at the pre-intervention baseline. Pre-intervention, Laterite's study[2] found that only 45% of farmers were regularly using at least half of the best practices taught by TechnoServe, which increased to 97% after training (2012 survey). The equivalent figure today for TechnoServe-trained farmers is 78%, demonstrating the extent to which best practice adoption has been maintained.

Importantly, there were clear disparities in the adoption rates between different best practices, suggesting that some best practices were adopted much more readily than others. For example, only 4% of farmers were still keeping accurate records of yields, income and inputs, compared to 88% in 2012, as record cards distributed by TechnoServe did not have space for multiple years. In comparison, 92% were still practicing some form of erosion control. Statistical analysis of the relationship between attendance data and best practice adoption reinforced this point; some best practices had a much stronger relationship with attendance data than others, implying a variation in the effectiveness of training by best practice.

Farmers who adopted at least half of TechnoServe's 10 agricultural best practices were more positive about their yield, suggesting that the best practices did have a positive impact. This finding reinforced Laterite's previous analysis, which used yield data to prove that there was a statistically significant relationship between yield and best practice adoption. Adopters of best practices were also more likely to want to increase the area of land growing coffee, indicating that they were more positive about the potential of coffee to provide a good income for their family.

While it was not technically feasible to undertake a statistically significant measurement of yield, the survey also confirmed a number of qualitative perceptions on key trends supporting the relationship between BP and yield: 91% of BP adopters reported an increase in yield and 35% reported what they perceived to be a large increase in yield. All indicators of increased wealth and asset accumulation were positively associated with best practice adoption.

[2] *Independent Assessment of TechnoServe's Coffee Agronomy Training Programme* (Laterite Ltd, 2013).

2. Introduction

2.1. Overview

Triple Line was contracted by TechnoServe (TNS) to quantify the long term impact of Phase 1 of the East Africa Coffee Initiative (2008-11) which was conducted in Rwanda, Kenya, Tanzania and Ethiopia with the objective of enabling small holder farmers to participate in and benefit from improving their incomes.

East Africa Coffee Programme

Rwanda, Kenya, Tanzania, Ethiopia

285 Wet Mills Supported

195,408 Farmers supported

36,066 Farmers trained

22% Increase in coffee income

Source: TechnoServe

In November 2007, the Bill & Melinda Gates Foundation awarded TechnoServe a four-year, $47[3]-million grant to formally launch the Coffee Initiative, a region-wide effort to boost the incomes of 195,000 smallholder coffee farmers through three specific and integrated strategies.

(i) Agronomy Programme

A farmer training programme known as **"Farm College**" was established, educating smallholder coffee farmers on sustainable agronomic practices to increase their yields. The agronomy programme worked to increase coffee tree productivity by building farmers' knowledge and skills in sustainable and yield-increasing agricultural practices through a two-year training programme. Over 36,000 women and men participated in the programme, attending monthly training sessions in small groups consisting of approximately 30 farmers. Participating farmers experienced an average yield improvement of 42% by end of project. The programme expected yields to increase with time as coffee farmers adopted best practices, reaching its optimum level four years after completing the agronomy training.

(ii) Wet Mill Programme

The Wet Mill Programme assisted farmer co-operatives in establishing or upgrading low-cost rural coffee processing stations or **wet mills**, and provide them with business support to improve the quality of their *Arabica*[4] coffees. In Rwanda the coffee was classified as **semi-washed**, with the cherry pulped and fermented on the farm using simple pulping and buckets for fermentation and **sun-dried cherries** or *Jenfel* in Ethiopia. These coffees were not sold at prices comparable to those of **fully washed *Arabica* coffees** from Central America.

The programme supported coffee farmers to set-up and/or efficiently operate 285 coffee processing wet-mills or washing stations that process, aggregate and sell higher quality, fully washed coffee. The businesses served 195,408 farmers, and produced 15,960 metric tons of fully-washed specialty-grade Arabica coffee over the lifespan of the initiative in the four East African Countries. As a result of the improved quality and enhanced supply-chain efficiencies, these businesses exported coffee at a premium of US$0.96 per kilo over the benchmark New York commodity price, and farmers earned US$0.50 per kilo farm gate premiums.

(iii) Coffee Service Provider Model

[3] The programme is now in its second phase and the grant extended to USD$65 mn with the aim of reaching 220,500 farmers.
[4] Coffee varieties are divided into two main categories with *Arabica* being the higher quality than *Robusta*, grown at lower altitudes.-

It is unsurprising that coffee production in East Africa is highly politicised given the very large number of people involved in the production and the importance of coffee exports to the national economies of the region. Governments have played a major direct or regulatory role in East Africa and the process of market liberalisation in Rwanda/ Ethiopia has occurred only in the last two decades. The **coffee services provider mode**l had to work within this context with a view to strengthening the position of the smallholder on the value chain and encouraging greater ownership and value added for the smallholder.

The **coffee service provider model** (CSP) model worked with private export companies who provided wet mills with **fee-based services**. These include: investment finance to support wet mill improvements, working capital financing to purchase cherries, price risk management, export logistics and linkages to international coffee buyers. In exchange for these services, the CSP takes a percentage of the sales of the co-operative, typically between 5% and 7%, and also deducts costs paid on behalf of the co-operative.

The model is essentially about building transparency and trust between the farmers and co-ops and the exporters and enabling the farmers to have a much better understanding of the operation of the international coffee market.

The aim is that the Co-operatives move up the value chain, selling higher quality washed coffee and for a price premium, the benefit of which is passed back to the farmer. The purpose of the model is to reach a position where private exporters are competing for the business of the co-operatives.

TechnoServe pioneered this model with two CSPs providing services to five co-operatives in 2007. By the end of the Coffee Initiative Phase One, 50 co-operatives were receiving CSP services from four coffee exporters who have since expanded these services to more than 100 co-operative and private wet mill businesses providing more than $5 million in annual working capital financing.

In December 2010, the success of the CSP model prompted the Rwanda coffee regulatory authority to formalize the position of CSPs in a new set of coffee regulations.

2.2. Objectives of the Evaluation

Phase 1 (2008-11) of the East Africa Coffee Initiative focused on Ethiopia, Tanzania, Kenya and Rwanda. Phase 2 continued the programme but had Ethiopia as its main focus. It is now five years since the Coffee Initiative ended and there is much to be gained from understanding the sustainability and impact of the original investment. The test of a robust development programme is to assess not just what it achieved during the period of implementation but what it left behind for the longer term.

The research was undertaken in Rwanda and Ethiopia. As the agronomy programme started in Ethiopia in 2012, its impact was only be evaluated in Rwanda.

The primary objective of the evaluation is to assess the extent to which the **financial gains** to smallholder farmers as a result of the agronomy and wet mill programme have been sustained since the completion of the programme. Importantly, the evaluation assesses the extent to which the **agronomy** changes made by the programme in terms of farm productivity and yields have continued after the period of support and whether the changes made under the **wet mill** programme continue to serve farmers and enable the achievement of a quality price premium.

The following evaluation questions have been framed by TechnoServe and were reviewed during the inception phase.

Evaluation Questions

1. What is the long term impact of the Agronomy programme on farm productivity?
2. How resilient are new wet mills set up during Phase 1? Do these businesses continue to deliver value in the form of premium prices and market access, generating incomes for local communities without direct support from TechnoServe?
3. Have farmers been able to sustain the price premium and volume-sales gains achieved during the programme?
4. How sustainable is the Coffee Service Provider model? Will Coffee Service Providers continue to support and serve wet mill clients without direct technical support and risk mitigation from TechnoServe?

Scope

The evaluation needs to focus on quantifying the sustainability of the programme and assessing the extent to which the **attributable financial gains** made have been sustained. It also captures more qualitative aspects including the acquisition of skills and best practices by the farmers, improved livelihoods and their resilience and ability to cope with shocks as well as their perceptions of the effectiveness of the programme.

Methodological challenges

Measurement of productivity gain is riddled with methodological difficulties not least caused by the vicissitudes of a commodity market such as coffee, regional and micro climatic conditions, outbreaks of pests and fungal diseases and other factors. This research also needs to be cognisant of other coffee programmes and government actions when identifying the attributable gains from the TNS programme. In reviewing the productivity gains, analysis is also required of how improvements may, or may not have been translated into increased living standards, gender equality and women's empowerment.

Areas of focus

Following a discussion with the TNS team in Addis Ababa in December 2015, it was agreed to focus on depth rather than breadth i.e. to identify whether productivity gains have been sustained for **one cohort** of farmers supported in (2010) by comparing their status with a second cohort as a de-facto control group. This approach is a practical **deeper dive** into understanding one cohort of farmers from one specific year of assistance, rather than an attempt to measure the results across a wider group of growers over subsequent years. It is felt that more can be inferred from an in-depth study where there are fewer variables to take into consideration – not least seasonality and climate. There is trade-off between measuring across a larger data set and leaving some doubt on the validity of the attributable gains, or having a more in-depth analysis by following one cohort across a number of different microclimatic zones and conditions. We are proposing the latter approach.

A field visit was undertaken in Rwanda (1-8 December 2015) and Ethiopia to the Jimma/Oromia region (5-15 January 2016). 5 wet mills in each country were visited and the key findings are set out in section 3.3 and Annex 2.

3. Context: Coffee Production in Rwanda and Ethiopia

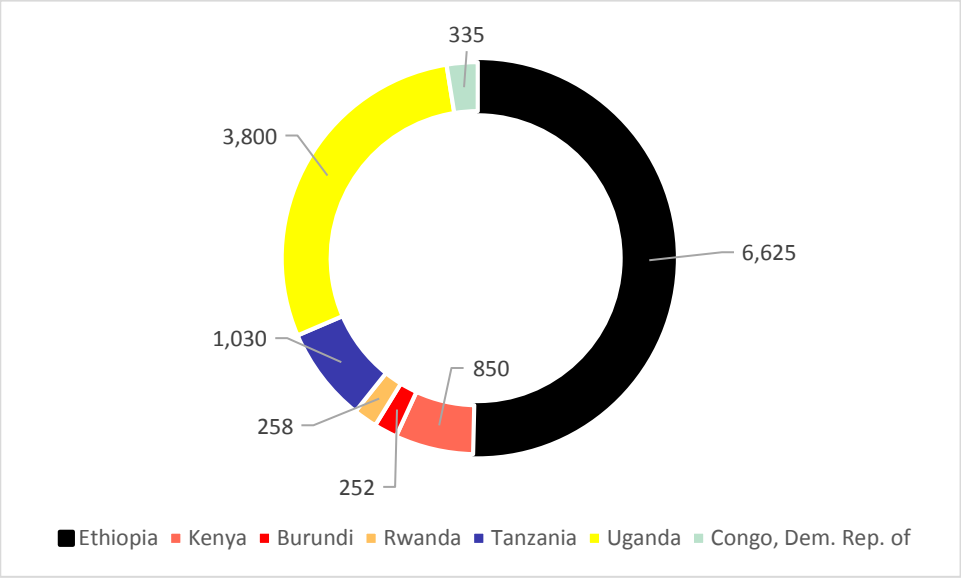
3.1. Production

Coffee provides livelihoods for some five million households in East Africa, the majority of whom live on less than USD 1.25 per day[5]. The region offers some of the best climatic and soil conditions for the production of high quality washed Arabica coffee comparable with Central America.

In the south-western Oromia region of Ethiopia, which is the origin and cradle of coffee production, it is still grown as wild or "forest coffee". More generally, coffee in large parts of East Africa is characterized by low input smallholder production with farmers typically having less than one hectare of coffee trees and operating minimal agricultural practices with limited purchased inputs. Production is well below potential with yields in some areas that average about 300 kilograms of green coffee per hectare against a potential on training demonstration plots average 1,800 kilograms[6]. East African coffee production at 13.2 million bags per year in 2014/5[7] is well below its potential: it is just 9.3% of world production or less than one third of the total production of Brazil, the world's largest producer. As Figure 1 shows, Ethiopia is by far the largest producer of coffee in the region, but unlike the other countries, Ethiopia also has a very large domestic market as shown in Figure 3.

Given the low incomes of the majority of farmers, the potential livelihood impact from improving farm yields is considerable. Farmer awareness and expertise on basic agronomic best practice from the application of fertilizer, to stumping, pruning or rejuvenation of coffee trees is limited and typically communicated informally or passed down from one generation to the next or from neighbour to neighbour.

Figure 1: East Africa Coffee Production 2014

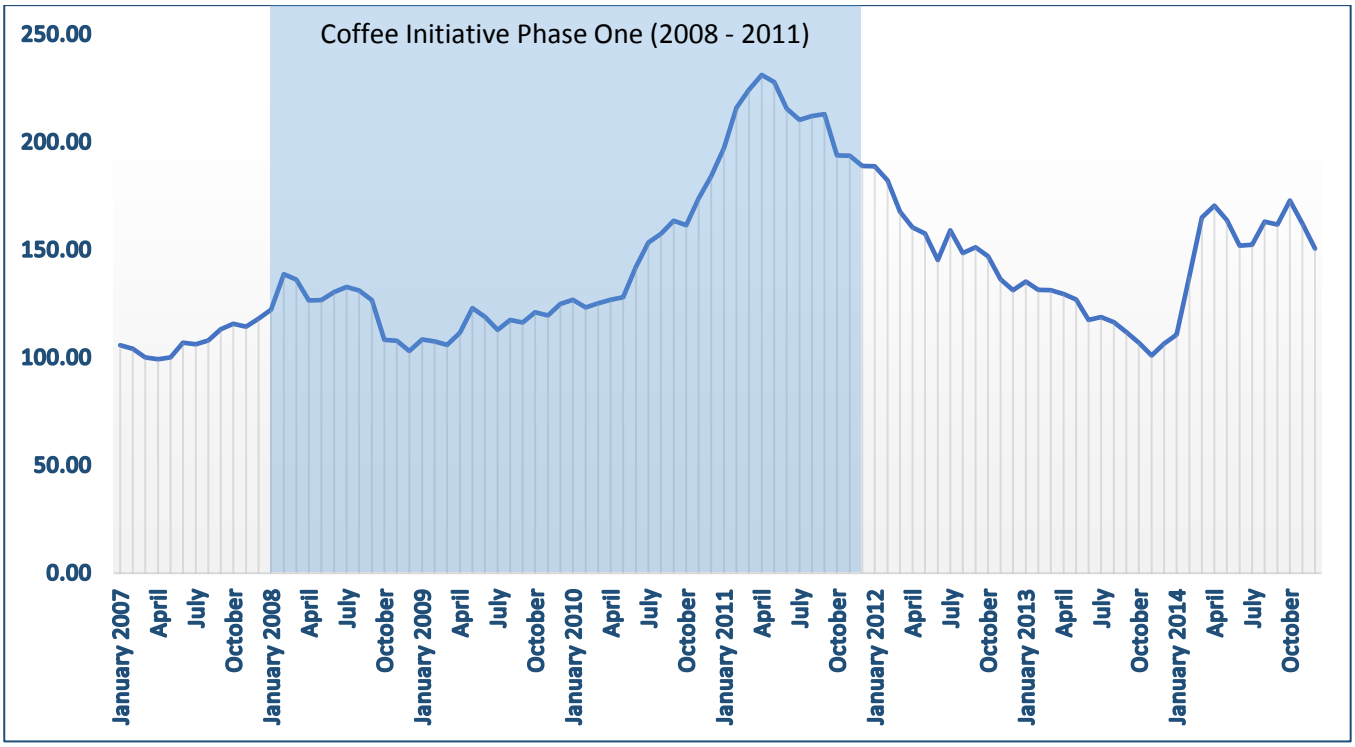


'000 bags of coffee. Source: International Coffee Organisation

[5] Source: TechnoServe
[6] TechnoServe survey of 18 demonstration plots in Kenya, 2015
[7] 1 bag= 60kg. Source International Coffee Organisation

Figure 2: International Coffee Price

Cts/lb; 2007-2014



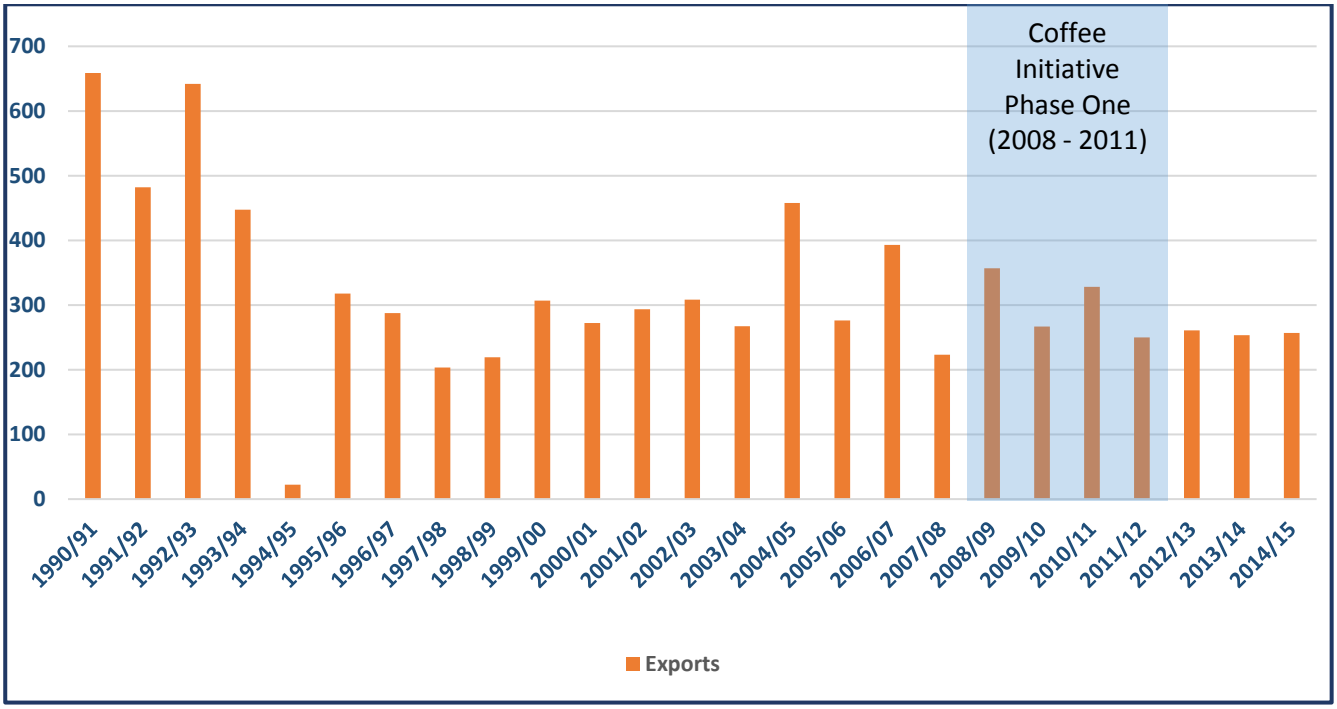
Source: ICO Composite Price Indicator Green Bean

The international price of coffee has traditionally been very volatile and market movement on the key market (New York futures exchange) can follow an erratic pattern with rapid daily or monthly movements as shown in Figure 2. These movements can be caused by real supply/demand factors such as a frost in Brazil, but markets can also move on rumours or anticipation of production changes.

Export contracts for Rwanda and Ethiopia broadly follow the price indicator shown with the specific key indicator being the New York Future "C" contract which relates to the specification of mild Arabica coffee produced in East Africa. During the final year of the Coffee Initiative Phase One, there was a substantial (doubling) of the international price. The impact of the market price on farmers' agronomy practices and supply response is complex and does necessarily result in greater investment by farmers in East Africa. For example, farmers are reluctant to rejuvenate/stump their coffee trees during periods of high prices as they are reluctant to forego the short-term profit in lieu of higher future returns. High international commodity prices also result in a reduction in the specialty premium as specialty buyers tend to pay high premiums when the commodity market is low but are unable to maintain such high premiums when the commodity market goes well above the normal range of $1.00 to $1.50 per pound. This phenomena results in the coffee trader maxim that 'high prices are bad for quality'. The impact of the market price on farmers will be explored with the research activity in June 2016.

Figure 3: Coffee Exports: Rwanda

'000 bags (60kg)



Source: International Coffee Organisation

Figure 2 shows that coffee exports in Rwanda have been relatively stable over the period of the TNS support. However, coffee traders in Rwanda estimated during the period of 2000 to 2010 that up to one third of Rwanda's exports were coffees from DRC and Burundi. This trade has dropped substantially in recent years due to higher taxation in Rwanda so the stable exports over the past four years may actually represent a higher level of production in Rwanda than in previous years. At independence, in 1962, coffee represented 55% of Rwanda's exports against minerals (37%), pyrethrum (3%) and tea (2%). There was a gradual decline following the demise of the International Coffee Agreement in 1989 followed by the virtual collapse of coffee production during the 1993/1994 genocide. Rwanda has a very small domestic market and coffee exports still account for almost 30% of Rwanda's total exports, produced by approximately 400,000 small holder farmers.

Some of the factors that have explained the stagnant coffee and exports from Rwanda include:

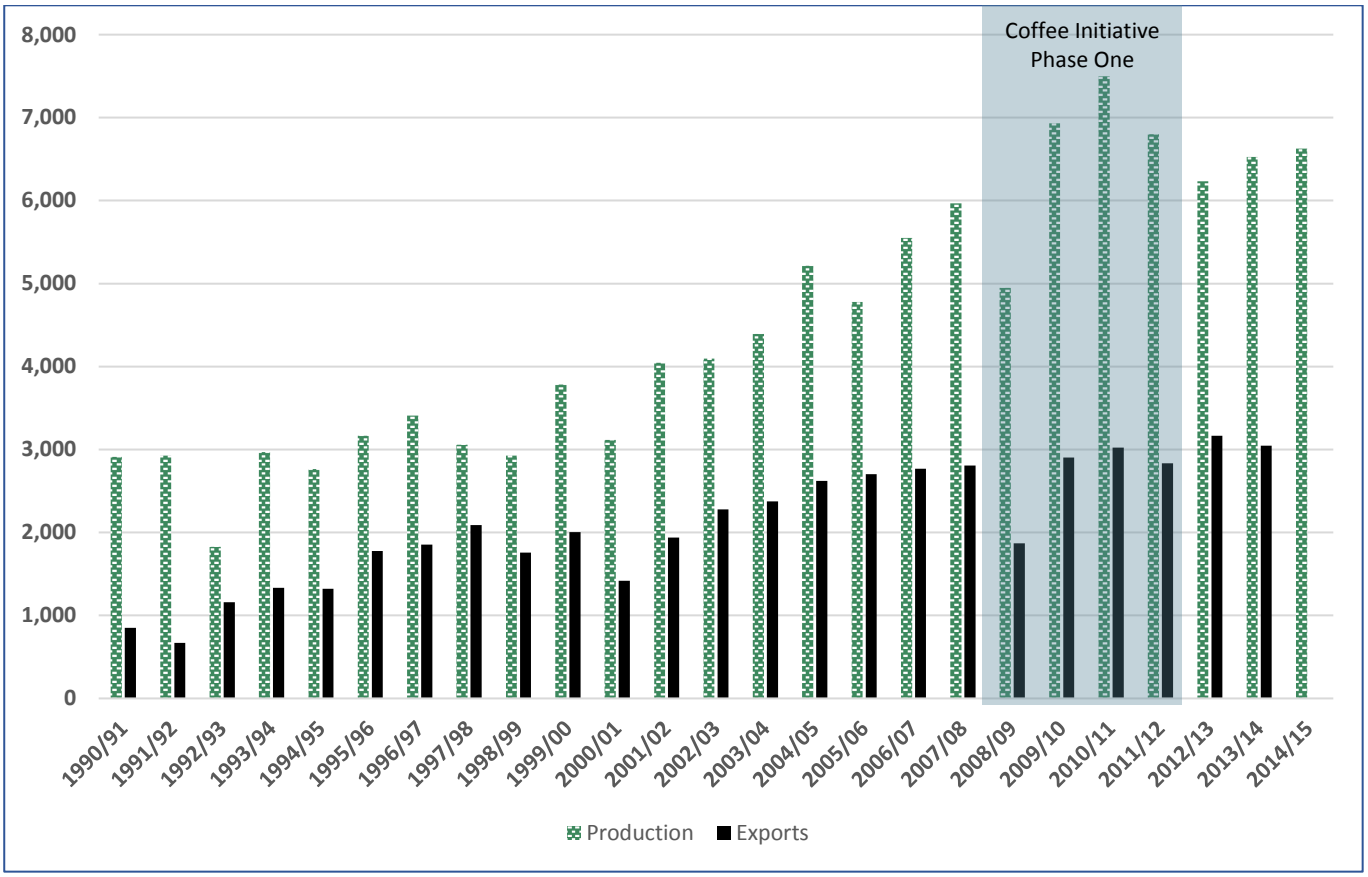
- **Declining soil fertility** and lack of access to fertilizer and other inputs - in particular the periodic intervention of the Government fertiliser distribution programme by the National Agricultural Export Development Board (NAEB). The co-ops are reporting that the overall production potential of smallholder coffee production has been well below potential and planned delivery of fertiliser and other inputs have not been made available or adequately distributed.
- Other factors include **pressure on land and demand for food crops** and population growth in Rwanda

- **Ageing of tree stock**: there has been some recent distribution of new seedlings and nursery stock including by exporters, but this would suggest that this may reflect inadequate agronomic practices including pruning.

3.2. Ethiopia: Key Trends in Coffee Production, Exports and Farm Returns

Figure 4: Coffee Production in Ethiopia

'000 bags (60kg)



Source: International Coffee Organisation

Coffee is a key commodity in Ethiopia supporting over one million households and accounts for over 30% of annual exports. While Ethiopia is undergoing very rapid economic growth and industrialisation, the importance of coffee to the macro economy as well as the rural political economy remains.

Unlike Rwanda, there is a large domestic market for coffee in Ethiopia. Coffee production is increasing although this is driven by new planting of large plantations rather than improved productivity of smallholder farms. There has been a significant increase in the proportion of fully washed coffee exported with TNS having supported over 4,555 tonnes of green coffee annually (76,000 bags) which has switched from the sun-dried *'jenfel'* to fully washed, representing 2% of exports by volume.

As highlighted above, coffee production in the Oromia/Jimma area of Ethiopia is characterised by very favourable climatic conditions with some naturally growing "forest coffee" production continuing.

More generally, the climatic and soil conditions for the growing of coffee at altitudes over 1,500 metres is ideal for a low input based smallholder coffee with no use of inorganic fertiliser, pesticides or fungicides.

4. Analysis of the Wet Mill Programme

This initial analysis has been based on a desk review of TechnoServe data for all their supported washing stations in Ethiopia and data collected as part of the International Growth Centre (IGC) study on coffee competitiveness in Rwanda by Morjaria and Macchiavello. A site visit was undertaken in December 1-8 2015 to Rwanda and in January 2016 in Ethiopia to a total of 10 co-ops/mills.

4.1. Overview of Coffee Value Chain in Rwanda and Ethiopia

4.1.1. Sun Dried, Semi Washed and Fully Washed Coffee

East Africa has produced high-quality coffee for decades. However, with the exception of Kenya, most farmers traditionally processed their coffee on their farms using home processed *'semi-washed'* or the sun-drying of cherry[8] techniques. The coffee was categorized on the international markets as *semi-washed* and did not enjoy the price premiums of the *fully-washed* mild Arabicas from Central America. Before the TechnoServe programme there were few washing stations in Rwanda or in the western Oromia region of Ethiopia.

Also referred to as coffee washing stations, wet mills are typically the place where coffee cherry is pulped (the outer skin is removed) and the beans are fermented to break down a sticky mucilage layer. The bean is then washed in water, sorted and dried on raised tables under full sunlight for up to two weeks until they reach an ideal moisture level. Coffee is then at the *parchment stage* and transported to the dry mills for hulling, sorting and grading into green bean coffee ready for export. In Rwanda these dry mills are owned by private exporters in Kigali, and in Addis they are either owned by coffee unions or increasingly by a growing number of private exporters.

A typical wet mill has an intensive period of 3 months during the coffee harvest and is a relatively simple operation with a permanent staff of no more than 2-3 permanent staff appointed by the Co-op (typically the engineer/manager and accountant) and then seasonal workers are engaged for cherry purchasing and managing the pulpers, drying tables, parchment storage and security. As set out in Table 2 the investment cost in a mill is low requiring a fixed investment in a pulper starting from US$15,000.

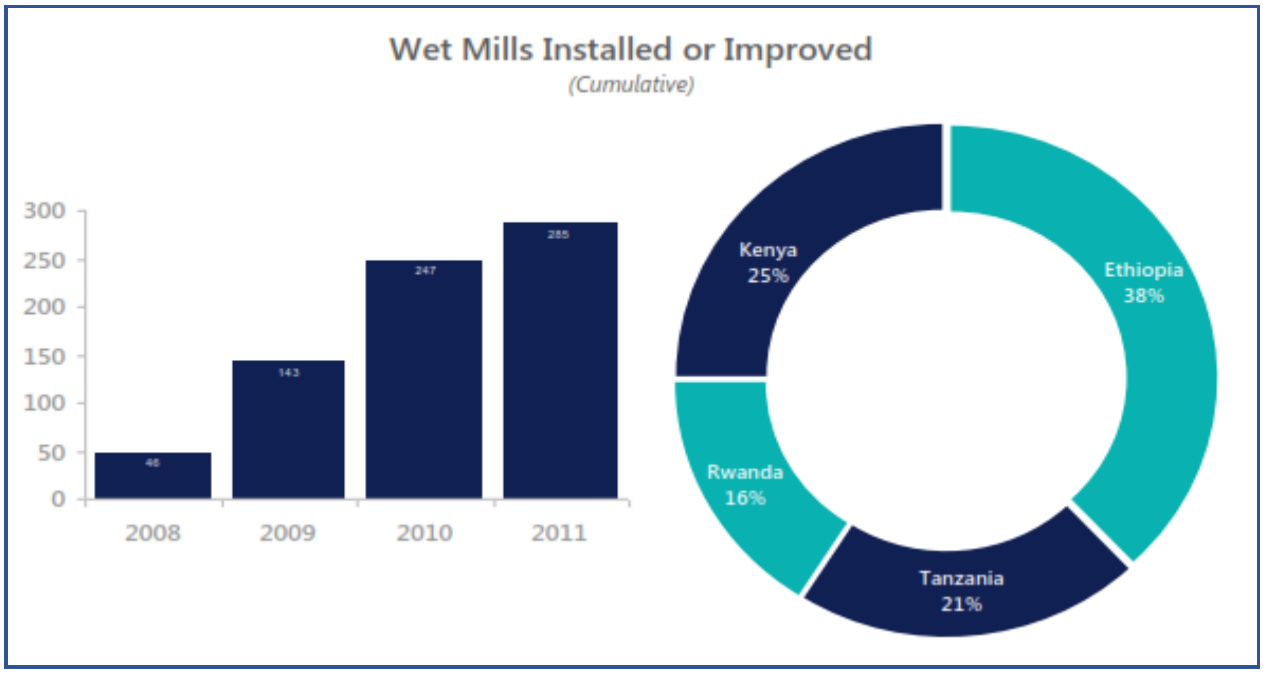
4.1.2. TechnoServe Wet Mill Assistance

The Coffee Initiative supported farmers to install 145 new wet mills and improve 140 existing wet mills between 2008 and 2011 in the four programme countries as set out in Figure 5. The assistance has been undertaken in close collaboration with Government bodies and following articulated Government strategies of encouraging quality improvement towards fully washed coffee[9]. Importantly, the role has been advisory and providing technical assistance and facilitating the provision of investment by third parties. The starting point was to work with groups of farmers that

[8] Known as *Jenfel* in Ethiopia
[9] E.g the National Coffee Conference of Feb 2015 and NAEB http://www.naeb.gov.rw/index.php?id=49

were either part of an underperforming co-op; or as in most cases, facilitating the formation and introduction of governance structures and operations for new co-ops.

Figure 5: Wet Mills Supported by TechnoServe 2008-2011



Source: TechnoServe

In the two countries reviewed, the TechnoServe supported wet mills have been a major part of the development of washed coffee. In Rwanda there has been a rapid growth in the proportion of coffee that is going through the wet mills, increasing from virtually nil in 2004 to over 40% in 2014. TNS supported 46 wet mills (35 new wet mills) in Rwanda which account for around 17% of the wet mill capacity in Rwanda[10].

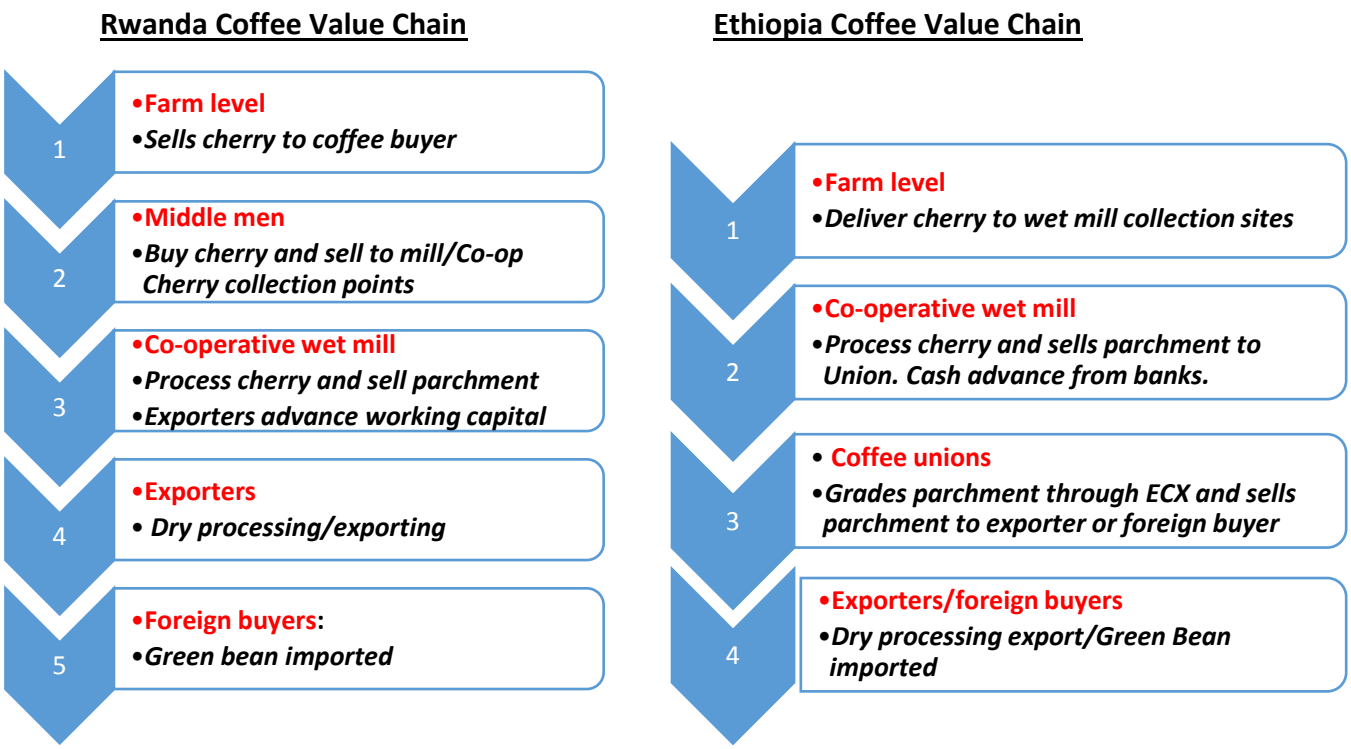
Similarly, in Ethiopia TNS supported 89 mills accounting for 26,500 bags of green coffee in 2014/5. Whilst this is a relatively small proportion of total coffee exports (approx. 1%), it represents a very significant proportion of the total washed coffee production from the region supported. For example, there were only 119 wet mills in the Jimma/Illubabor region at the start of the programme and there are now 188, of which TechnoServe has supported 69.

[10] Macchiavello, R and Morjaria, A (2015) : *Policy Brief: Coffee Washing Stations in Rwanda; An Overview of Issues & Policy Recommendations* International Growth Centre

4.1.3. Key Differences in Coffee Value Chains

In Rwanda the co-ops employ buyers to purchase and collect coffee cherry from the farmers, whereas in the Ethiopian model, farmers tend to deliver cherry to the wet mill collection sites. There are some other differences in the production and value chain as set out in Figure 6 below.

Figure 6: Value Chain Flow (Rwanda / Ethiopia)



Access to Finance

- In Rwanda the co-operatives tend to work with a concentrated export sector: the three biggest are Rwacoff, Rwanda Trading Company (RTC) and Coffee Business Centre (CBC). The exporters provide financial support (operating capital) to pre-finance the purchase of cherry- through the coffee service provider model.
- In Ethiopia, TechnoServe has facilitated a risk sharing facility (see box) between the commercial banks guaranteed by the IFC that has enabled the co-ops to invest in wet mills. This has brought these previously unbanked co-ops into a relationship with investment finance.

TechnoServe led an initiative in 2010 for the co-ops to access finance by helping to establish a new relationship between the International Finance Corporation (IFC) and Nib International Bank, one of Ethiopia's largest private commercial banks. A $10 million Risk Sharing Facility was made available as a revolving loan facility to 62 coffee co-operatives, representing approximately 47,000 farmers (up to $250,000 per co-operative), disbursed against cash flow requirements and collateralized by coffee stocks. These ***previously unbanked co-operatives*** have been able to export over two million pounds of high-quality, washed coffee to 12 international buyers in Europe and the United States.

Co-op Membership and Cherry Purchase

- In **Ethiopia** there is a much closer connection between the co-operatives and their membership. First, a much greater proportion of the coffee cherry processed through the co-operatives are members (over 73% in 2014/5),

whereas the co-ops in Rwanda collect cherry from both members and non-member coffee farmers. In Rwanda only around 35% of coops purchase from members (see Table 2).

- In **Ethiopia**, the farmers tend to deliver the cherry directly to the cooperatives and there are no middlemen purchasing coffee. This provides a leaner cost structure for the wet mills as a significant part of the co-op cost in Rwanda relates to cherry purchase. Once processed at the wet mill, the parchment is graded by the Ethiopia Commodity Exchange (ECX) (ECX quality certification is based on coffee classes (cup quality), types, and grades. The two processing classes are washed and sun dried, and types are determined according to regional and sub-regional origins). Following grading by the ECX, the coffee makes its way to the co-operative Union who trades with the private exporter or directly with the overseas buyer.
- Unions charge 5% of the returns from each of the co-operatives as a management / marketing fee. The rest returns to the co-operatives for distribution (bonus payments, payment of loans, reinvestment or kept as reserve cash). Under the Ethiopia co-operative law, co-operatives are required to retain at least 30% of the profits.

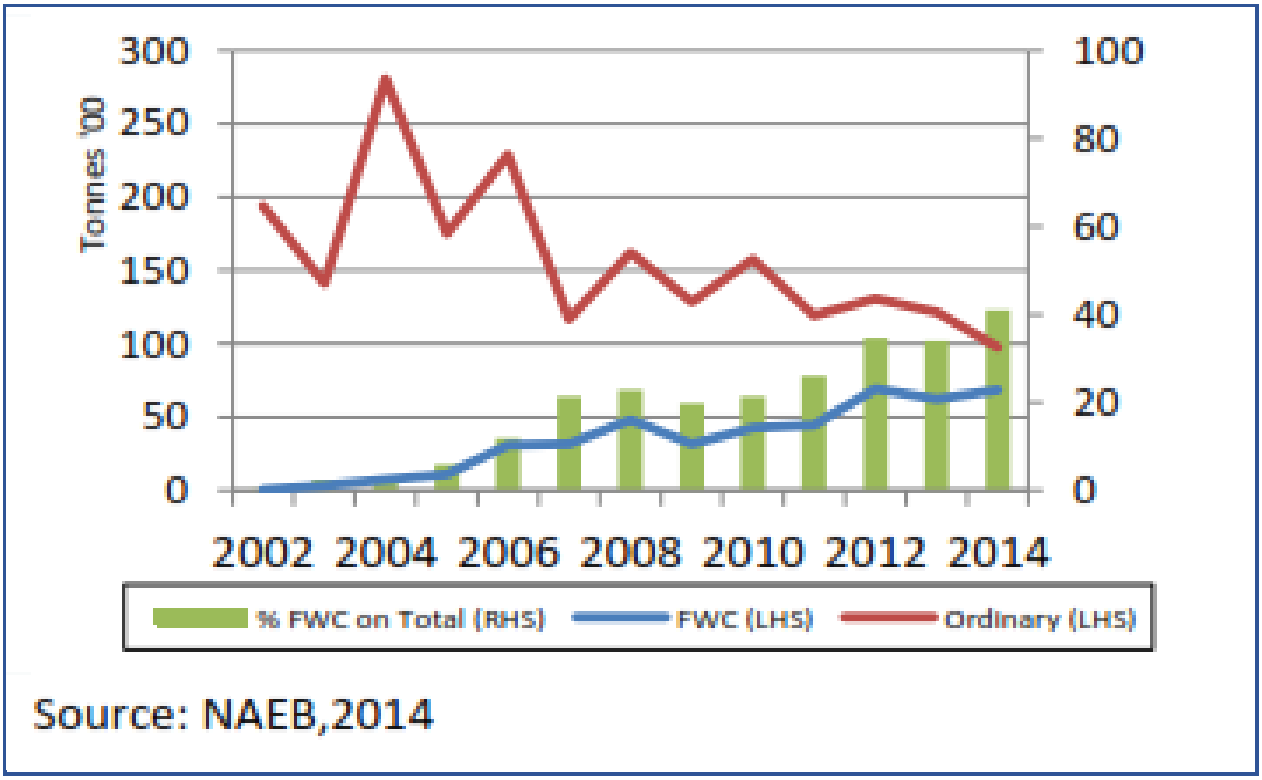
4.2. Key Results of the Wet Mill Programme-Rwanda

4.2.1. Wet Mill Support

The TechnoServe model of supporting wet mills with a combined focus on agronomy including facilitating access to finance is consistent with the (NAEB) Rwandan government strategy for the coffee industry). TNS has facilitated access to finance for the Co-operative owned wet mills through the exporters. Farmers have been empowered to have greater direct links with roasters and share of the export price through the coffee service provider model. There has been an improvement in the efficiency of the value chain by creating a more transparent price incentive system where cooperatives receive higher prices for higher quality coffee and changing the relationship between the coffee exporter and the grower.

The TechnoServe model has contributed to a significant change from farm-produced **semi-washed** parchment coffee to the farmer selling coffee cherry to the Co-op owned wet mills to produce **higher quality fully washed** parchment coffee. There has been a rapid growth in the proportion of coffee that is going through the wet mills increasing from virtually nil in 2004 to over 40% in 2014. TNS supported mills account for around 17 % of the wet mill capacity in Rwanda.

Figure 7: Fully-washed and Semi-washed Coffee Production Rwanda



Source: Macchiavello and Morjaria (2015) op.cit

There are two key patterns emerging from the trends in the last ten years in Rwanda. First, while overall coffee production and exports in volume terms is static, there is an increase in the unit value of coffee as the proportion of fully washed coffee has increased from less than 5% before the start of TNS programmes in 2007 to over 40% in 2014. While export values will have largely followed the swings of the international coffee market as set out in Figure 2, Rwanda has undertaken a step change towards higher quality washed Arabica. TechnoServe has supported 35 out of the 218 washing stations operating in Rwanda in 2015.

4.2.2. The Coffee Service Provider Model

The **Coffee Service Provider** model has enabled access farmers to have the potential for better access to markets and connection with exporters with improved market price transparency. The exporters can in some cases have traceability back to the origin and Co-op/mill which is an important feature for some specialty coffees. In essence the CSP has worked and has solved the problems that it was intending to solve:

(i) Access to finance

TechnoServe has facilitated access to capital for the wet mills through the exporters to finance the working capital to purchase cherry. The exporters and local banks have also financed capital investments and the co-ops have a good record of repaying investment capital quickly, reflected in the low level of debt recorded by the co-ops (see Table 2).

(ii) Access to Premium Markets

The Coffee Service Provider (CSP) model has also proved to be sustainable with a number of exporters continuing the model since the completion of the TechnoServe programme. The SMS

recording of weekly cherry purchases and parchment stocks (an initiative launched by TechnoServe) is enabling a better informed and more orderly market and transparent value chain to emerge. It has also enabled a few co-ops to export their crop, with certification of origin movements and branding by Peet's Coffee and Tea in the USA being one of a number of examples. Whilst the CSP model may not have been widely adopted by all exporters, it is being continued by the leading exporter RTC.

The TechnoServe programme has thus contributed to opening the opportunity for farmer engagement and access to origin based premium as well as some access to the higher value speciality market.

4.3. Rwanda Wet Mills-Key Findings

4.3.1. Farm Price Premium

The primary objective of the TechnoServe programme is to increase returns to smallholder farmers. This requires a clear understanding of the price benefit from encouraging a move from the home production of semi-washed parchment coffee to selling cherry to the wet mill. There are two key issues in making this comparison of the price benefit to farmers. Firstly the farmers, by virtue of their ownership of the cooperatives have moved up the value chain to become coffee cherry processors and some have become exporters through the coffee service provider model and becoming party to export sales. Thus the business status of the farmers has changed and, where possible, this processing gain should be separated from the gains from coffee production

Secondly a comparison of semi-washed prices with cherry prices needs to recognise that there are substantial market movements depending on supply/demand both on the Rwandan market and international market. Demand for semi-washed coffee can be high when the availability on the domestic market is short and exporters have orders to fill. Exporters in 2015/16 were reporting strong demand for semi-washed coffee. An opposing factor as the IGC report records is the growth of demand for cherry as washing station capacity has increased and there is a scramble for cherry.

A simple comparison of the market price for semi-washed coffee in 2015 has been based on a comparison of the farm gate price for semi-washed coffee with the purchase price paid for coffee cherry paid by the TNS mills (first and second payment).

Table 1: Calculation of Washed Coffee Premium 2015

Exchange rate end 2015 1USD= RWF 750

	Unit		
1 Semi- Washed Price average 2015			
-Parchment -Kigali	RWF/KG	900	
-Parchment -Ex- Farm[11]	RWF/KG	840	
-Green equivalent	RWF/KG	1126	
-Cherry equivalent	RWF/KG	168	
-Green equivalent	$/kg	1.50	
2. Cherry Price Paid to TNS Wet Mill			
-Cherry First Payment	RWF/Kg	199.97	
-Cherry Second Payment	RWF/kg	10.66	

[11] Estimated deduction for transport to Kigali from coffee growing regions RWF 60/Kg parchment

	Unit		
-Total	RWF/kg	210.63	
-Green equivalent	RWF/kg	1411.22	
Net price to farmers for cherry – green equivalent excluding cost saving	$/kg	1.88	
Cash Cost saving		*0.00*	
Total benefit – Green equivalent	$/kg	*0.38*	+25%

Source: Rwacoff and IGC

The price premium for TechnoServe supported washed coffee over 'ordinary' semi-washed coffee at the end of the programme in 2012 was calculated as US$0.99 per kg green (US$ 3.91 compared to US$2.92)[12] or 34%. In percentage terms this premium has therefore been maintained in 2015 with a 25% premium over semi-washed, but the absolute premium has fallen to an estimated US$0.38 per green kg. This narrowing of the absolute premium reflects the lower level of market prices in 2015, but has been driven in part by the overall stable level of production in the country and the high number of buyers chasing both semi-washed coffee and cherry[13].

Based on the above data and imputing only a small cash value of the labour cost saved by not producing parchment[14], the overall assessment is that a net farm-gate price premium that was achieved at the end of the programme has been sustained in the four years since the completion of the TNS programme. TechnoServe can claim full attribution for this increase and indeed can claim significant contribution to the wider development of new coffee washing stations (e.g including investments made by Root Capital).

4.3.2. Performance of the TNS Washing Stations

Table 2 shows the provisional and confidential results from an IGC/NAEB project to measure the key performance of Coffee Washing Stations in Rwanda. The Table shows the number of coffee stations surveyed and the key results comparing the TNS supported washing stations with the average of all stations.

Table 2: Coffee Washing Stations in Rwanda

		Surveyed in 2015			Non-Surveyed in 2015			Non-Operational in 2015		
		TNS Coop	Non-TNS Coop	Private	TNS Coop	Non-TNS Coop	Private	TNS Coop	Non-TNS Coop	Private
Province	*East*	**4**	**10**	**21**	0	4	2	2	0	3
	Kigali	**0**	**0**	**1**	0	0	0	0	0	0
	North	**2**	**8**	**11**	0	0	1	0	0	2
	South	**11**	**15**	**28**	1	0	4	1	3	11
	West	**13**	**20**	**54**	0	1	7	0	0	5
# of CWS		**30**	**53**	**115**	**1**	**5**	**14**	3	3	21

Source: Macchiavello and Morjaria (2015) (Confidential)

[12] The East Africa Coffee Initiative :Innovations, Lessons Learned and Results from TechnoServe (Dec 2013)

[14] There would be very little cash cost involved as this would involve generally involve family labour. Some shadow wage value should recognise the cost of pulping and drying to parchment.

Table 3: Key Indicators from Coffee Washing Stations Rwanda

	Unit	TNS supported new wet mills	National Average (i.e. other Co-op+ Private)
Wet Mill Key Indicators			
-Land Area	Ha	1.33 ha	2.88 ha
-Parchment processed	Tonnes	41.4	84.9
-Number of Pulpers	Units	1.40	1.26
-Fixed capital RWF	RWF	36.6mn	116.2mn
-Loan Outstanding- average (No)	RWF	54.8mn (7)	99.7mn (73)
Connected to grid	%	*27%*	*29%*
Average drying capacity	M^2	1150	2586
No of Farmers Purchased	No	535	815
% Co-op Members	%	*34.7%*	*n/a*
Wet Mill Operations			
Total Costs of Production Parchment *TNS/Average*	RWF/KG %	1,344 *93.8*	1,433 *100*
Cherry Costs/kg Parchment	RWF/KG	999.7	1,068.2
Labour costs/KG Parchment	RWF/KG	84.6	94.6
No of Permanent Employees	No	3.7	5.3
Farmers			
% of Farmers with Long Term Relationship with Mill	%	*64%*	*65%*
% farmers supported with extension	%	*11.8%*	*31.8%*
Average Price of Cherry	RWF/Kg	200.0	214.6
Second Payment	RWF/Kg	17.8	12.6
Total Payment to Farmers	RWF/Kg	217.8	227.2
((Cherry to Parchment	ratio	5.44	5.03

Source: Macchiavello and Morjaria (2015) (Confidential)

It should be noted that the Coffee Initiative focused on some of the more challenging areas where private operators were not interested in setting up wet mills. This included areas of low coffee density and lower availability of water for wet mill operations. Key findings include:

- The TNS supported mills are **smaller** (roughly half the average size in terms of drying capacity), with **a lower unit cost base** (-6.2%) than the average with **less capital employed** and **significantly lower labour costs**.
- The TNS supported Co-ops have leaner operating costs and have lower loans outstanding at RWF 55mn (US$72,000), approximately half the average.
- However, whilst an overall profitability analysis has not been undertaken, the private mills are obtaining **higher overall prices** for parchment and a greater proportion or **higher grade** parchment than the TNS supported mills

- The TNS supported mills are not paying farmers any higher than average prices for cherry although the **second payment is higher**. However this payment is below optimum (see below).
- Only **34% of the cherry** purchased by co-ops are from co-op members.
- It is noted that **10% of the TNS** supported co-ops were not operational in 2015 compared to a **higher proportion (-18%)**of non-operating private mills.
- Relative few co-ops are **providing extension support** to farmers (12.8%) and lower than the national average, although a large proportion of farmers have already received training through TechnoServe's Farm College.

The IGC/NEAB analysis does not include the overall profitability of the mills by ownership type but focuses on the cost structure and capacity utilisation. The study notes that there is now excess capacity with the existing washing stations, and the key challenge is not a shortage of cherry for the wet factories to process – over 50% of Rwandan coffee is semi-washed and by-passing the wet factories.

The key issue is therefore to align the incentives and ensure that the benefit of the washed coffee premium is passed back to the grower. Given that overall coffee production in Rwanda is not increasing, there remains a steady demand for semi-washed coffee and the co-ops therefore need to ensure that the cherry price and the **second payment** to the grower incentivises the farmer to sell cherry to the wet mills. The wet mill option for farmers should be made more attractive, given that a farmer can receive the payment for semi-washed coffee in one instalment.

Annex 2 summarises the key findings from the field and it is noted that out of 5 wet mills visited, many were in need of some **technical assistance and management support** to improve operations. A number lamented the absence of TNS contact other than from SMS activity. In our view only 1 of the 5 mills visited could be considered fully sustainable without some support.

In particular there was a general tendency for the **co-op to reinvest in new pulpers** when more adequate maintenance would have prolonged the life of the existing plant. The reinvestment as well as in some cases, strengthening additional and diversified facilities.

Whilst the TNS supported co-operative mills have low management and operating costs and therefore have the potential to be more competitive than the privately run mills, evidence from the visits indicates that the private mills are expanding more rapidly and securing a greater proportion of the coffee crop. The impression given to the evaluators is that the co-ops are not being run **sufficiently along strict business lines**, or fully in the interest of the farmer members as a whole. Many of the co-op presidents are semi-retired farmers who have an interest in building a community institution and legacy as well as running a wet mill. As a consequence they are not returning a sufficient proportion of the cherry return to the farmer.

While an obvious policy recommendation to increase the percentage of FWC exports is to increase the number of CWSs in Rwanda, we recommend against this given it might exacerbate the negative efficiency effects of competition. An alternative strategy to increase production is to increase the capacity utilisation of each station through programs to improve existing station management with a particular focus on managing relationships between farmers and stations.

Macchiavello, R and Morjaria, A (2015): *Policy Brief: Coffee Washing Stations in Rwanda; An Overview of Issues & Policy Recommendations International Growth Centre*

Another common issue was the general problem of **spare part** availability and the servicing of pulpers which has led to over-investment in wet mills. Pulpers were being replaced after only 3 years' service instead of servicing and maintaining the existing plant. While the lack of maintenance on some of the wet mills was very evident to the evaluators, a number pointed to the lack of availability of some key spare parts for the Penagos machines which led co-ops to invest in new pulpers.

So while there is very positive evidence that the price premium, and therefore income premium to the smallholder coffee farmer has broadly been maintained for fully washed coffee since the end of the TNS support in 2012, the wet mills supported are in need of management and technical support in the long term and there is a clear need for the emergence of a cadre of technical and maintenance service providers to be available to the sector as well as improvements in the availability of distributors of replacement parts for coffee pulpers.

The evaluators while recognising the capacity utilisation issue identified by Macchiavello and Morjaria would suggest that the above practical measures to support the operations and management of wet mills and realigning the incentives for smallholders to sell cherry and have a greater stake in the wet mills that they own would be equally effective.

4.4. Key Results of the Wet Mill Programme Ethiopia

TechnoServe started its wet mill programme in the Oromia region centred around Jimma and Bonga. This area is at the centre of the former Kaffa Kingdom where coffee originated, and where in the 500sq kilometres of the Bongo Forest Reserve naturally growing "forest coffee" is still found. In spite of this area being the centre of coffee production with very favourable growing conditions, when TechnoServe started work here there were very few wet mills in operation. "Jimma coffee" was thus associated with poor quality.

Unlike Rwanda, where washed coffee production was virtually non-existent at the start of the TNS programme, there were a substantial number of washing stations operating in the South of Ethiopia. However, there were a limited number of washing stations in the Jimma and Agaro areas, some of which were a legacy of the major EC Coffee Improvement programme in the 1990s. There were 119 wet mills operating in Jimma/Illubabor at the start of the TNS programme and by 2015 there are 188 operating, of which TNS has supported 69. For most of the 69 co-ops, the farmers did not previously have access to a wet mill. TNS mobilised the farmers and in the majority of cases started the co-operatives. In the case of a few co-ops, however, TNS worked with existing institutions and facilitated the coop's reform and renewal. The evaluation team made visits in 12-15 January 2016 to 5 co-ops (2 in the Kaffa Region: Diri and Michiti; and 3 in the Agaro region: Duromina, Biftu Gudina, and Hunda Oli).

There is a large premium paid for washed coffee compared to the sun- dried or 'jenfel' coffee in Ethiopia. Therefore, unlike Rwanda where there was an incremental premium between semi-washed coffee and fully washed through the washing station, there was a major step change from sun-dried to washed coffee in Ethiopia.

As a result of the development of the washing station, farmers started to deliver cherry to the co-op rather than wait for a buyer to come and purchase 'jenfel'. It has been a complete change in the farming system. In delivering the cherry to the coop there is a clear association with the wet mill as being owned by the farmers. The mills in Ethiopia not only received greater buy-in from their members but have also reduced procurement costs.

The step change in the price received by the farmer has been very significant. Typically in the pre-TNS period a farmer would receive 3/birr kg Jenfel and some are now receiving as much as 10birr/kg for cherry at the mill.

4.4.1. Analysis of Farm Price Premium

Table 4 shows the price premium received by farmers for washed coffee of over the average sun-dried coffee (jenfel) for the 49 mills supported under the 2010 programme for the last 4 years, three of which were after the completion of TechnoServe support. An adjusted added value is calculated based on the difference between the Ethiopian Coffee Exchange (ECX) price for jenfel and the value of the washed coffee as received by the mill and returned to the farmer. The table shows both the arithmetic average i.e. the difference in the average jenfel price and washed price for the 49 mills; and an average price weighted by the volume of sales. The details of the calculation are shown in Annex 2.

Table 4: Farm Gate Premium Ethiopia

Year	Adj value add ($/kg green)	% premium over farmgate price
2011	$0.90	41%
2012	$0.82	41%
2013	$1.35	49%
2014	$1.25	45%
Average	**$1.08**	**45 %**

Source: TechnoServe/ECX data (see Annex 1)

It should be noted that the weighted average premium is consistently higher than the arithmetic average, which reflects that a number of the larger mills, notably Duromina, have achieved above average returns to farmers.

The overall conclusion from the data is that the gains recorded at the end line survey by TechnoServe have been maintained over the last three seasons and that this premium has increased substantially on the US$0.82/kg reported at the endline in 2012. The premium for TechnoServe supported washed coffee over unwashed coffee at the end of the programme in 2012 was calculated as $0.82 per kg green coffee (USD$ 4.16 compared to US$ 3.34) or 25%. This premium has increased by 31% to an average of $1.08 per kg green coffee over the past three seasons, representing a farm-gate price premium of 45%. A more detailed analysis is summarised in Annex 1 which shows a wide range in the price premium between the mills which reflects a range of the factors including and the performance of the mill, weather factors and the volatility of the coffee market.

4.4.2. Analysis of Wet Mill Profitability

TechnoServe collects data on the cost structure and profit and loss for each of the 89 mills supported. Figure 8 shows that there is a very wide spread of the profitability of the mills with the data shown for the last two years for each of the four cohorts. The table also shows that there are few outliers of very poor performing mills regarding large losses (from the 2012 cohort), but in general there is an interesting positive correlation between the size of the mill and its profitability.

Figure 8: Cross Sectional Profitability of the TNS Supported Wet Mills by Cohort 2013-14

Figure 9: Profitability of the Wet Mills by Cohort 2009-2014

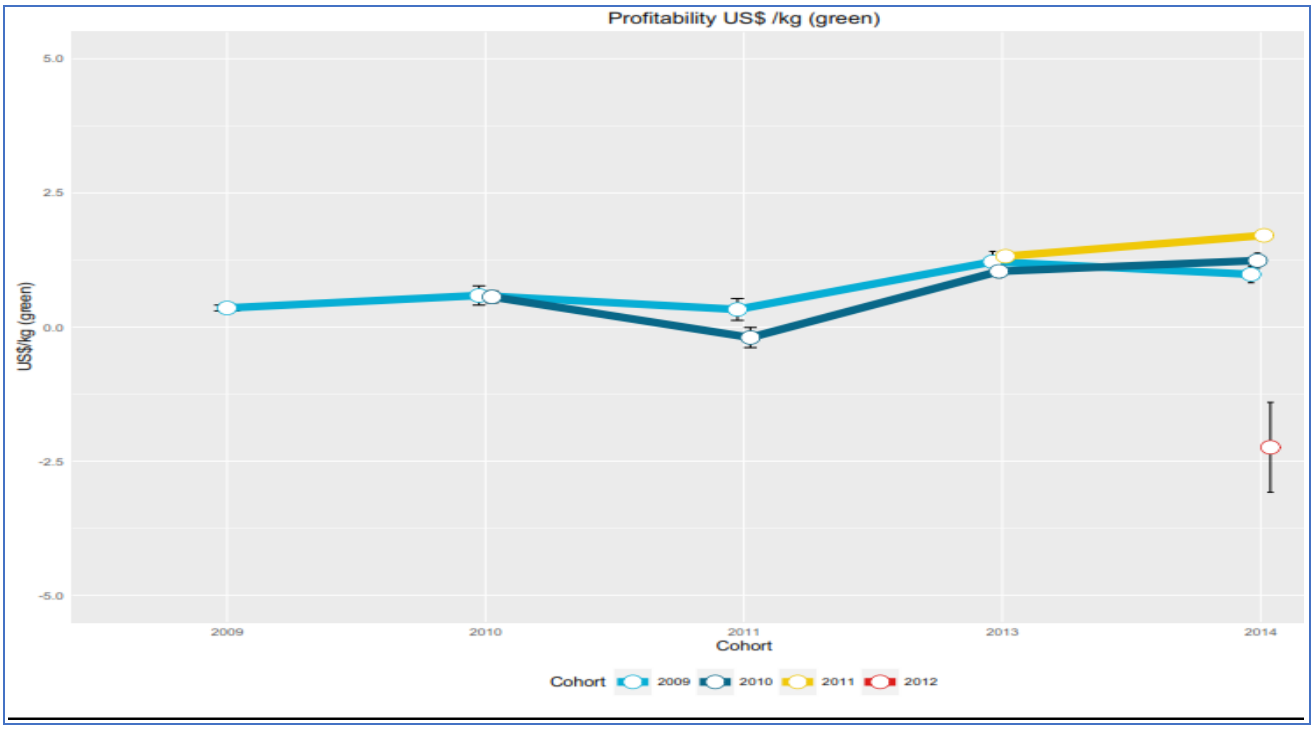
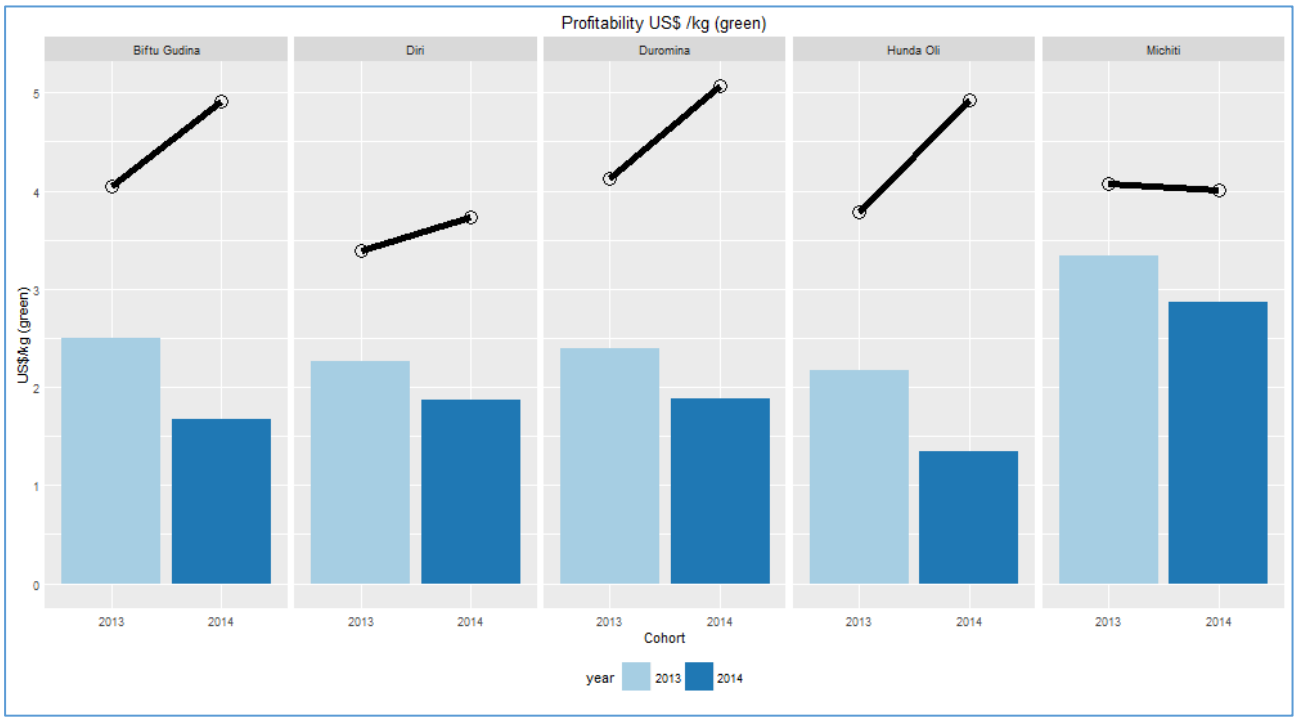


Figure 8 indicates that not only the cohorts of mills supported have remained profitable over the past 3 years, but that the general trend is towards a gradual increase in the profitability of the mills for all of the cohorts. It should be noted that the 2012 cohort recorded poor performance in their first year which is recorded in 2014.

While it is recognised that the six coops visited by the evaluation team may not have been representative of all 89 mills, the impression given was very positive. All 5 of the mills were performing well as set in Figure 10.

Figure 10: Profitability of the Wet Mills reviewed in 2013-2014



The histogram shows the **net profit** of the five mills visited which is returned to the farmer and the black lines show **the gross profit of the mills**, not including the retention by the mill for new investment. All five mills displayed very strong profitability and were able to invest substantially in the expansion of their mills.

All coop leaders visited demonstrated a strong business acumen and also a very clear sense of being empowered to drive forward their coffee communities. The TNS model has enabled smallholder coffee to undertake a step change with a transformational impact on the communities (see examples in Annex 1). The challenge in the future will be to ensure that the co-ops led by part time volunteers can maintain the momentum. The managers and staff of the co-ops appear to be dependent on the co-op leadership. In the longer term, the sustained growth and management of the coops will require a stronger cadre of paid management making the day to day decisions to run the co-ops with appropriate systems and checks and balances in place.

5. Measuring the sustainability of the agronomy programme

5.1. Overview and objectives

This evaluation focuses on the agronomy programme, which between 2009 and 2015 trained 139,609 smallholder coffee farmers across Ethiopia, Kenya, Tanzania and Rwanda in agricultural best practices. The training took the form of monthly classes on 11 different agricultural best practices (BPs) over two years. Groups were given training in small groups of around 30 farmers, each managed by a TechnoServe-trained 'farmer-trainer'. Training was based at focal farms with demonstration plots so that farmers could see physical evidence of the benefits of adopting agricultural best practices, as well as try out implementing the best practices themselves.

This analysis focused on farmers in Rwanda, where 25,857 smallholder coffee farmers benefitted from TechnoServe training. The survey sample was drawn from a single (2010) cohort which consisted of 9,123 farmers trained during 2010-2011. Rwanda was chosen because the agronomy programme had not yet been fully rolled-out in Ethiopia by 2011, and the evaluation wanted to investigate the retention of agricultural techniques 4 years after the completion of training.

The primary objective of the evaluation is to assess the extent to which the use of best practices taught to smallholder farmers by TechnoServe have been sustained since the completion of the programme. The best practices (BPs) taught by TechnoServe were:

- Record keeping, Mulching, Coffee Nutrition, Weeding, Pruning, Application of fertiliser, Rejuvenation, Integrated Pest Management (IPM), Safe Use of Pesticides, Erosion control, and Shade.

In order to measure the overall sustainability of the agronomy programme, the ideal measure would be to undertake a yield survey during the 2016 season. However, this presented a number of methodological issues - in particular in adequately identifying a constant sample of farmers as well as operational issues associated with a physical measurement survey which would require farmers to reliably and frequently record their cherry production throughout the season.

Given the difficulty of assessing yields, and the natural variation between yields in different regions, IPE Triple Line and TechnoServe agreed that the study would only focus on agricultural best practice adoption and assess the extent to which farmers were still adopting best practices.

However, the link between best practice adoption and yield has an empirical foundation. The adoption of agricultural best practices is expected to significantly increase yield. This relationship has been verified both in previous studies and specifically within the context of smallholder coffee farmers in Rwanda in the *Independent Assessment of TechnoServe's Coffee Agronomy Training Programme* (Laterite Ltd, 2013). IPE Triple Line supplemented the analysis of this relationship through self-assessment questions of the impact of TechnoServe best practices on yield.

The figures for best practice retention were compared with Laterite's end-line report (the *Independent Assessment of TechnoServe's Coffee Agronomy Training Programme).* However, that report also examines safe use of pesticides, which was removed from this survey. The Laterite figures presented here have been recalculated having removed safe use of pesticides, and therefore are different to the figures presented in the original report. There are three further comparability issues worth noting. Firstly, the sample for this survey was drawn from 3 cooperatives (Misero, Giseke, and Nyarubaka), whilst the Laterite sample was drawn from several more. Differences at the cooperative level could therefore affect the comparability of the surveys. Secondly, the sample for the Laterite survey was drawn from the list of farmers who attended at least 50% of TechnoServe's training sessions. The Triple Line survey sample was drawn randomly from the total list of farmers registered by TechnoServe, some of whom attended less than 50% of the training sessions. Finally, the Laterite baseline survey was not conducted with the 2010 cohort of farmers prior to taking the training, but rather the 2012 cohort prior to taking the training. The Laterite post-evaluation survey and the Triple Line survey were both conducted with the 2010 cohort. The baseline thus is drawn from a different sample and may have an upwards bias if there were peer-group effects from the first two years of training.

5.2. Methodology overview

The in-person survey of smallholder Rwandan farmer households was conducted over three weeks in August 2016, using locally trained enumerators and tablets with Open Data Kit Collect

software.[15] The farmers were contacted by going through the cooperatives and the TechnoServe-trained farmer trainers. After data-cleaning, the sample was composed of 620 households.

A control group was not used for the survey. The objective was not to evaluate the impact of TechnoServe training by comparing TechnoServe trained farmers with non-TechnoServe trained farmers, but rather to measure the sustainability of the programme. The key purpose of the survey is to record the change since the endline survey in 2012, and not to measure the additionality of the programme compared to a control group.

5.3. Sample methodology

IPE Triple Line used a multi-stage cluster sampling methodology to build our sample of Rwandan small-holder coffee farmers. In our first stage, we selected three cooperatives out of the total of 10 which TechnoServe had worked work. In the second stage, we randomly selected a sub-sample of focal farmer groups from these three cooperatives.[16] Our final sample was comprised of every farmer trained at the randomly selected focal farms/focal farmers.

There were two reasons for this method: practicality and statistical representation. It was practical to work through cooperatives and focal farmer groups, as that replicated TechnoServe's original programme and facilitated survey enumerators in identifying and accessing smallholder farmers for interview.

Significantly, the method used also helped deliver statistical representation. Multi-stage cluster sampling is also likely to give more accurate results when most of the variation (heterogeneity) in the population is within the groups, not between them.

Our sample size was arrived at based on the following criteria:

- To ensure the sample population was as representative as possible of the population in general (based on known characteristics e.g. attendance rate, gender) i.e. to ensure statistical significance of results at 95% confidence level with a 5% confidence interval.
- To ensure a household level survey could be conducted in a practical and timely manner.
- To ensure maximum participation of the sample group of farmers.
- To cover all farmers who participated in the training programme – i.e. those that attended any number of training sessions.

5.4. Sample outline

The 3 selected cooperative areas, out of the 10 trained by TechnoServe, were Giseke, Mizero, and Nyarubaka. These 3 cooperatives were chosen for reasons of practicality; they were clustered relatively closely together, and was in an easily accessible area – especially when compared to the other cluster of cooperatives which received TechnoServe training, which are in the far west of the country close to the border with the Democratic Republic of Congo. There were also towns in the area with suitable facilities for training and housing the enumerators.

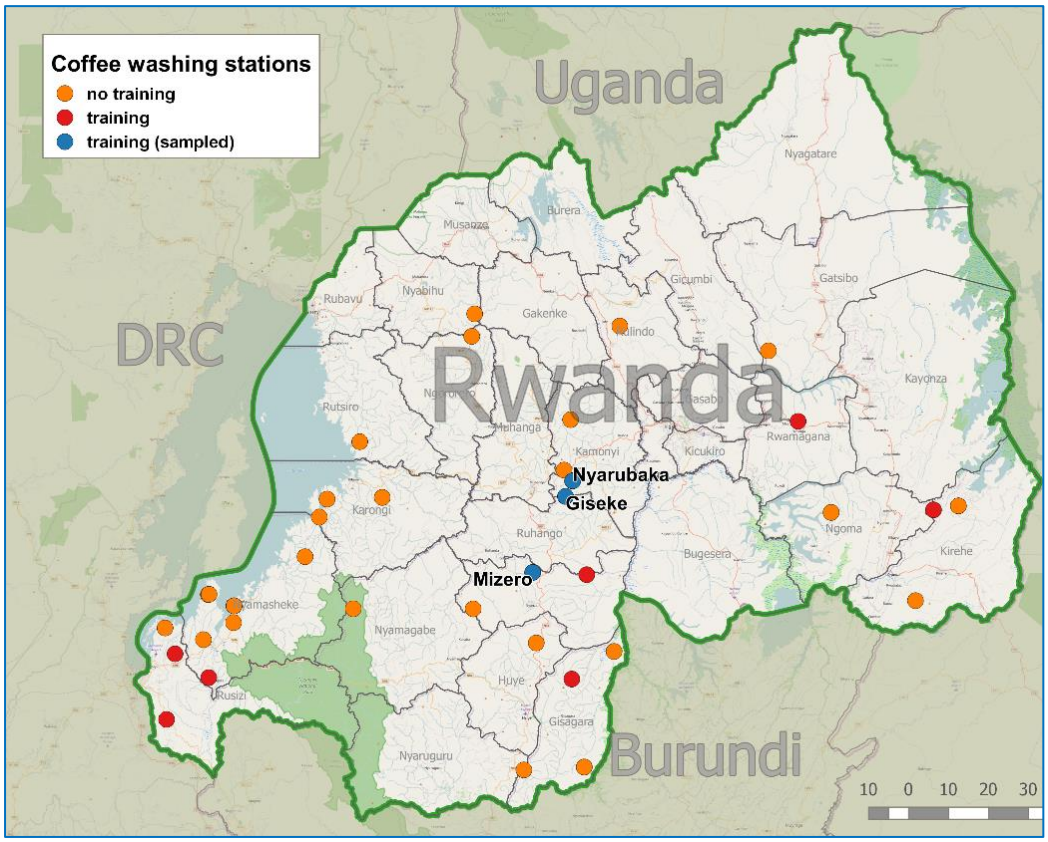
The 3 cooperatives chosen had 2354 farmers who attended at least one agricultural BP training session by TechnoServe. They were distributed amongst 116 focal farmer groups where training was led by a farmer-trainer. 33 focal farmer groups were then randomly selected, each

[15] https://opendatakit.org/
[16] Focal Farmer Groups are the clusters of farmers trained together in a village around a demonstration plot belonging to a Focal Farmer

representing one group of smallholder farmers. Our sample consisted of every farmer trained by our randomly-chosen focal farmer groups – providing an initial sample of 765 smallholder farmers.

Our estimated non-response rate was 10-12%, given that some farmers would be farming different crops, have moved out of the area, passed away, or refused to answer the survey. Where possible, we recorded the reasons for non-response to evaluate whether there were any significant themes or trends as to why farmers had dropped out of our sample.

Figure 11: Map of coffee cooperatives in Rwanda



5.5. Survey questionnaire and best practice adoption rules

The survey questionnaire was composed of 4 main sections: household demographics, questions on assets and wealth, questions on coffee production, and questions on BP adoption. A full version of the questionnaire can be found at Annex 1.

The survey was devised by IPE Triple Line and validated and agreed by TechnoServe in English. It was then translated into Kinyarwanda, the predominant local language, by a local agronomic trainer who had previously worked with TechnoServe and Laterite. Enumerators had access to both language versions and a supporting set of enumerator notes to guide the interviews that were consistent with notes previously used by TechnoServe.

Our BP adoption rules provide a framework with which the survey enumerators evaluate whether farmers were using TechnoServe's BPs or not. The rules were built with TechnoServe input, and were designed for comparability with earlier Laterite evaluations of BP use. This ensured that the survey could be compared both for Laterite's initial baseline and their 2012 post-intervention evaluation.

Where possible, adoption rules were based on visual checks and not on farmer questions or self-assessment. This was perceived to be the most reliable method of validating adoption, given problems around the reliability of farmer self-assessment and recall. However, that comes with the caveat that some farmers don't carry out some best practices all year around. Visual evidence is therefore not a totally reliable indicator of best practice adoption. The comparison for this survey – Laterite's study – used data drawn from two visits to record best practice use. Given their greater spread over the year, this could explain why their results record more best practice use.

Table 5: Best practice survey adoption rules

Best practices	BP adoption rule
Record Keeping	Visual check of record card
Mulching	Visual check of mulch and mulch location
Weeding	Visual check of weeds under tree canopy and weed size
Coffee nutrition	Visual check of tree health through inspection of leaves
Composting	Visual check of evidence of compost
Rejuvenation	Visual check of number of stems, age, and thickness
Pruning	Visual check of at least two types of pruning techniques used
Safe use of pesticides	Visual check of PPE equipment and question about pesticide disposal. Non-users of pesticides classed as adopters.
Integrated pest management (IPM)	Question about knowledge of techniques for combatting Antestia and leaf-rust, with at least two known techniques
Erosion control	Visual check of at least one type of erosion control
Shade	Visual check of medium shade cover, or question about newly planted shade trees

5.6. Survey methodology

IPE Triple Line identified and recruited a team of 15 experienced local enumerators to carry out the survey. Enumerators were split into three teams, each led by a supervisor. The enumerators all had previous experience with primary data collection in agriculture, and 13 had specific experience in primary data collection from coffee. The overall team was supervised by a

TechnoServe trained master-trainer, and the data managed by an expert from the Rwandan National Agricultural Export Development Board (NAEB) who had also previously worked with Laterite in their data collection.

The survey used tablet computers, rather than pen-and-paper. Tablets allow for photo verification of best practices, and Global Positioning System (GPS) verification of location. Prior experience also suggested that data integrity and security is guaranteed where data was backed up on a daily-basis to a remote server (cloud storage) e.g. there was less chance of survey records getting lost when using tablets compared to pen-and-paper, especially when surveys were conducted on-site in remote rural areas.

Our enumerators were trained by the IPE Triple Line team in the use of OpenData Kit Collect software running on Android Tablets. This software was chosen because it is open-source (and therefore cost-effective), reliable and field tested with a large community of users and support. It also was data-light, meaning that there was less chance of data transmissions being lost through poor network connections, when compared to other options. Finally, the software allowed for remote real-time monitoring, allowing IPE Triple Line to quickly identify any problems from the central office.

The enumerators received three and a half days of 'classroom' training to ensure they were familiar with the survey software and survey questions. The training was conducted in both English and Kinyarwanda to ensure maximum comprehension. Enumerators were also issued with a set of notes to ensure they understood the logic of each question, and had clear instructions on when and how to prompt respondents.

Half a day training was conducted at two coffee farms, where specific agronomic training was provided on a demonstration plot to enable enumerators to recognise evidence of BPs being carried out. The group was taken to both a high-yield and a low-yield plot, to help the enumerators learn to identify evidence of best practices. Enumerators were also given an information pack with detailed descriptions and photos to help identify best practices.

Focal farmers accompanied enumerators on survey trips to identify the right farmer and avoid contamination of our sample. Enumerators also had to record their geographical coordinates mid-survey using the phone's GPS to verify their location to further ensure the reliability of the sample e.g. that farmer interviews were being conducted in unique locations.

The survey was piloted for 3 days, and then suspended for 2 days to carry out data checks and quality control with the survey team reflecting on comments received from the enumerators on how well the questionnaire and survey software/hardware was performing.

As part of the survey enumerators took photos of best practices, where possible, for later verification by IPE Triple Line.

The survey was planned to take place in August 2016 for the following key reasons:

- This was not during harvest time so farmers should be more readily available for surveys.
- Farmers conduct pruning during June/July and so by August there should be evidence of pruning
- Fertiliser application of Nitrogen-Phosphorus-Potassium (NPK) should have been applied in April/May and this should be evident in the nutritional health of the trees observed by August.

5.7. Data cleaning

Our original survey list was composed of 765 unique household IDs (HH-IDs). 123 farmers couldn't be located or were no longer farming coffee, and one farmer refused to answer the survey.

A further 14 survey responses were lost through technical errors, with one tablet malfunctioning and some records lost as a result. 7 survey records were recorded against farmer's names who were not in the original sample frame, and were removed, to avoid contaminating our survey with any farmers not trained by TechnoServe.

This left us with a final sample of 620 respondents. Our non-response rate was 19%. However, only 21 non-responses were due to technical or sample errors, and only one respondent refused to answer, suggesting that there were no major problems with the survey design or implementation.

Table 6: Survey sample breakdown

Original Dataset	765
Survey non-respondents	124
Lost due to technical error	14
Incorrect names	7
Final no. unique HH IDs	620

5.8. Sample summary statistics

In Annex 6.2 we present statistical t-tests comparing each sampling stage (surveyed cooperatives, sample population, and survey population) with the general population, using the variables shown in the table below. The t-tests show that there are statistically significant differences between our survey population and the general population, which could cause a small upwards bias to our results. However, the differences, whilst statistically significant, are small. We therefore do not think these differences have had a material impact on our main conclusions.

It is recognised that the cooperatives selected could be above average compared to the overall TechnoServe programme. For example, the attendance rate of TechnoServe training sessions was higher in the cooperatives we visited.

This discrepancy was partly due to gender disparity – women were more diligent in attending training sessions than men, and within our surveyed cooperatives women were more likely to be the main farmer.

There was also a difference between the survey population attendance rate and the cooperative survey attendance rate. The former was higher because drop-outs (those who were in our original sample but were not surveyed because they couldn't be found) had a below-average attendance rate.

A similar mechanism is also the explanation for the difference in the percentage of untrained farmers (defined as those who attended less than 50% of sessions).

To be purely representative, and to reflect that there are some differences between cooperatives, the survey would have had to incorporate members of every cooperative. This idea was not considered feasible, given their geographic distribution across the country. Although it would have

been possible to create a counterfactual group of farmers receiving less training, we took the view on Technoserve's recommendation that although our approach could have resulted in bias in for example the overestimation of best practice adoption for the entire population, the Laterite Agronomy Assessment Report of 2011 confirmed that there was no "*conclusive evidence on farmer trainer over-reporting in either the yield or best practice*" where no control group was used. Further any reporting bias was likely to be within acceptable limits (i.e. between 5 – 15% overestimation depending on the best practice in question

Table 7: Sample summary statistics

	Dataset of 10 cooperatives	Dataset of 3 chosen cooperatives	Sample pop.	Survey pop.
N	9,231	2,843	765	620
% untrained farmers	14.9%	12.7%	10.7%	8.4%
% attendance rate	71.7%	74.9%	76.0%	77.4%
% where men were the main farmer	61.7%	53.5%	53.2%	53.7%
% where women were the main farmer	35.9%	44.1%	44.8%	44.4%

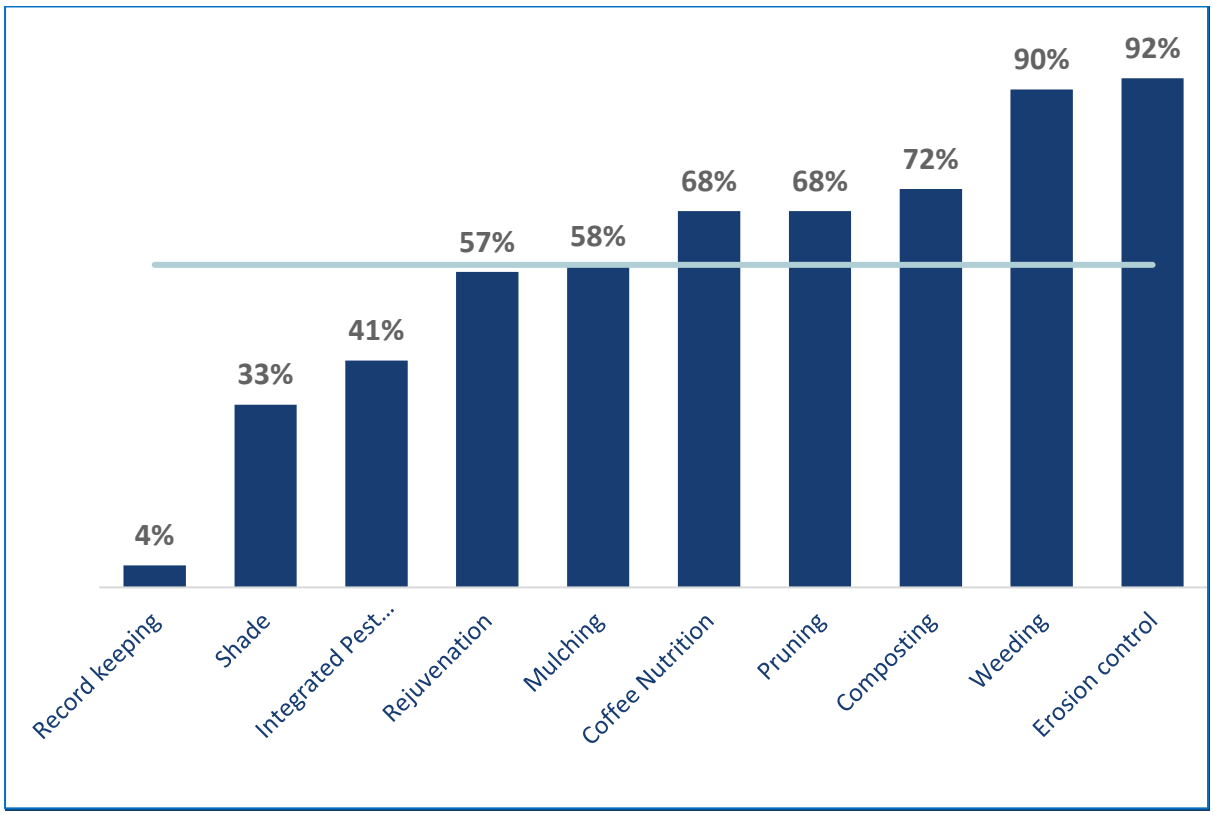
5.9. Analysis of survey results

This analysis is based on the survey of Rwandan smallholder coffee farmers carried out by IPE Triple Line in August 2016. We first present the results on the sustainability of best practice adoption, before exploring what the survey revealed about the relationship between best practice adoption and self-assessment of yields. We then analyse the profiles and household characteristics of best practice adopters to try and understand more about the type of farmer who continued using TechnoServe best practices. Finally, we study the profiles of the non-respondents, to observe whether there were any common trends as to why respondents were unable to be reached. Throughout the analysis, when comparisons are made they are statistically significant using t-tests with a 95% level of confidence, unless noted explicitly otherwise. The t-tests are all outlined in the Annex 2.

5.10. Analysis of best practice retention

There was a large variation between the adoption of the different BPs, ranging from 4% to 92% of farmers adopting a practice. The average level of adoption for each BP was 58%. The highest level of adoption was for erosion control, closely followed by weeding. The lowest was for record keeping. Farmers were given record books by TechnoServe, but they would have run out by time of survey, possibly explaining the disappointing result in that category. However, this practice does not directly contribute to coffee tree yields.

Figure 12: Adoption of best practices (% of trained farmers)



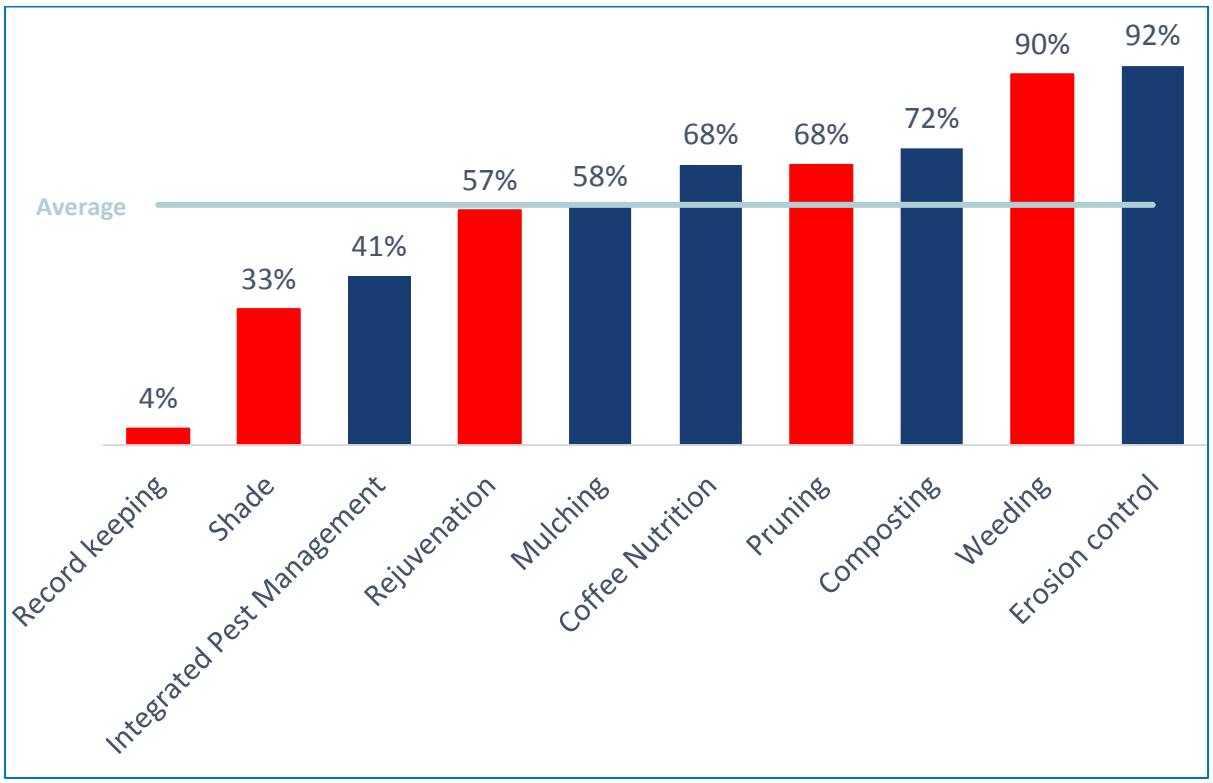
We looked for statistically significant relationships between a farmer's attendance rate at TechnoServe training sessions and BP adoption. For 5 BPs there was a statistically significant positive relationship between the overall attendance rate and BP adoption (with a 95% level of confidence).

The 5 BPs for which there was a positive relationship between adoption and overall attendance rate (shaded in blue on the graph below) were:

- Mulching
- Weeding
- Pruning
- Integrated Pest Management (IPM)
- Erosion control

For the other best practices, there was already prior adoption or the relationship wasn't strong enough to appear in the data.

Figure 13: Relationship between overall attendance rate and best practices



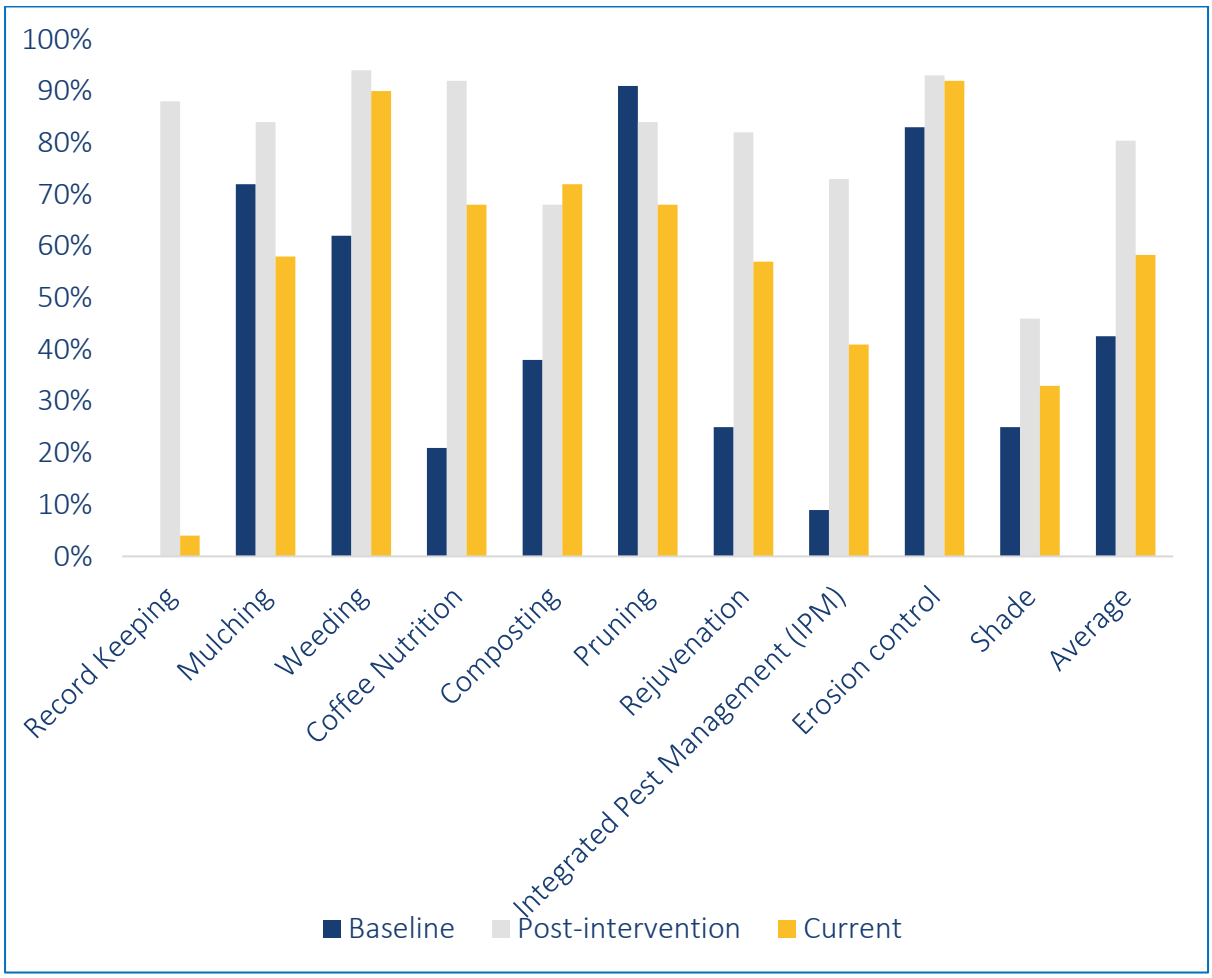
Statistically significant positive relationship between the overall attendance rate and BP adoption

No relationship between the overall attendance rate and BP adoption

The most significant fall in adoption from immediately post-training to current day were in record keeping (88% to 4%). The adoption rules for record books were reliant on visual checks of specific equipment, which farmers may not have been able to maintain since 2011. For record keeping, the enumerator required a visual check of a record book. In some categories, usage appears to have risen (e.g. composting). This could signify either peer group effects, a greater appreciation of the benefits of that best practice, or the absence of Government subsidised fertiliser.

Pruning was used more pre-intervention than either immediately post-intervention or now. This could highlight the difficulty in using visual checks, especially in an environment when some practices are carried out seasonally.

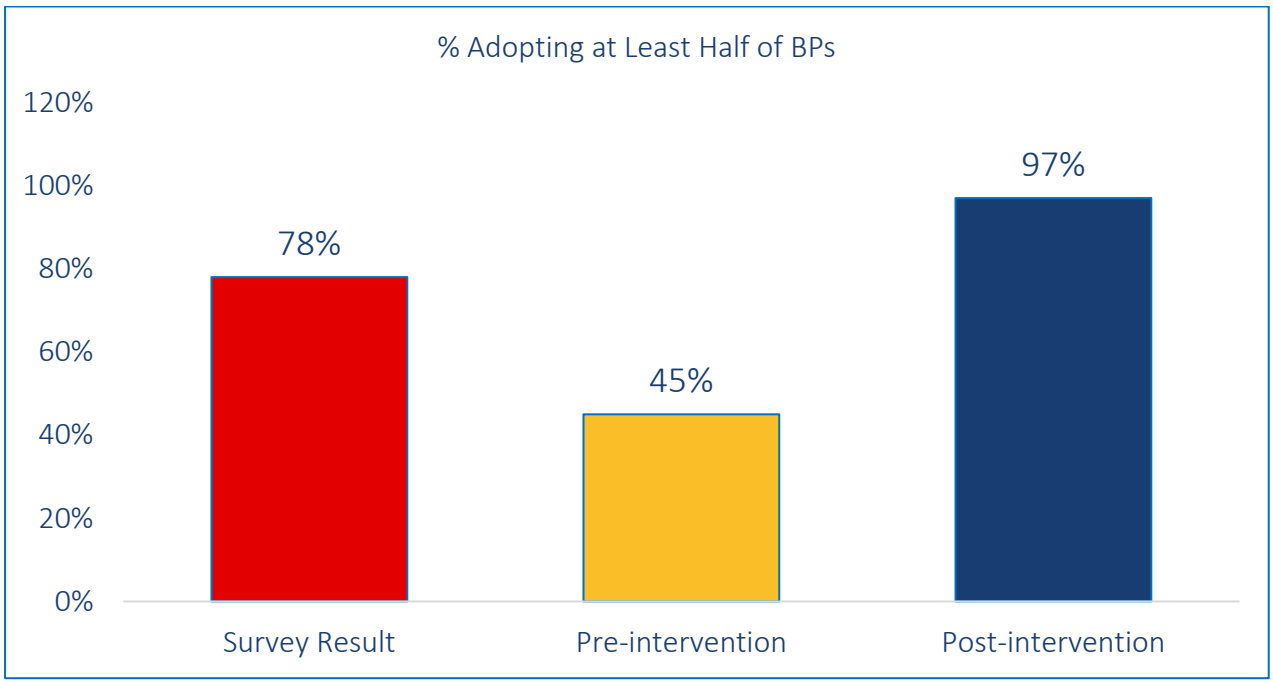
Figure 14: Comparison of best practice use before and after training



The original metric used by Laterite and TechnoServe in comparing BP adoption across cohort and geographic regions was the percentage of farmers employing at least half of all BPs.

This evaluation found that 78% of farmers were still employing at least half of the BPs taught through TechnoServe's agronomy program, 5 years after the training ended. This figure compares with 45% for pre-intervention, and 97% immediately post-intervention. We define farmers who use at least half of all BPs as 'BP high adopters'. Farmers who use less than half of the TechnoServe BPs are referred to as 'Low adopters'

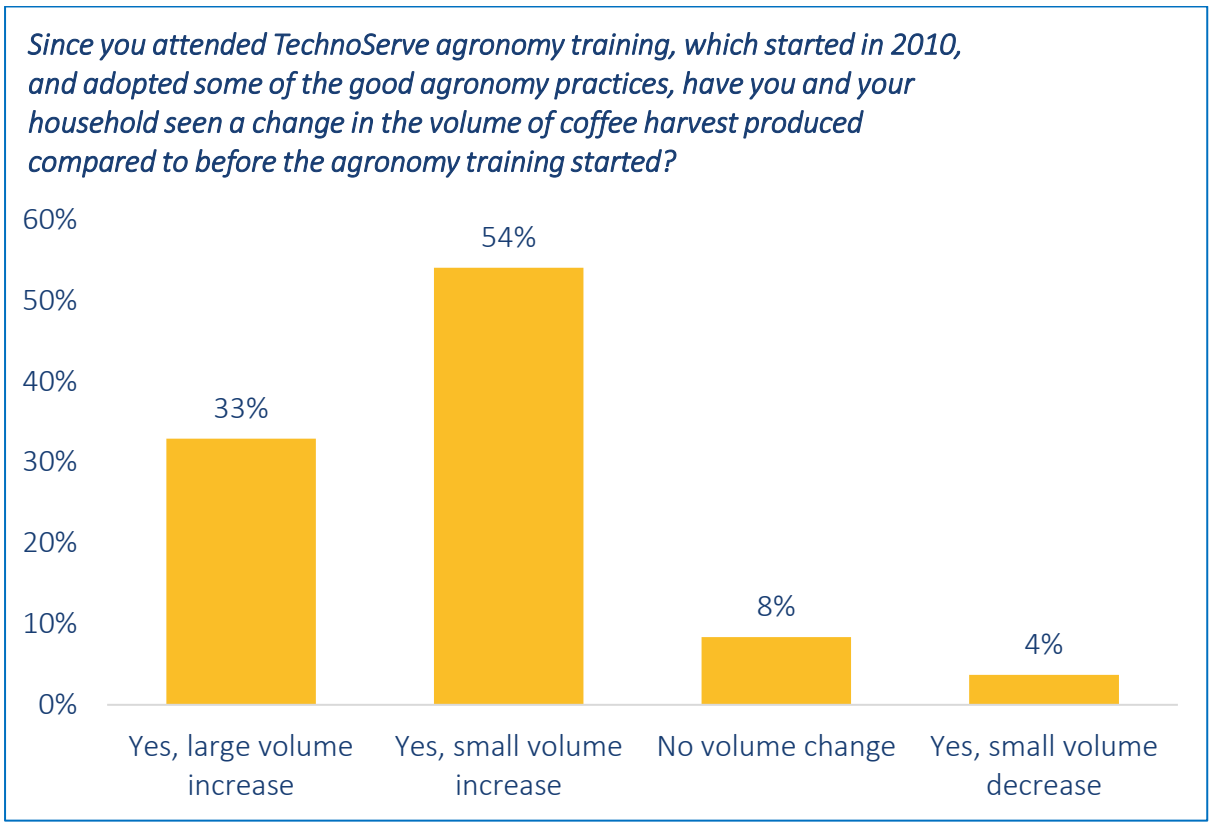
Figure 15: Comparison of best practice high adopters before and after training



5.11. Exploring the relationship between best practice adoption and yield

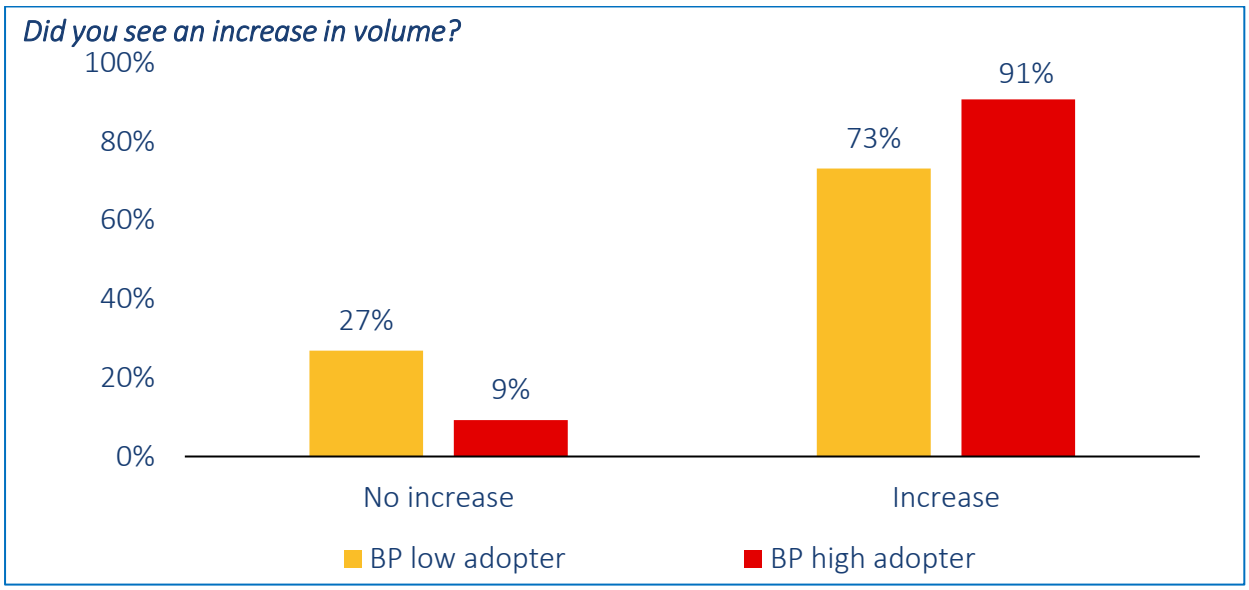
Notwithstanding the bias from recall/self-assessment, in response to a question on TechnoServe's training on self-assessed yield increase, farmers were positive. 87% of farmers reported that yields had risen, whilst only 5% reported that yields had fallen. This finding validates and reinforces previous Laterite analysis showing that yields rose as a result of TechnoServe training.

Figure 16: Survey results on self-assessed yield increases



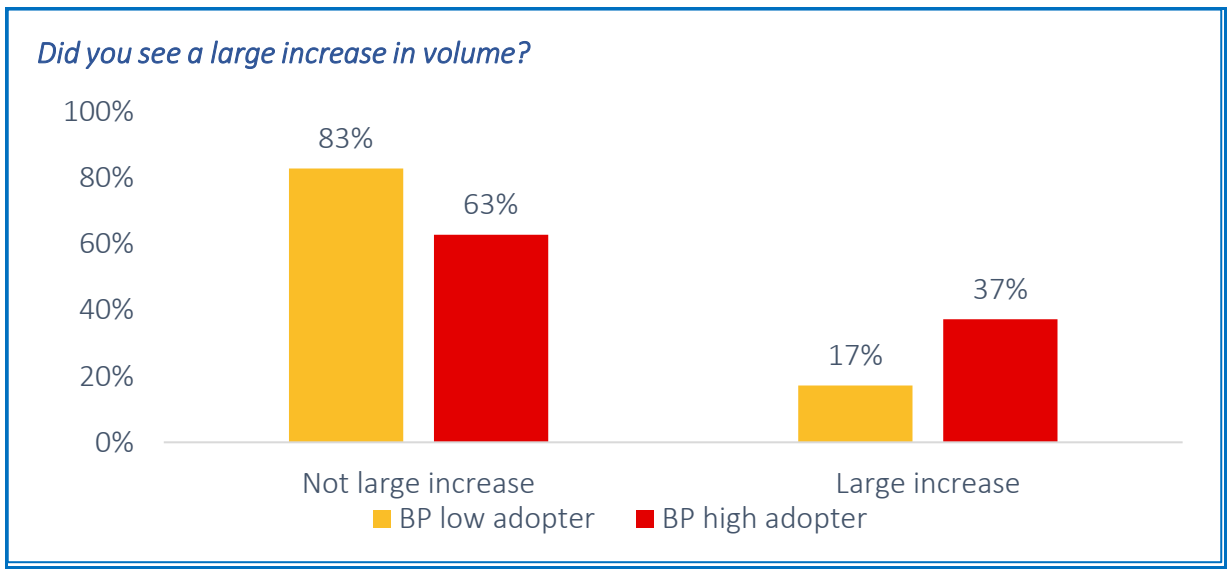
We used the group of 'BP high adopters' – those who were using at least half of the best practices to segment this analysis. If best practices had a positive impact on yield, we would expect to see that more BP high adopters were positive about their yield increases than BP low adopters. We segmented the question on yield increaes so that it was binary; if farmers replied that they had seen a volume increase, we recorded their answer as "increase". If they reported either a volume decrease or no change, we recorded "no increase". The hypothesis that BP high adopters were more positive about yield was correct; 91% of BP high adopters reported an increase in yield, compared to only 73% of BP low adopters.

Figure 17: Comparing best practice high adopters and low adopters on self-assessed yield



The contrast between these two groups was even starker when examining only positive responses on 'large increase in volume'. Again, we created a binary response, in which only farmers who reported large volume increases were recorded as having had a "large increase". Farmers who only reported small yield increases were recorded as "Not a large increase". 37% of BP high adopters reported a large increase in volume, compared to only 17% of BP low adopters. This again suggests that adoption of best practices does have a clear positive impact on yield volumes.

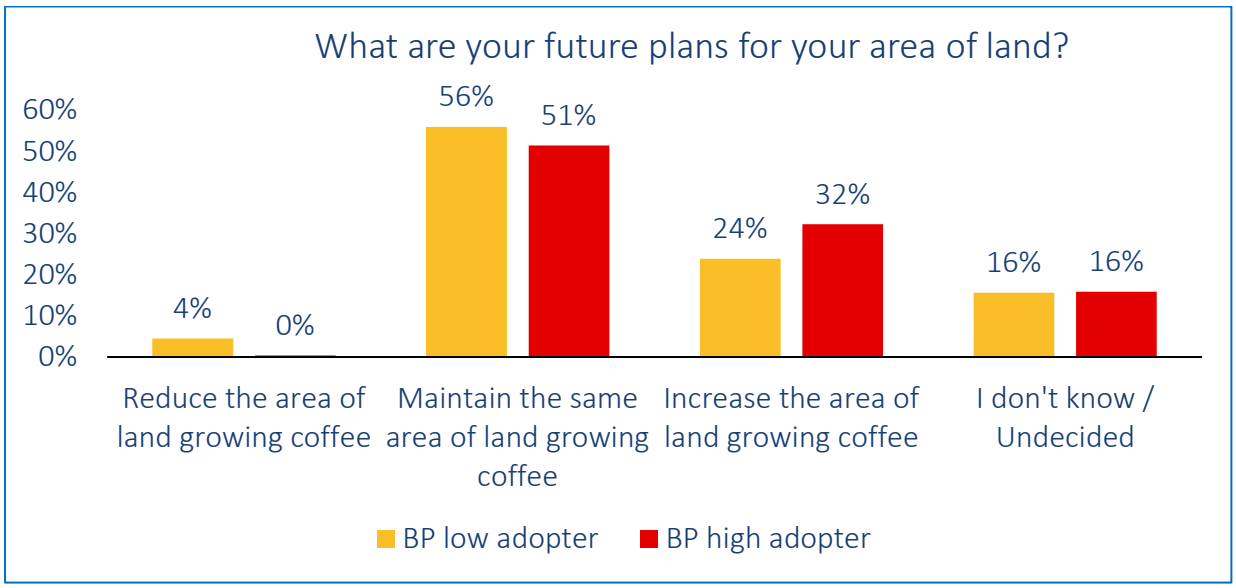
Figure 18: Comparing best practice adopters and non-adopters on large yield increases



Survey respondents were also asked about their future plans of the area of land with which they were cultivating coffee. Answers to this question reflect how confident farmers were about coffee as a livelihood. 32% of BP high adopters wanted to increase the area of land growing coffee, compared to 24% of BP low adopters.

This finding again suggests that BP high adopters are more confident about the potential of coffee-farming to provide a good livelihood for them and their families. This reinforces the positive relationship between yield estimations and BP adoption.

Figure 19: Survey results on future plans for coffee growing



Although this survey did not record yields, due to the practical obstacles in doing so, the questions on self-assessed yields and future plans do imply that BP high adopters perceived that they were producing more coffee when compared to BP low adopters. This conclusion suggests that the TechnoServe BPs do work in raising yields and incomes.

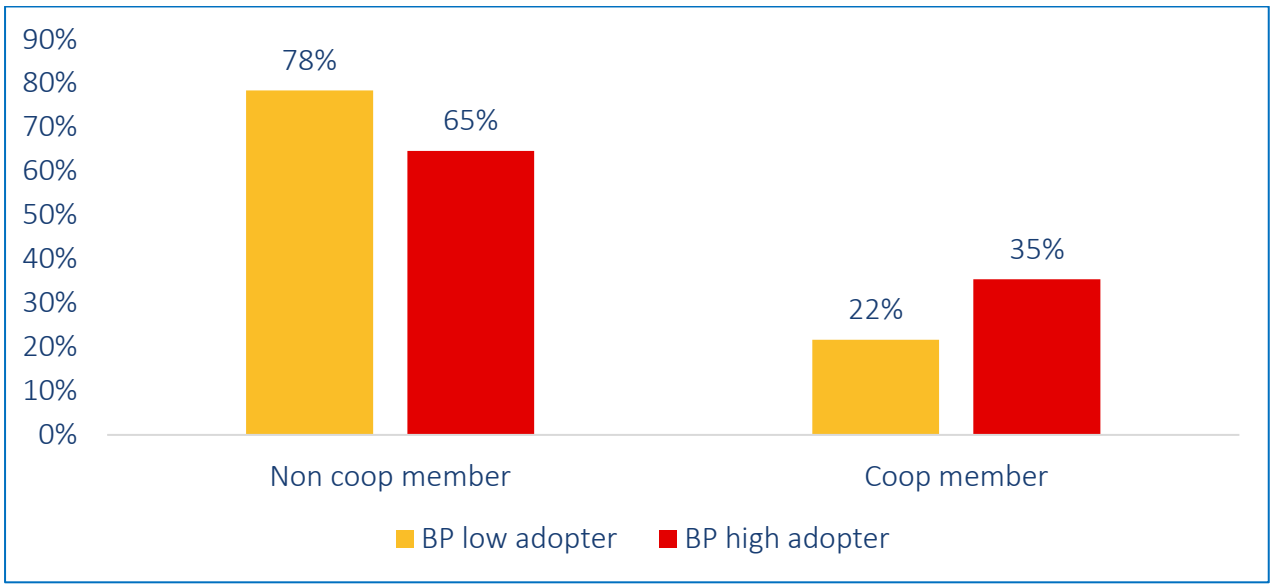
5.12. Understanding best practice high adopters

The analysis then turned to understanding the difference in the household characteristics in our BP high adopters versus BP low adopters, in an attempt to try and understand why some farmers responded positively to TechnoServe training and some didn't.

Our first result was that BP high adopters were more likely to be members of cooperatives. Although training was conducted around cooperatives, not all farmers trained by TechnoServe were paying members. The survey asked farmers whether they were contributing members to their cooperative. The results showed a clear connection between cooperative membership and BP adoption. 35% of BP high adopters were members of cooperatives, compared to only 22% of BP low adopters.

However, we do not know which way the chain of causality works i.e. whether good farmers are more likely to become members of cooperatives, or whether membership of cooperatives helps to reinforce good agricultural practices through peer group effects. If the latter, then in the future smallholder coffee farmers should be encouraged to join their local cooperatives. Regardless of the direction of causality, recognising that cooperative members are more likely to be BP high adopters could offer value in helping to quickly identify and target farmers who are not maximising their yield.

Figure 20: Comparing cooperative membership with best practice adoption



The survey also revealed that wealthier farmers were better farmers. IPE Triple Line generated a basic 'assets index' consolidating 14 different questions that were asked in the survey (e.g. 'how many chickens do you have?' 'Do you own a TV?'). Weightings were applied to each asset to generate a score for each farmer based on levels of ownership (a full example can be found in Annex 3). This index was used as a proxy indicator of household wealth.

The index, in the internal methodology, drew upon:

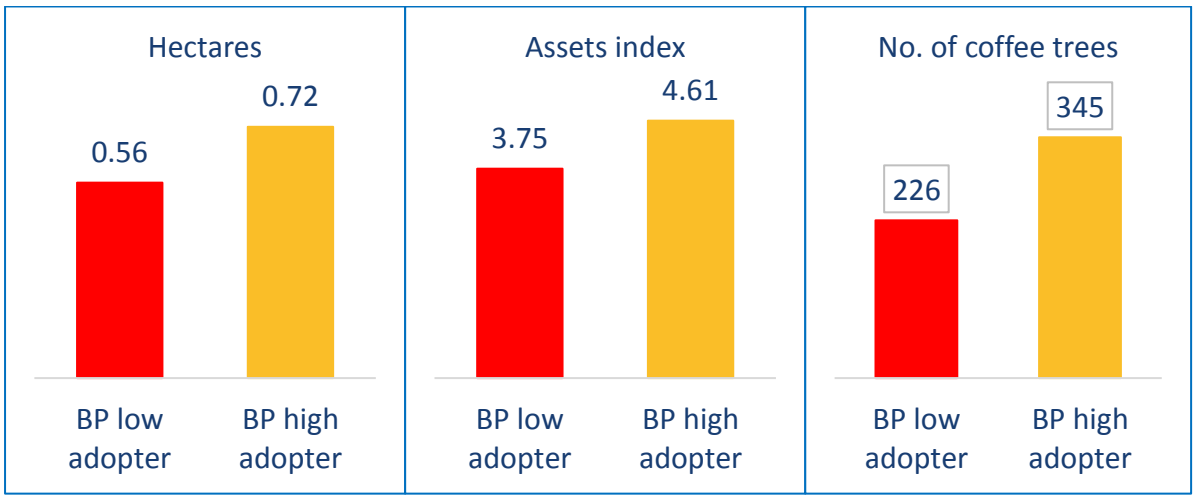
- Progress out of Poverty Index (PPI)
- USAID Poverty Assessment Test
- Rwandan Government Statistics on how common some assets are

As another proxy for household wealth, we also had the number of coffee trees per farm as well as the amount of hectares owned.

The analysis showed statistically significant differences between BP high adopters and BP low adopters across our indicators of wealth. This relationship was true across all three of our proxies for household wealth.

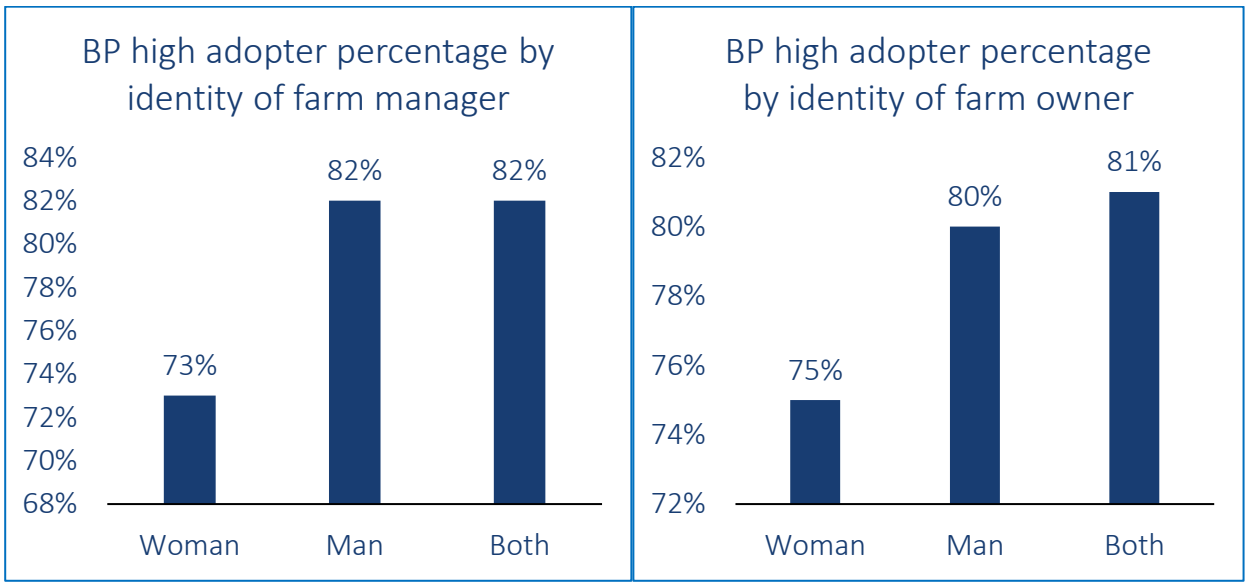
However, the data did not reveal the direction of causality; whether good farmers became wealthy, or whether farmers who were already wealthy were more likely to adopt BPs – or had been using BPs prior to intervention.

Figure 21: Comparing indicators of wealth with best practice adoption



The data also suggested that when farms were owned or managed by the female head of household, they are less likely to be BP adopters, a result which was statistically significant. This probably reflects the additional labour that women are expected to undertake with regards to childcare and household management, leaving them less time to either attend TechnoServe training sessions or implement the BPs on their farms.

Figure 22: Comparing farm owner and farm manager with best practice adoption

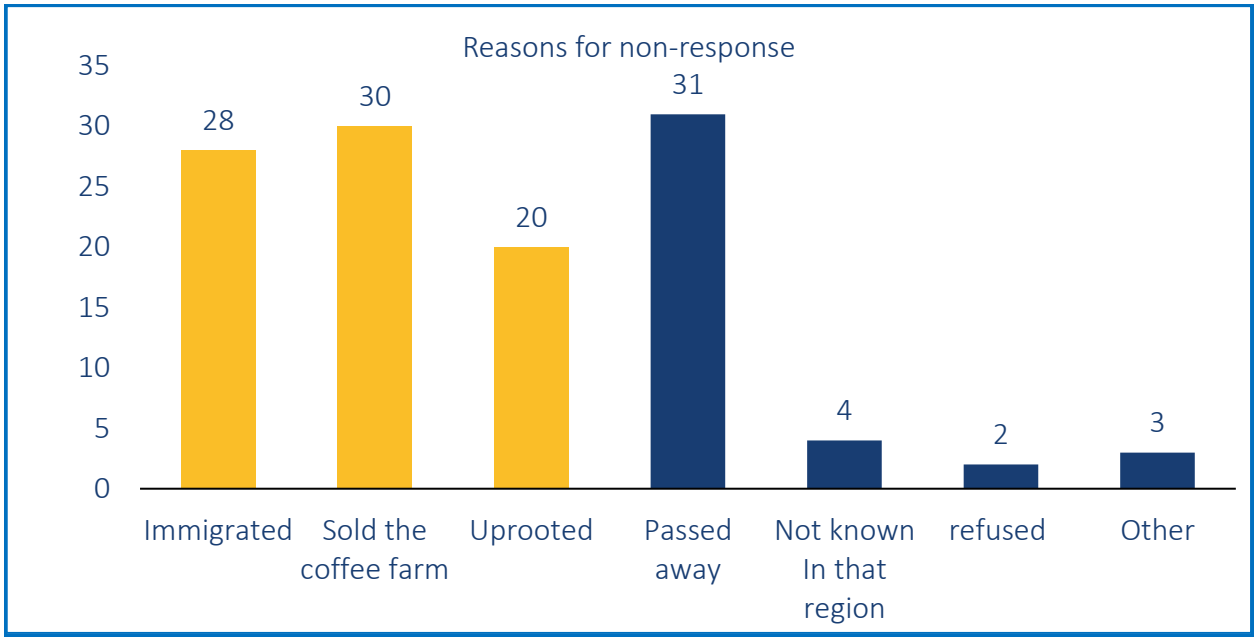


5.13. Analyzing survey non-respondents

Where possible, IPE Triple Line asked neighbours and the focal farmer to try and track down the location of farmers in our survey sample who we couldn't find.

The greatest single cause of non-response was as a result of farmers passing away. However, 30 farmers had sold their farms, 20 had turned to different crops, and 28 had moved out of the area.

Figure 23: Explaining non-respondents

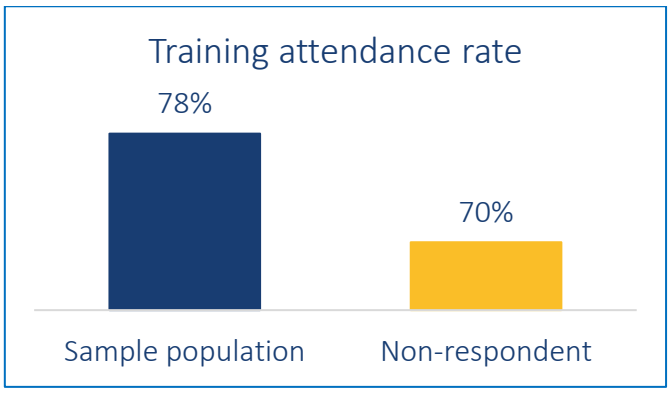


Sample non-respondents had a lower attendance rate at TechnoServe training sessions than our survey population, a difference which was statistically significant.

There are two possible explanations for this. TechnoServe training could have had a positive impact in persuading farmers to continue farming coffee, through showing them techniques that would improve their yield. Farmers who didn't attend enough TechnoServe training sessions may not have been sufficiently persuaded by the potential of coffee as a secure livelihood.

Alternatively, farmers who didn't attend training regularly were originally less motivated and less persuaded by the business case for farming coffee – they were originally more sceptical about coffee, and didn't attend training sessions as a result.

Figure 24: Comparing training attendance rate for non-respondents versus sample population



Where possible, IPE Triple Line gathered anecdotal evidence as to why some farmers had decided to stop farming coffee. This generated direct insights into that decision-making process.

There were two important findings from these interviews. Firstly, many drop-outs were economically motivated; farmers frequently complained about the price of coffee and compared it unfavourably to other crops. Some farmers who had decided to continue farming coffee reported similar beliefs.

Secondly, the role of the state and government policies was likely to have played a large part in the decision-making process. The absence of access to subsidised fertiliser and land development are likely drivers that pushed farmers out of farming coffee. The Government of Rwanda has adopted a very ambitious policy of 35% of their population living in urbanised areas by 2020, compared to 16.5% in 2012[17]. As a result of this government initiative some rural land has been re-designated as peri-urban or urban land, permitting more residential accommodation and industrial construction. The cooperatives surveyed were in the countryside around the town of Muhanga, which has been identified as a secondary city "growth pole" in Rwanda. The government hopes that the city will grow from 52,000 people in 2012 to 112,000 in 2020[18]. It would thus not be surprising if some land on the urban-rural periphery there had been re-designated, as interviewees suggested.

5.14. Agronomy programme conclusions

There is a strong relationship between the adoption of agronomic best practice (BP) and yield improvement, as was demonstrated at the endline survey conducted in 2013[19] which concluded that the adoption of best practice led to increases in yield of up to 57.5% for the 2010 cohort and even higher for other cohort groups.

If farmers maintain their best practice especially in the key areas of pruning, composting and mulching then these yield increases are maintained. The key purpose of this study was to assess the extent to which best practice has been maintained four years after the endline and therefore make some assessment of the long term sustainability of the impact of the agronomy programme on farmers' yields and income.

The survey results showed that although best practice adoption has fallen since the agronomy programme ended, it remains considerably higher than the pre-intervention baseline. The 2013 Laterite study reported that only 45% of farmers were regularly using at least half of the best practices taught by TechnoServe at baseline in 2010. The equivalent figure for trained farmers today - four years after the 2012 endline for TechnoServe - is 78%, demonstrating the extent to which best practice adoption has become more widespread.

Firstly although farmer adoption of TechnoServe BPs has declined overall, usage is still considerably higher than the baseline figures. This suggests that the program succeeded in improving agricultural techniques, and consequently has had a positive impact on yield.

Secondly this evidence is supported by the farmers own perception of yield improvement: BP high adopters also reported larger yield increases than BP low adopters and were also more positive about the future of coffee than BP low adopters, which again suggests that TechnoServe's agronomy program had a positive impact on livelihoods.

The analysis also showed a stronger relationship between some BPs and training attendance rates. This suggests that some BPs were more readily adopted by farmers, and that the training

[17] Rwandan Ministry of Infrastructure, *National Urbanisation Policy*, December 2015, pg. 13
[18] Rwandan Ministry of Infrastructure, *National Urbanisation Policy*, December 2015, pg. 9
[19] Independent Assessment of TechnoServe's Coffee Agronomy Training Programme (Laterite Ltd, 2013).

sessions for other best practices may have had a more limited impact. This was most clearly demonstrated with regards to record book use, where adoption by farmers had reduced.

While it was not technically feasible to undertake a statistically significant measurement of yield from the endline[20], the BP survey also confirmed a number of qualitative perceptions on key trends supporting the relationship between BP and yield: 91% of BP high adopters reported an increase in yield and 38% reported what they perceived to be a large increase in yield. All indicators of increased wealth and asset accumulation were positively associated with best practice adoption.

6. Overall conclusions

6.1. Evaluation Questions

The focus of the study changed from the original terms of reference but the following overall conclusions can be drawn in relation to the evaluation questions posed.

1. What is the long term impact of the Agronomy programme on farm productivity?

The overall conclusion of this evaluation is that there has been good adherence to the critical farmer best practice methods five years after the completion of the programme. This provides strong support for the view that the yield gains recorded at the endline have been maintained. Other factors notably deteriorating soil fertility, the absence of government supported access to fertiliser and other pressures on land have limited the potential growth of the coffee sector in Rwanda. But coffee remains a critically important sector for the rural population of Rwanda and the agronomy programme has played a major role in enabling farmers to have significantly higher yields. While we were unable to independently measure farmer yields, the evidence from the survey confirms that the substantial yield gains documented at the end of the project have remained for most farmers five years later.

2. *How resilient are new wet mills set up during Phase 1? Do these businesses continue to deliver value in the form of premium prices and market access, generating incomes for local communities without direct support from TechnoServe?*

In Rwanda, 10% of TechnoServe supported wet mills were no longer operating in 2015. However, there was a greater percentage of private mills (-18%) during that period ceased operations over the same perid. This finding suggests that the majority of the wet mills have developed into sustainable businesses, displaying a greater degree of resilience than non-TechnoServe supported wet mills. In Ethiopia, TechnoServe wet mills have been profitable over the past 3 years, and profitability has been increasing. Again, this is a good indicator of business resilience and sustainability.

In both countries, there is clear evidence that the price premium has been sustained. In Ethiopia, the farmgate price premium has risen from $0.82 in 2012 to an average of $1.08 over the period, a price premium of 45%. In Rwanda, the price premium has also been sustained, with farmers achieving a price-premium 25% greater than semi-washed coffee.

3. *Have farmers been able to sustain the price premium and volume-sales gains achieved during the programme*?

[20] There was substantial discussion with TechnoServe and the Laterite team on the feasibility of measuring the change of a sample of farmers from the 2010 cohort. Issues included the need to identify a consistent sample of farmers and an appropriate control group as well as the need to collect weekly data from farms.

The evidence from both Rwanda and Ethiopia is that in both countries the price premium obtained at the end line has been maintained, with a bigger step increase in price being recorded in Ethiopia as result of the change from *jenfel* to mild washed arabica. The site visit review of the wet mills in Rwanda confirmed that the mills would benefit from improved management and further technical assistance is needed especially in relation to the management of the mills including maintenance of equipment, utilisation of wet mill capacity and engagement with smallholder grower members.

4. How sustainable is the Coffee Service Provider model? Will Coffee Service Providers continue to support and serve wet mill clients without direct technical support and risk mitigation from TechnoServe?

A detailed analysis of the coffee service provider model was not conducted for this evaluation, but from the review of wet mills undertaken in Rwanda, there is good evidence of a major systemic change in the way the coffee market works for the benefit of smallholder coffee growers. It has enabled origin identified coffee to be sold in Europe and the USA and for smallholders to benefit from this higher value added and greater transparency in the value chain.

6.2. Summary Conclusions

1. TechnoServe wet mills have had a **positive impact on farmgate prices** in both Rwanda and Ethiopia. In Rwanda, farmgate prices for cherry to be fully washed coffee has remained 25% higher than semi-washed coffee which is a relatively small narrowing of the premium since 2011.

2. In Ethiopia, the price has varied considerably but it has remained considerably higher than the price for coffee processed using traditional methods. Importantly the premium for washed coffee reported at the endline in 2012 of $0.82/kg has grown to $1.08 (4 year average). **Washed coffee enjoys a premium that is double the traditional jenfel.**

3. In Ethiopia, the variance between the prices realised by wet mills for their fully-washed parchment coffee implies that some cooperatives have been far more successful in producing consistent export quality. Whilst the majority of the cooperative-run wet mills have been successful as businesses, there is evidence from both Ethiopia and Rwanda that the business performance of some wet mills could be improved and some renewed training and **institutional capacity building would benefit the mills**.

4. In Ethiopia, compared to Rwanda, cooperative wet mills have had more success in building sustainable links with farmers and this in part is due to the fact that the farmers deliver cherry directly to the wet mill. This has helped ensure more of the gains are delivered to the farmers, with better oversight of cooperatives, and more farmers have been encouraged to become active cooperative members.

5. Although farmer adoption of TechnoServe best practices has declined, usage is still more than double the baseline figures. This suggests that the agronomy programme succeeded in improving agricultural techniques, and consequently improving incomes. Best Practice (BP) high adopters also reported larger yield increases than BP low adopters, validating the link between yield increases and BP usage. BP high adopters were also more positive about the future of coffee than BP low adopters, which again suggests that **TechnoServe's agronomy program had a positive impact on livelihoods.**

6. The analysis also showed a stronger relationship between some BPs **and attendance rates.** This suggests that some BPs were more readily adopted by farmers, and that the training sessions

for other BPs had a limited impact. This was most clearly demonstrated with regards to record book use, where adoption by farmers has fallen.

Annex 1: Price Premium Data Ethiopia

		Adj value add ($/kg green)				Adj. value add ($)				Volume (kg green)				Avg ECX unwashed ($/kg green)			
	CWS	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
1	Achebo	$0.54	-$0.09	-$0.17	$2.61	17785.08672	-178.083314	-1325.279922	13481.78262	32746.66667	1998	4350	25667.5	3.2870258	2.4863784	5.1440319	6.39334
2	Alaga Sekala	$1.51	$1.45	$0.99	$1.96	64407.13041	10657.02661	48116.39432	56138.75154	42717.33333	7357	10984	5282	3.3949543	2.4021552	4.9051045	6.6138
3	Andode	$0.56	$0.20	$0.25	$1.27	13157.26558	800.1534493	3136.373745	27043.3688	23339.5	3994.166667	12514	63044	3.3949543	2.4021552	5.4258594	6.28311
4	Baro	$0.51	-$0.16	-$0.15	$1.51	6335.942958	-1055.85524	-1503.800757	16288.64422	12312.5	6546.833333	5326	21821	3.2870258	2.4863784	4.4085366	6.17288
5	Bufata Gibe	$0.67	$0.26	$0.61	$2.00	29605.72993	1991.100546	21688.94871	82433.60672	44259	7724.833333	13542	51995	3.3949543	2.4021552	5.2287526	6.83426
6	Camp	$1.21	$1.81	-$0.51	$1.88	18886.53417	8101.650775	-856.1726225	11362.28072	15613.66667	4474.333333	1600	14428	3.2870258	2.4863784	4.6291863	6.39334
7	Cheraki	$0.33	$0.20	$0.00	$0.00	9694.321452	646.7666124	0	0	28979.66667	3240.833333	0	0	3.3949543	2.4021552	0	0
8	Chime	$0.36	$0.17	$0.05	$0.74	13777.40735	973.5338018	662.2241593	10701.96964	38094	5589	6138.5	63450.5	3.3949543	2.4021552	5.1911467	6.28311
9	Chiri	$2.16	$2.73	$1.03	$2.74	47407.26539	14040.18804	15478.27669	32601.84556	21937.5	5137.666667	6500	0	3.277302	2.1670983	5.7944883	6.72403
10	Debello	$0.60	$3.03	$0.28	$1.82	23869.66368	40737.9219	9039.509064	54150.83011	39973.5	13427	15352	90373.5	3.3949543	2.4021552	4.7884715	6.83426
11	Dembi Zuria	$0.71	$0.39	$0.34	$0.00	16642.49516	1940.952674	2857.072318	0	23375.16667	4952.333333	1800	-49386.2	3.2870258	2.4863784	4.6273235	FALSE
12	Diri	$1.13	$1.72	$1.53	$1.77	19932.92063	6022.126983	21941.16084	4879.511015	17587.66667	3502.166667	5310	373	3.277302	2.1670983	5.5982786	6.72403
13	Dizi	$0.04	-$0.41	-$0.12	$0.00	870.8642205	-503.716501	-712.4472861	0	20761.5	1221.333333	1323	0	3.2870258	2.4863784	4.6209016	FALSE
14	Doyo	$0.94	$0.37	$1.30	$1.98	50542.89328	5773.970247	54096.16008	66416.13859	54052.66667	15655.33333	12300	26330	3.3949543	2.4021552	5.3510802	6.28311
15	Duromina	$2.63	$3.07	$1.34	$2.29	214987.2029	127798.9488	206816.2226	491818.9644	81709.5	41685.16667	34525.35	5002	3.3949543	2.4021552	6.3151425	7.429502
16	Geri	$0.33	-$0.33	$0.54	$1.82	3247.295387	-2363.81899	2416.141172	10468.05507	9808.333333	7157.666667	3130	4817	3.2870258	2.4863784	4.9061761	6.39334
17	Getchi	$0.20	-$0.33	-$0.14	$0.89	3359.775327	-2237.32775	-829.8256501	5143.186167	16427.83333	6783.833333	3109	14155.5	3.2870258	2.4863784	4.8985185	6.39334
18	Gole	$1.98	$1.60	$0.65	$2.12	21674.08706	11163.44875	2672.345417	21406.74978	10950	6991.666667	2400	5943	3.2870258	2.4863784	4.6298991	5.73196
19	Gudina Welini	$0.44	$0.30	$0.51	$1.36	12525.93382	551.0939333	8541.633553	23817.1091	28681.66667	1810.333333	5922	19404.5	3.3949543	2.4021552	5.3659008	6.28311
20	Hana Bosoke	$0.81	$1.42	-$0.15	$2.04	12674.34299	7759.306566	-315.7693493	16775.97109	15647.16667	5481.833333	1141.5	38695	3.2870258	2.4863784	4.7987485	5.73196
21	Harewa Gatira	$0.88	$2.22	$0.25	$0.94	53169.43015	19657.85087	8811.495329	24871.72176	60758.5	8861.333333	14852.5	97561	3.3949543	2.4021552	5.1014982	6.28311
22	Hawa Yember	$1.03	$0.55	$0.66	$1.52	16150.22332	6074.386311	3870.654167	13814.7973	15697	11091.66667	2859	977	3.2870258	2.4863784	6.3822751	6.17288
23	Hunde Gemachu	$0.71	-$0.05	$1.42	$0.00	7621.902953	-5.3419309	3160.209092	0	10796	109	1480.96	0	3.3949543	2.4021552	6.59372	FALSE
24	Ilketinjo	$1.21	$1.29	$0.68	$1.03	56166.28104	9255.363986	17744.40519	23258.2073	46546.5	7174.166667	9998	2456	3.3949543	2.4021552	4.9252465	5.40127
25	Jato Seka	$0.39	$0.21	$0.48	$1.50	11730.85672	80.50206055	6883.010331	25631.65161	29946	375.8333333	15489	60308.5	3.3949543	2.4021552	5.3732349	6.28311
26	Jawi	$1.38	$0.33	$0.22	$1.28	37195.02884	1218.954371	2192.155089	29028.94748	26866.83333	3725.166667	4525	104264	3.3949543	2.4021552	4.630234	5.73196
27	Jimmate	$0.51	$0.32	$0.11	$1.05	30764.09704	3054.24296	2768.62917	24166.23823	59890.66667	9576.333333	13501	64775	3.3949543	2.4021552	5.2055885	6.28311
28	Karo Mariam	$0.22	-$0.25	$0.22	$0.66	3219.540056	-814.594748	2289.30888	701.6786737	14820.16667	3247.5	6974	4085	3.2870258	2.4863784	4.6230113	5.73196
29	Kecho Tirtira	$0.45	$1.15	$0.51	$1.73	27640.86838	14047.95048	18373.41571	60505.94512	61897.83333	12268.83333	33835.64	5249	3.3949543	2.4021552	5.1155478	6.72403
30	Kiltucheba	$0.38	$0.25	$0.37	$0.78	11486.37893	399.1349303	4718.429365	12084.8292	30540.83333	1590.666667	4226	22743.5	3.3949543	2.4021552	5.0978614	6.28311
31	Kitaber	$0.00	-$0.46	$0.58	$1.82	42.24012081	-1244.57415	9467.656518	5423.298185	23060.5	2677.833333	2602	-320	3.2870258	2.4863784	4.6267881	5.73196
32	Koma	$0.38	$1.59	$0.35	$1.27	10092.49314	7855.036145	4000.585496	31461.36227	26342.16667	4926.5	14045	114091	3.3949543	2.4021552	5.2480083	6.28311
33	Kundi Gagi	$0.59	-$0.20	$0.40	$1.82	18723.40034	-2175.1108	8498.092213	21697.50781	31527.66667	10670.83333	9357	5061	3.2870258	2.4863784	4.7334863	5.73196
34	Kuti	$1.88	$0.07	$1.46	$1.48	40365.71427	453.5205928	34276.566	12764.4549	21489.33333	6388.333333	7503	2875	3.277302	2.1670983	5.4300831	6.72403
35	Lelisa Halo	$1.09	-$0.18	$0.19	$1.78	53701.41326	-3455.99388	8624.868782	39245.13546	49283	19539.16667	29847	21022	3.3949543	2.5981567	4.4867991	6.28311
36	Loko Saya	$0.34	-$0.16	-$0.33	$0.71	3757.199457	-813.318644	-1878.674695	3445.689528	11112.33333	5038.5	4612	11164	3.2870258	2.4863784	4.6241534	5.73196
37	Mecha	$0.26	$0.09	$0.28	$1.11	7412.106068	187.6267502	4055.740341	21337.11913	28660.33333	2008.333333	4258	94698.5	3.3949543	2.4021552	5.2436834	6.28311
38	Michiti	$2.59	$0.14	$2.78	$3.14	38547.07361	1395.001357	51305.80252	40497.6873	14883.16667	9908.833333	5086	-57	3.277302	2.1670983	6.6125338	6.72403
39	Mito Gundib	$0.51	$0.19	$0.67	$1.92	13271.95166	462.6753514	12403.79699	44276.92503	26055.66667	2481.166667	7025.5	80762.5	3.3949543	2.4021552	5.4216599	6.28311
40	Nano Challa	$3.02	$0.40	$1.03	$2.65	100899.169	5497.058029	41147.29414	133118.5061	33368.83333	13822.66667	19448.4	7014	3.3949543	2.4021552	6.141686	8.37748
41	Shegole	$0.35	$0.29	$1.34	$1.79	18391.50134	5224.466665	36140.14308	51191.9336	53151.66667	18199.66667	28151	61435	3.3949543	2.4021552	6.8240777	6.72403
42	Sineso	$0.57	$0.09	$0.08	$0.00	13841.49677	373.4754071	4096.52326	0	24291.83333	4061.833333	45100	0	3.2870258	2.4863784	4.5194234	FALSE
43	Sota	$0.79	$0.15	$0.57	$1.57	13728.49051	983.855112	1229.267061	11105.21264	17389.5	6535.333333	1600	16430	3.2870258	2.4863784	4.6387648	5.73196
44	Tencho	$0.83	$0.23	$0.06	$1.19	30107.1585	2657.967523	1498.998004	25022.35001	36223.66667	11437.83333	10168.5	53006	3.3949543	2.4021552	4.3381324	6.28311
45	Wakito Madallu	$0.68	$0.17	$1.00	$2.13	26197.14809	1408.473548	20790.48716	46141.7342	38534	8408.333333	6971.75	39448	3.3949543	2.4021552	5.1880325	6.72403
46	Wodiyo	$2.19	$0.07	$0.36	-$2.27	25287.2279	240.6576883	2446.237138	-938.7518334	11555.33333	3394.666667	23436	0	3.277302	2.1670983	6.1236858	0
47	Wutete	$0.22	-$0.34	$0.34	$1.05	7176.167825	-3710.71068	5374.743799	15068.21075	32504.33333	10931.66667	4807	23640	3.2870258	2.4863784	4.6296992	6.39334
48	Yayu Zuria	$0.31	-$0.32	$0.72	$0.90	3730.544003	-1523.20579	3351.268524	3246.463531	12024.5	4724.5	2570	7821	3.2870258	2.4863784	5.415947	5.026488
49	Yukro	$0.00	$0.64	$0.00	$0.00	0	16652.03688	0	0	0	26086.83333	44644.48	25590	3.5898074	2.4021552	5.9677504	7.05472
	Weighted Average	**$0.90**	**$0.82**	**$1.35**	**$1.25**	**1,281,801.26**	**316,056.77**	**709,560.28**	**1,663,097.62**	**1,428,193.00**	**383,994.67**	**526,241.08**	**1,327,495.30**	**3.3472783**	**2.413109**	**5.0997992**	**6.0553013**

Annex 2(a) Field Visit- Rwanda

Name of Coop	**IZERE**	District	Nyanza
Date of visit	7th December 2015		
Participants at interview	President (Valence), Manager (Goreti), Secretary (Azarius)		
Date Co-op Formed	Formed in 2009 with TNS support.	No of farmers served 2015	Currently purchase from 1260 farmers (members and non-members)
No of Members at formation	500 farmers came to meeting, 240 expressed interest but only 70 members joined (Paid membership fee)	No of Members in 2015	70
Co-op formed before TNS programme?	No		
Pulper (Original / Current)	Penagos 500		
Pulper capacity Kgs/hr	500kg per hour – 150T / Season.	Mill Capacity Utilisation 2015 %	100% capacity utilisation.
Production 2015	150 tonnes of cherry	Production Trend (Last 4 years)	Growing - Cherry volumes (2010 – 20Ton, 2015 – 150 Ton)
Exporter has/is providing Capex	Yes	Exporter Provides working capital	Yes
Profit made (last 2 years)		Bonus distributed to farmers	Yes – 2015 (5 Rf / Kg).

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Purchases increasing but co-op isn't expanding in terms of membership. (No clear benefits of being a member – VfM for the membership payment of 20,000 Rf)
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	No
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Production growing but slowly agronomy practices

		verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	3 Doing satisfactorily but needs some s support

General Comments
• They have a generator; • Have planted vertiva grass to absorb the waste water; • Tree numbers range between 200 and 4000 per farmer; • Machine bought in 2010. Received capex loan of $ 13000 which was paid off in 2013; • The co-op has reinvested in tables, land, water pump and a parchment warehouse; • Do not have access to grid power.

Name of Coop	**KIREZI**	District	Nyanza
Date of visit	7th December 2015		
Participants at interview	President (Tiojen), VP (James), Secretary(Valence), Advisor (Dermitira)		
Date Co-op Formed	Formed in 2009. Obtained legal status in 2010.	No of total farmers served 2015	
No of Members at formation	80	No of Members in 2015	357
Co-op formed before TNS programme?	No		
Pulper (Original / Current)	Penagos 800		
Pulper capacity Kgs/hr	800kg per hour – 250T / Season.	Mill Capacity Utilisation 2015 %	71% capacity utilisation.
Production 2015	178 tonnes of cherry	Production Trend (Last 4 years)	Growing - Cherry volumes (128, 131, 150, 178)
Exporter has/is providing Capex	Yes	Exporter Provides working capital	Yes
Profit made (last 2 years)	2015 – 8Mil Rf	Bonus distributed to farmers	Yes – 2015 (10 Rf / Kg). Equates to 22% of total profits.

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Purchases increasing. Co-op is expanding in terms of membership.
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	No
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Production growing, agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	3 Doing satisfactorily but needs some s support

General Comments

- Special buyer paying $6/kg GBE; Would like to work with buyers directly and would like to understand the value chain more; Has 18 site collectors; TNS trained them on coop management, accounting, processing skills, machine usage, sustainability standards and agronomy.

Name of Coop	**Mukindo**	District	Nyanza
Date of visit	7th December 2015		
Participants at interview	VP (Tasis), Secretary(Jean), Farmer Trainer(Alex) Farmers (Diojen, Felicien) President Supervisory Committee (Jean Bosco)		
Date Co-op Formed	First meetings and Coop formation in 2009 and CWS set up in 2010	No of total farmers served 2015	457
No of Members at formation	239 original members but reduced to 146 when it was realised that the balance were not coffee farmers	No of Members in 2015	239
Co-op formed before TNS programme?	No		
Pulper (Original / Current)	Mackinon 2000		
Pulper capacity Kgs/hr	2000kg per hour – 750T / Season. In total, the capacity is 2500T/season when you add the Penagos 500 they also have.	Mill Capacity Utilisation 2015 %	18 % capacity utilisation.
Production 2015	136 tonnes of cherry	Production Trend	Growing slowly - Cherry volumes (120 - 136) in the last two years.
Exporter has/is providing Capex	Yes for the first machine but bought the second using profits.	Exporter Provides working capital	Yes
Profit made (last 2 years)	2015 – 10Mil Rf	Bonus distributed to farmers	Yes – 2015 (10 Rf / Kg). Equates to 13% of total profits.

1	Wet Mill appears to be in good condition and being well maintained	One is, the other one is not being utilised.
2	Coffee purchases are increasing and the co-op is expanding	Purchases increasing. Co-op is expanding in terms of membership albeit slowly.
3	Co-op appears to be well managed operating along business lines and growing	Poor financial management decisions.
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	No
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Production growing slowly, agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support	2. Has potential but needs substantial technical support

	3- Doing satisfactorily but needs some support 4- Fully sustainable	

General Comments

- 10 collectors are coop employees.
- NAEB has set catchment area for the washing station. This is to prevent encroachment into others territory (Probably better to leave the market forces to determine the winners and losers);
- Coop working to improve customer service and farmer retention through initiatives such as provision of weighing balances, paying cash for cherry and providing inputs such as fertiliser and pesticides;
- In order to increase production, the coop plans to:
  - Increase membership;
  - Increase number of seedlings;
  - Give back larger bonuses
- Agronomy training has worked. Farmers still implementing best practice. No issue in relation to plant nutrition;
- Want more training on marketing. Direct contracts with market.

Name of Coop	**Kigembe**	District	Huye
Date of visit	8th December 2015		
Participants at interview	President (Stanislaus) Accountant (Faultina), Farmer (Christian)		
Date Co-op Formed	2009 – The idea was initially brought in by TNS but they didn't buy in at first due to failures they had seen with other coops.	No of total farmers served 2015	1554
No of Members at formation	100	No of Members in 2015	210
Co-op formed before TNS programme?	No		
Pulper (Original / Current)	Penagos 800		
Pulper capacity Kgs/hr	800kg per hour –250T / Season.	Mill Capacity Utilisation 2015 %	76 % capacity utilisation.
Production 2015	190 tonnes of cherry	Production Trend	Growing slowly – 130 t in 2011 and 190 in 2015.
Exporter has/is providing Capex	Yes	Exporter Provides working capital	Yes
Profit made (last 2 years)	2011 – 4Mil Rf, 2nd year 17mil Rf	Bonus distributed to farmers	First year gave back all the profits in form of bonuses and in the second year gave back 6mil out of 17mil (35%).

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Purchases increasing. Co-op is expanding in terms of membership albeit slowly.
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Yes
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Production growing slowly, agronomy practices verification to be done at a later date.

7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	2. Has potential but needs substantial technical support

General Comments

- Need more agronomy advice to support yields.
- Training is needed, learning is a continuous process
- Only 30% of intended fertiliser for distribution to farmers disappears through distributors.
- Spare parts: RITC provided the spare parts for the new machine. Technical support provided by RTC (The cost was added to the working capital).

Name of Coop	**Mizero**	District	Huye
Date of visit	8th December 2015		
Participants at interview	President (Denis) Advisor, farmer trainer, manager, farmer		
Date Co-op Formed	Formed a coop and registered in 2009	No of total farmers served 2015	139
No of Members at formation	60	No of Members in 2015	Grew to 363 in 2011. Now only 139 (44 m; 95 f) as many members were not coffee farmers and/or had not paid
Co-op formed before TNS programme?	No		
Pulper (Original / Current)	Penagos 500		
Pulper capacity Kgs/hr	500kg per hour – 150T / Season.	Mill Capacity Utilisation 2015 %	50 % capacity utilisation.
Production 2015	78 tonnes of cherry	Production Trend	2012 129 2013 69 2014 39 2015 78 Low prices caused low production but problems of spare parts limited volume of purchases in 2014. Strong production in 2012 was stimulated by the big bonus in 2011
Exporter has/is providing Capex	No	Exporter Provides working capital	Yes
Profit made (last 2 years)	7 and 5 Mil Rf in 2014 / 15	Bonus distributed to farmers	In 2011, paid Rf 22mn bonus of rf60/ kg to members and fr50/kg to non-members. Small profit made in 2014 used to pay medical insurance for members. Profit of 5Mil in 2015 – Not distributed to farmers (Using funds to upgrade tables and buy second hand machine.)

1	Wet Mill appears to be in good condition and being well maintained	No
2	Coffee purchases are increasing and the co-op is expanding	Purchases have been static due to little capacity to process caused by the machine break down.
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Initially, yes but not recently
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Production has been dropping mainly due to machine break downs.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	2. Has potential but needs substantial technical support

General Comments

- No shortage of coffee in region. A private wet mill has started in the region and is processing 400 tonnes of cherry and selling to Rwacof;
- Coffee farmers getting older. There is need to follow up with best practice. Not all have adopted;
- TNS trainer voluntarily providing advice. Only 1 of 4 TNS trainers to be doing so.
- Coop had very good relations and they are very thankful to TNS but they left too soon. We were a baby learning to crawl when they left, TNS needs to come back. They want to be more involved in the value chain – "They are like a football team that lost their captain and manager"

Annex 2(b) Field Visit- Ethiopia

Name of Wet-mill / Coop	**Diri**	Region (As defined by TNS)	Bedele
Date of visit	13th January 2016		
CSP	KFCFCU		
Cohort	2009	Total Cherry Volume (2014/15)	16,712 kg
Volume from Members	16,339Kg (220 / 372 Members)	Volume from Non Members	373 Kg (42)
Share exported	90%		
Capacity	Penagos 500 & James Strada 1500		
Pulper capacity Kgs/hr	500kg per hour – 800T / Season. (Assumption – 8 hours per day / 25 working days per month / harvest season - 4 months in a season)	Mill Capacity Utilisation 2015 %	Sharp reduction in performance in 2014/5
Production 2015	16 tonnes of cherry	Production Trend	2011 – 117,217 2013/14 – 83,665 2014/15 – 16, 712
Capex	KFCFCUUnion	Working Capital	Union
Profit made last year (ETB)	107,281	2nd Payment distributed to farmers (Per Kg of Cherry)	4.01 per Kg of Cherry. Equates to 62% of total profit.

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Coop numbers have been stagnant over the last two years (Between 2013 and 2015)
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Yes (62% in 2014/15 and 70% in 2013/14)
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support	3 Doing satisfactorily but needs some s support

	3- Doing satisfactorily but needs some support 4- Fully sustainable	

General Comments

- Harvest season is generally shorter in the lower regions and longer in the higher regions;
- The ideal wet mill size is 2 Ha to facilitate having enough drying beds which was a constraint for this co-op. Note some key co-op members were not present at mill.

Name of Wet-mill / Coop	**Michiti**	Region (As defined by TNS)	Metu
Date of visit	13th January 2016		
CSP	KFCFCU		
Cohort	2010	Total Cherry Volume (2014/15)	67,078
Volume from Members	67135 Kg (285 Members)	Volume from Non Members	(57) Kg (0)
Share exported	90%		
Capacity	1500Kg/ Hour capacity		
Pulper capacity Kgs/hr	1500kg per hour – 550T / Season. (Assumption – 8 hours per day / 25 working days per month / harvest season - 2 months in a season)	Mill Capacity Utilisation 2015 %	12% Utilisation.
Production 2015	67 tonnes of cherry	Production Trend	2011 – 90,324 2013/14 – 103,382 2014/15 – 67,078
Capex	KFCFCUUnion	Working Capital	KFCFCU Union
Profit made last year (ETB)	768,449	2nd Payment distributed to farmers (Per Kg of Cherry)	537,914 - 70% of Gross Profit

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Coop member numbers have been stagnant over the last two years (Between 2013 and 2015)
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Yes (70% in 2014/15 and 70% in 2013/14)
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	3 Doing satisfactorily but can do better. Grow numbers to bridge the utilisation gap. Resolve the production fluctuation gap.

General Comments

- 8 full time employees; 54 seasonal employees; Production trend fluctuating. Needs to grow numbers to bridge the utilisation gap. Resolve the production fluctuation gap

Name of Wet-mill / Coop	**Duromina**	Region (As defined by TNS)	Metu
Date of visit	14th January 2016		
CSP	Oromia		
Cohort	2010	Total Cherry Volume (2014/15)	1,226,710
Volume from Members	1,221,708 Kg (271Members)	Volume from Non Members	5002 Kg (89 Non Members)
Share exported	90%		
Capacity	Site 1 (2500+1500) Site 2 (2500 + 2500) Total – 9000kg/hour		
Pulper capacity Kgs/hr	1500kg per hour – 3,456T / Season. (Assumption – 8 hours per day / 25 working days per month / harvest season - 2 months in a season)	Mill Capacity Utilisation 2015 %	35% Utilisation.
Production 2015	1,226 tonnes of cherry	Production Trend	2011 – 494,050 2013/14 – 964,285 2014/15 – 1,226,710 2015/16 - 1,321,000
Capex	Bank	Working Capital	Bank
Profit made last year (ETB)	8,387,022	2nd Payment distributed to farmers (Per Kg of Cherry)	5,870,915 - 70% of Gross Profit

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Coop member numbers have been stagnant over the last two years (Between 2013 and 2015)
3	Co-op appears to be well managed operating along business lines and growing	Fair
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Yes (70% in 2014/15 and 70% in 2013/14)
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	4 – Fully sustainable.
General Comments		

Outstanding success story of rapidly growing business receiving exceptionally high returns from US Market.

- Received 10,000 USD from Aligero for quality improvement. Used that to set up additional drying tables;
- Site 1 has 220 drying tables and site 2 has 150 tables;
- Of the members, 50 are women;
- Working capital is 15.5M Br
- Considering setting up own Union in collaboration with a few other Coops such as Hundauli. A new union will bring about:
    - increased buyer satisfaction (shorter transactions means faster cash for the farmer),
    - Money received sooner means reduced burden of interest payments;
    - Milling will be done faster (a big issue);
- Paid off Asset finance loan in 1 year;

Name of Wet-mill / Coop	**Hunda Oli**	Region (As defined by TNS)	Agaro
Date of visit	14th January 2016		
CSP	Oromia		
Cohort	2012	Total Cherry Volume (2014/15)	395,358 (15/16 - 600K?)
Volume from Members	392, 141 (160 members)	Volume from Non Members	3,217 (13 non-members)
Share exported	90%		
Capacity			
Pulper capacity Kgs/hr		Mill Capacity Utilisation 2015 %	
Production 2015 /16	600,000 kg	Production Trend	2015/16 – 600,000 2014/15 – 360,844 2013/14 - 395,358
Capex	EDB	Working Capital	EDB
Profit made last year 14/15 (ETB)	1,675,616	2nd Payment distributed to farmers (Per Kg of Cherry)	1,172, 931 - 70%

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	The numbers have remained the same over the last two years.
3	Co-op appears to be well managed operating along business lines and growing	Farm productivity has increased but the cooperative has not grown in numbers.
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Yes – 70% over the last two seasons.
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	4 – Fully Sustainable.

General Comments

Successful coop but needs support to grow numbers and stabilise / further grow the yield

- Storage capacity of 2100 bags – 126,000Kgs;
- Spent 400,000 EBR on getting water to 450 households;
- Currently 160 households are members but the full capacity is 430 households;
- Talked about Coffee made happy – focus on hullers, Keeping the standards so buyers pay more;

- Before the TNS project there was the EC project which focussed in the areas of Agaro, Limu and Yabo.
- The South and West regions experience more rains;
- The east regions predominantly focus on Jenfel;
- Approximately 70% of the coffee tree stock is old;
- Coffee Berry Disease was a problem 30 years ago;
- Would have been good if the programme had been for 4 years instead of 2;
- See through the results before leaving. Consider the full life cycle (The farmer needs to see the changes before you leave;
- In the future, there will be climatic changes to be factored in in addition to population growth which will affect productivity and available land for growing coffee respectively;

Name of Wet-mill / Coop	**Biftu Gudina**	Region (As defined by TNS)	Agaro
Date of visit	14th January 2016		
CSP	Oromia		
Cohort	2012	Total Cherry Volume (2014/15)	413, 831Kgs
Volume from Members	391,673 - 117 members	Volume from Non Members	22,158 - 28 Non members
Share exported	90%		
Capacity	1,600,000 Kg		
Pulper capacity Kgs/hr	2 pulpers (1500 + 2500). 2500 one bought in 2015. Total 4000Kg/Hr	Mill Capacity Utilisation 2015 %	25%
Production 2015	413, 831Kgs	Production Trend	2015/16 – 558,000 2014/15 – 413, 831 2013/14 – 305,908
Capex	Bank	Working Capital	Bank
Profit made last year (ETB)	2,447,937	2nd Payment distributed to farmers (Per Kg of Cherry)	1,713,556 – 70%

1	Wet Mill appears to be in good condition and being well maintained	Yes
2	Coffee purchases are increasing and the co-op is expanding	Growing production but the numbers have remained the same over the last two years.
3	Co-op appears to be well managed operating along business lines and growing	Yes
4	Co-op is making a profit in most years	Yes
5	Co-op is returning over 60%+ of bonuses to farmers	Yes. On average 70% paid back
6	Coffee production in the region is growing in and agronomy practices seem to have been sustained	Agronomy practices verification to be done at a later date.
7	Overall assessment of sustainability of co-op. 1- Not sustainable 2- Has potential but needs substantial technical support 3- Doing satisfactorily but needs some support 4- Fully sustainable	4 Fully sustainable

General Comments

- TNS facilitated loan machine loan plus construction loan. They paid that back in 1 year;
- First machine was 1500 Kg / hour. Current one is 2500 Kg / hour (bought in 2015);
- They have 150 drying tables;
- Started with 84 members but now have 180 (64 female)members but can get more;
- They have a 5Km catchment area;
- Ranked 95% in one US ranking;
- They have a 60 to 70 day harvest period;
- Left Oromia Union for Limu (For a 1 year period as they contemplate forming own union);
- Key wet mill parts – Belt (Available locally), Sleeve / Sieve (Not easily available);
- Accountant and manager are part of the 9 full time roles;
- 126/150 seasonal labourers who are paid 30 Br per day;
- Changes seen – Better infrastructure, More cash to the farmers and their families, Healthcare has improved, better clothing;
- The cherry is transported by mule;
- They have spent 50,000 on road construction and 10,000 to construct a school. 150,000 spent to construct a boarding school;
- Of the seasonal labourers, more are women and there is a member within the control committee;
- Agronomy training is going on at the moment;
- On average there is around 2500 trees per farmer on average land size of 1 hectare.

Annex 3: Survey questionnaire

160722 RW 2010C Sustainability Survey Triple Line

Introduction

Q 0.1.1. Please select your Name.

- Martyn Clark
- Anthony Wahome
- David Smith
- Eunice Khaguli
- Eric Rukwaya
- Adorata Uwamariya
- Berwa Berthille
- Eric Kirezi
- Kantengwa Mack Sandrine
- Ntasoni Theodomir
- Bayimenye Ruth Fiona
- Kanani Aphrodis
- Uwayezu Delphine
- Rukundo Pascal
- Yubire Dhalia
- Kalisa Olivier
- Nizeyimama Eugene
- Irabaruta Yvonne
- Mbabazi Sarah
- Maniraguha Angellique
- Kayitesi Ida

Q 0.1.2. Please enter the HH ID.

The FARMERID that you entered does not match the sample list. Please double check the FARMERID and re-enter.

SAY: "I work for IPE Triple Line, a research firm. Today we are undertaking a best practice survey of the TechnoServe Coffee Initiative Programme which you participated in, and which finished in 2012. We hope to determine whether best practices learned under the programme have been sustained after completion of the programme. This will enable TechnoServe to identify the successes and challenges

to improve the effectiveness of such programmes in the future. You have been selectedto take part in this survey.

We would like to ask you some questions about yourself and visit your coffee field where you apply your best farming practices. Any information we collect will remain confidential. The survey will take about 45 minutes. Would you be prepared to be part of the survey?"

Q 0.1.3. ASK: Who in your household is mostly responsible for managing the coffee farm day-to-day?

- Woman (wife)
- Man (husband)
- Both husband and wife equally
- Joint with other family members
- Someone else

Q 0.1.4. ASK: Does the person who manages the coffee farm day-to-day agree to participate in this visit?

NOTE: The person who manages the farmer day to day MUST be present. If the time is not convenient arrange to come back on another day

- Yes
- No

» **SECTION 1: Household Information**

» » Module 1: Identification & Verification

ASK: Is your (OR your spouse's) name?

- Yes
- No

Q 1.1.1. ASK: What is your full name?

NOTE: Go back and check the Household ID entered. If correctly entered, then enter the name. Enter the full name - First Name followed by Last Name

Q 1.1.2. ASK: What is the full name of your spouse?

NOTE: Enter the full name - First Name followed by Last Name. Enter '0' if there is no Spouse.

Q 1.1.3. Who in the household is being surveyed?

NOTE: This MUST be the person(s) managing the farm, invite the husband or wife if they wish to join.

- Woman (wife)
- Man (husband)

- Both husband and wife

Q 1.1.4. ASK: Who owns the farm?

NOTE: This should be the person in whose name the farm is registered.

- Woman (wife)
- Man (husband)
- Both husband and wife equally
- Jointly with other family members
- Someone else

Q 1.2.1. ASK: Can you tell the woman/wife's age or year of birth?

NOTE: If farmer knows the age correctly, then select 'Age'. If farmer know the year of birth correctly, then select 'Year of Birth'. If farmer doesn't know or doesn't want to answer, select 'I don't know '.

- Age
- Year of Birth
- I don't know

Q 1.2.1.1. ASK: What is the woman/wife's age?

NOTE: Enter only the age (0 to 99)

Q 1.2.2.2. ASK: What is woman/wife's year of birth?

NOTE: Enter only the Year of Birth (1935 to 2000)

Q 1.2.3. ASK: Can you tell the man/husband's age OR year of birth?

NOTE: If farmer knows the age correctly, then choose 'Age'. If farmer know the year of birth correctly, then choose 'Year of Birth'. If farmer doesn't know or doesn't want to answer, select 'I don't know '.

- Age
- Year of Birth
- I don't know

Q 1.2.3.1. ASK: What is the man/husband's age?

NOTE: Enter only the age (0 to 99)

Q 1.2.3.2. ASK: What is man/husband's year of birth?

NOTE: Enter only the Year of Birth (1935 to 2000)

Q 1.2.4. ASK: What is the woman/wife's level of education?

- No formal education
- Pre-primary education (e.g. Nursery school, early child development)
- Primary education
- Lower secondary education
- Upper secondary education
- Post-secondary non-tertiary education (e.g. Vocational schools)
- University/ Bachelor's
- Post-graduate (Masters or higher)
- Other

Q 1.2.5. ASK: What is the man/husband's level of education?

- No formal education
- Pre-primary education (e.g. Nursery school, early child development)
- Primary education
- Lower secondary education
- Upper secondary education
- Post-secondary non-tertiary education (e.g. Vocational schools)
- University/ Bachelor's
- Post-graduate (Masters or higher)
- Other

Q 1.2.6. ASK: Is the woman/wife a cooperative member currently and has paid the registration fees?

- Yes
- No

Q 1.2.7. ASK: Is the man/husband a cooperative member currently and has paid the registration fees?

- Yes
- No

Q 1.2.8. ASK: How many people live in your household including you and your spouse?

Q 1.2.9. ASK: Of the total people that live in your household, how many children are 14 years of age or under?» » Module 3: Land, Livestock and other Assets

» » » Module 3.1: Land

Q 1.3.1.1. ASK: How many total hectares of agricultural land do you own or manage?

NOTE: This includes all land owned including woodlot, farming land and cleared land, where the farmer grows coffee and food crops. Please enter the area in HECTARES.

Q 1.3.1.2. ASK: How many coffee fields do you have?

NOTE: These need to be fields managed by the household that you are visiting.

For example, all the coffee trees in this area should be counted as 1 field and all the coffee trees in a different area should be counted as another and so on.

Q 1.3.1.3. ASK: How many coffee trees do you have?

NOTE: This should include coffee trees in all the fields managed by the household you are visiting. If the number given by farmer is more than Z, just enter Z.

Q 1.3.1.4. ASK: How many coffee trees have been planted in the last 4 years?

NOTE: This should include coffee trees planted in all the fields managed by the household you are visiting. The number given by farmer cannot be more than Z

» » » Module 3.2: Livestock

EXPLAIN: I am going to read to you a list of livestock and I need you to tell me how many of each you and your spouse own.

Q 1.3.2.1. ASK: How many chickens do you have?

Q 1.3.2.2. ASK: How many goats or sheep do you have?

Q 1.3.2.4. ASK: How many pigs do you have?

Q 1.3.2.5. ASK: How many cows do you have?» » » Module 3.3: Other assets

EXPLAIN: I am going to read to you a list of assets and I need you to tell YES or NO for each asset you and/or your spouse own.

Q 1.3.3.1. ASK: Does your household have a bicycle?

- Yes

- No

Q 1.3.3.2. ASK: Does your household have a motorcycle?

- Yes

- No

Q 1.3.3.4. ASK: Do you have a house with a cement sealed floor?

- Yes
- No

Q 1.3.3.5. ASK: Does your house have electricity?

- Yes
- No

Q 1.3.3.6. ASK: Do you have a radio?

- Yes
- No

Q 1.3.3.7. ASK: Do you have a television?

- Yes
- No

Q 1.3.3.8. ASK: Do you have a set top box connection?

- Yes
- No

Q 1.3.3.9. ASK: Does your household have a rainwater or mains water tank?

- Yes
- No

Q 1.3.3.10. ASK: Does your household have a Mobile phone?

- Yes
- No

» » Module 4: Coffee Sales

Q 1.4.1. What proportion of coffee did you sell as cherry in 2016 compared to semi-washed coffee?

- All
- Around Three Quarters

- Around Half
- Around One Quarter
- Less than One Quarter
- I don't know

Q 1.4.2. Where do you sell your coffee?

- ☐ Direct to the co-op wet mill
- ☐ Direct to a private wet mill
- ☐ To a known agent of the wet mill
- ☐ To a buyer
- ☐ I don't know / Refuse to answer

Q 1.4.3. Enter the name of the wet mill where you sold your coffee

NOTE: If the wet mill given by farmer is not in the list, select 'Other '.

- ☐ Giseke Coffee
- ☐ Mizero Coffee
- ☐ Kawa Nyarubaka
- ☐ Musambira Coffee
- ☐ Mbuye Coffee-Nkubiri
- ☐ Butara Coffee
- ☐ Koabaka Intarushwa
- ☐ Other

» » Module 5: Farmer Perceptions

Q 1.5.1. ASK: Which of the following practices have you used since the training started in 2010?

NOTE: Best Practices include applying compost, weeding, etc. Do NOT prompt the farmer or read out the list of options.

MULTIPLE answers can be selected. Listen to the farmer carefully and choose all the options mentioned by the farmer.

- ☐ Record Keeping
- ☐ Mulching
- ☐ Weeding
- ☐ Applying fertilizer or compost
- ☐ Composting
- ☐ Rejuvenation
- ☐ Pruning
- ☐ Safe use of pesticides

□ Pest and Disease Management

□ Erosion control

□ Shade

Q 1.5.2. ASK: Since you attended TechnoServe Agronomy training, which started in 2010, and adopted some of the good agronomy practices have you and your household seen a change in the volume of coffee harvest produced compared to before the agronomy training started?

- Yes, large volume increase
- Yes, small volume increase
- No volume change
- Yes, small volume decrease
- Yes, large volume decrease
- I don't know

Q 1.5.3. ASK: Which of the following factors do you think most influence your coffee yield?

NOTE: Factors include weather, soil, etc.

Do NOT prompt the farmer or read out the list of options.

MULTIPLE answers can be selected. Listen to the farmer carefully and choose all the options mentioned by the farmer.

□ Access to Fertilizer

□ Soil conditions

□ Weather conditions

□ Time spent farming Coffee

□ Use of the Coffee Best Practices

□ Access to Finance

□ I don't know

Q 1.5.4. ASK: To what extent would you agree with the statement - Factors affecting your coffee yield are out of your control?

NOTE: Select the answer that is most suitable according to the farmer.

- Strongly Disagree
- Disagree
- Neither Agree not Disagree
- Agree
- Strongly Agree

Q 1.5.5. Do you have any plans to change the area of your land that is growing coffee in the next three years?

- Reduce the area of land growing coffee

- Maintain the same area of land growing coffee
- Increase the area of land growing coffee
- I don't know / Undecided

Q 1.5.6. From whom did you learn about Best Practices for improving coffee production?

NOTE: Ask the farmer to give only the MAIN source of information.

- Neighbour
- Family Members
- TechnoServe
- Another programme
- Other

Q 1.5.6.1. Enter the name of Another Programme

» » » Module 5.1: Best Practice Ranking

Please choose the top three practices that you think contribute to increases in yield.

NOTE: First, Read out the full list of options:

Record Keeping

Mulching

Weeding

Applying fertilizer or compost

Composting Rejuvenation Pruning

Safe use of pesticides

Pest and Disease Management

Erosion control

Shade

ASK the farmer to choose only TOP 3 practices. Select the answers from the drop-down list.

Q 1.5.7. First Preference.

Q 1.5.8. Second Preference

Q 1.5.9. Third Preference

» SECTION 2: Best Practices

» » Module 1: Record Keeping

Q 2.1.1. ASK: Do you have a Record Book or Card?

(if YES) ASK: May I see your Record Card?

NOTE: If the farmer cannot find their card mark "NO Record Card". Do not count delivery slips as a Record Card.

- NO Record Card

- YES, Farmer has a Record Card

Q 2.1.2. PHOTOGRAPH: Record Card

» » Module 2: Pesticide Use & Safe Use of Pesticides

Q 2.2.1. ASK: In the last 12 months, did you spray any Pesticides?

NOTE: Pesticides includes insecticides, fungicides and herbicides.

- NO, I didn't use any pesticides on my farm in the last 12 months- YES, I sprayed pesticides on my farm in the last 12 months

Q 2.2.2. ASK: What personal protective equipment (PPE) did you use? Please show me all your personal protective equipment.

NOTE: Record the answer based on what you SEE.

- Farmer used and I have seen all three PPE items in good order including (i) mask, (ii) gloves and (iii) boots

- Farmer did not use or farmer cannot show me all three PPE items

Q 2.2.3. ASK: How do you dispose of your pesticide containers?

NOTE: Do not read out the options. Select the option based on what the farmers says.

- Containers thrown into fields or compound

- Containers thrown into rubbish pit

- Containers destroyed by burning

- Containers buried

- Containers thrown into Pit latrine/Toilet

- Containers NOT disposed. NAEB takes away the containers.

» » Module 3: Composting

Q 2.3.1. ASK: Are you making compost?

- NO, Not making compost

- YES, Making compost

Q 2.3.2. LOOK: At the site where compost is being made or stored. Is a compost pit, compost heap, or pile of manure seen?

- No compost heap or pit seen
- Compost heap consisting of different materials seen
- Compost pit consisting of different materials seen
- Pile of only manure seen.
- Compost site seen and compost has been applied to field.
- Recently applied compost seen under trees in the field

Q 2.3.3. PHOTOGRAPH compost heap or compost site where compost has already been applied to field/trees.

ASK: Can you please take me to your mature coffee field where you implement best practices?

NOTE: GO TO COFFEE FIELD TO CONDUCT REMAINDER OF SURVEY.

If the farmer has more than one coffee field, then ask them to take you to the mature coffee field where they adopted the practices they learnt in the TechnoServe training.

GPS INSTRUCTION: Walk through the field. Then, go to the centre of the coffee field and take a GPS measurement.

NOTE: It might take a few minutes for the tablet to register the GPS. Wait for it to load. If it takes longer than 3 minutes, skip to the next question.

» » Module 4: Mulching

Q 2.4.1. LOOK: Is there any mulch on the field?

NOTE: Mulch is any organic material, such as leaves, crop residues, banana stems, coffee husks that cover the soil.

- NO, mulch seen on field
- YES, mulch seen on field

Q 2.4.2. LOOK: Where is the mulch? Is it only under the tree canopy or covering most of the field?

NOTE: Select the answer that best describes most of the field.

- Mulch under tree canopy only
- Mulch covering most of the field

Q 2.4.3. LOOK: How thick is the mulch under the tree canopy? Can you see the soil?

NOTE: Select the answer that best describes most of the field.

- Less than 2cm of mulch, bare soil seen
- More than 2cm of mulch, no soil seen

Q 2.4.4. PHOTOGRAPH: General mulching status of the coffee field

» » Module 5: Integrated Pest & Disease Management

Q 2.5.1. ASK FARMER: What methods do you know to reduce the occurrence of Antestia?

NOTE: Show the picture of Antestia so they know what you are talking about.

Do NOT prompt the farmer or give the answers. Only select the methods that the farmer mentions. DO ask the farmer if they know other methods before completing the question.

MULTIPLE answers can be selected. Select all options that the farmer mentions.

□ Prune or keep trees open

□ Squash the Antestia adults or eggs when they are seen

□ Have beneficial insects like spiders, praying mantis, chameleons in the farm

□ Spray insecticides

□ Do not know any methods

You cannot select "Do not know any methods" with any other option. Please go back and correct your response.

Q 2.5.2. ASK FARMER: What methods do you know to reduce the occurrence of Coffee Leaf Rust?

NOTE: Show the picture of Coffee Leaf Rust so they know what you are talking about.

Do NOT prompt the farmer or give the answers. Only select the methods that the farmer mentions. DO ask the farmer if they know other methods before completing the question.

MULTIPLE answers can be selected. Select all options that the farmer mentions.

□ Feed the tree well to keep it healthy

□ Use good agricultural practices such as weeding or mulching to reduce stress and keep trees healthy

□ Prune or keep canopy open□ Spray fungicides (e.g. Alto or Copper)

□ Use a variety of coffee resistant to Leaf Rust

□ Do not know any methods

You cannot select "Do not know any methods" with any other option. Please go back and correct your response.

» » Module 6: Weeding

Q 2.6.1. LOOK: How many weeds are under the tree canopy?

NOTE: Select the answer that best describes most of the field.

- No weeds under the tree canopy

- Few weeds under the tree canopy

- Many weeds under the tree canopy

Q 2.6.2. LOOK: How big are the weeds under the tree canopy, on average?

NOTE: Select the answer that best describes most of the field.

- Weeds are less than 30cm tall or 30cm spread for grasses

- Weeds are more than 30cm tall or 30cm spread for grasses

Q 2.6.3. PHOTOGRAPH: General weed status of the coffee field

» » Module 7: Fertilization Practice

Q 2.7.1. LOOK: At the colour of the coffee tree leaves. Are the leaves dark green or do they show signs of deficiencies, with some leaves yellow, pale green, or brown?

NOTE: Select the answer that best describes the appearance of leaves on the majority of trees. Young leaves will be paler green but this is

NOT a deficiency

- Nearly all leaves are dark green and less than 5% (less than 5 in 100) show deficiencies.

- 5% or more (5 or more in 100) of the leaves are yellow, pale green or brown.

Q 2.7.2. PHOTOGRAPH: Leaves of an average coffee tree

Q 2.7.3. ASK: Which fertilizers did you use on your coffee in the last 12 months?

NOTE: Ask farmers to include ALL the fertilizers they have used in the last 12 months, including foliar fertilizers. Do NOT read out the list of possible fertilizers to the farmer.

DO ask farmer if there was anything else use.

Refer to record card to confirm if any fertilizers where bought.

Make sure the farmer knows compost and manure are considered to be fertilizers. MULTIPLE answers can be selected. Select all options that the farmer mentions.

- Compost
- Manure
- NPK 17:17:17
- NPK 22:6:12
- NPK 20:10:10 or Other NPKs
- Zinc/Boron Foliar Feed (Tracel)
- Lime
- Worm tea The farmer did not use fertilizer

You cannot select "The farmer did not use fertilizer " with any other option. Please go back and correct your response.

Q 2.8.1. LOOK: How many main stems (vertical stems) do most of the coffee trees have?

NOTE: Enter a response that best describes most of the field.

- Most trees have 1 or 2 main stems
- Most trees have 3 main stems
- Most trees have 4 main stems
- Most trees have 5 or more main stems

Q 2.8.2. LOOK: Are the main stems on each tree all about the same age or of varying ages?

NOTE: Main stems of the same age will be about the same thickness. Main stems of varying ages will be different thickness. Include trees that have just been rejuvenated with 1 old main stem and new suckers as main stems of the same age.

Select the answer that best describes most of the field.

- Most trees have main stems of the same age (i.e. same thickness)
- Most trees have main stems of varying ages (i.e. varying thickness)

Q 2.8.3. LOOK and ASK: How old are the oldest main stems on each tree?

NOTE: ASK the farmer and also LOOK in at the thickness of stems. Select the answer based on what you SEE and what best describes most of the field.

- 8 years or younger
- Older than 8 years

Q 2.8.4. LOOK: In the field, which pruning method(s) have been used?

NOTE: MULTIPLE answers can be selected. Select all pruning methods seen. If you don't see any pruning in the field, select 'No pruning method used'.

- ☐ Centres opened
- ☐ Unwanted suckers removed
- ☐ Dead branches removed
- ☐ Branches touching the ground removed
- ☐ No pruning method used

You cannot select "No method used" with any other option. Please go back and correct your response.

Q 2.8.5. PHOTOGRAPH A number of average trees in the field

NOTE: This should capture the status of pruning status and number of main stems.

» » Module 9: Erosion Control

Q 2.9.1. LOOK: Which erosion control method(s) do you see in the farmer's field?

NOTE: MULTIPLE answers can be selected. Select all methods seen. You can ask the farmer to show you the erosion control method but you must SEE it to select the method used.

- ☐ Stabilizing grasses
- ☐ Mulch
- ☐ Water traps
- ☐ Physical barriers (e.g. rocks)
- ☐ Terraces
- ☐ No erosion control method seen

You cannot select "No erosion control method seen" with any other option. Please go back and correct your response.

» » Module 10: Shade

Q 2.10.1. LOOK: Are there some shade trees and shade in the farm? What level of shade is present on average on the farm?

NOTE: Shade can come from any trees, such as bananas, fruit trees, indigenous trees, etc.

- NO shade, less than 5%
- Light shade, 5 to 20%
- Medium shade, 20 to 40%
- Heavy shade trees, over 40%

Q 2.10.2. ASK and LOOK: Has the farmer planted any new shade trees in the last 2 years?

NOTE: These might not be giving shade yet. Count trees that have been planted to specifically fill gaps in shade. Shade trees can be any indigenous or fruit trees such as bananas, etc.

- NO new shade trees planted in the last 2 years
- YES, new shade trees planted in the last 2 years

The main respondent does not agree to participate in the survey. Please thank the farmer(s) for their time and say goodbye.

NOTE: This is the end of the survey, you will not be required to ask this farmer any more questions.

You have now completed the visit.

1. Take a moment to check the survey and ensure you've answered all the questions accurately.
1. When ready, thank the farmer for their time.

Annex 4: Using t-tests to compare our survey population to the overall population

The following t-tests compare the average for different variables between two separate population groups. They are used to indicate whether our sample population was significantly different from our overall population. We compare the total population of farmers who attended at least one TechnoServe training session, farmers who were trained through the three cooperatives we visited, our sample population, and our surveyed population (excluding non-respondents). As explained earlier, there are significant differences; the cooperatives we visited had a higher attendance rate than average, and our surveyed population had an even higher attendance rate because of the impact of non-respondents. We compare on 4 different variables: the percentage of untrained farmers (defined as those who attended less than 50% of training sessions), the attendance rate, the percentage where the main farmer was male, and the percentage where the main farmer was female.

T-tests are the common statistical method of comparing two populations to examine whether they are statistically significant. The null hypothesis is that the populations are the same, and therefore the average on each variable will be the same.

For each t-test, the table shows the average for the variable and the two population in question, as well as the size of each population group. The p-value indicates the probability that there is a significant difference between the means. If there are significant differences, then we assume that the populations are not identical and there is a difference between the two means.

Annex t-test 1: Comparing the rate of untrained farmers in surveyed cooperatives with the cooperatives served by TechnoServe

Variable Untrained farmers	Population groups Surveyed coops					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	6280	0.160	0.005	0.367	0.151	0.169
1	2843	0.127	0.006	0.333	0.115	0.140
Combined	9123	0.150	0.004	0.357	0.143	0.157
diff		0.033				
t =	**4.057**					
			Pr(T >			
Pr(|T| > |t|) =	**0**		t) =	1		

		Pr(T < t) =	0

Annex t-test 2: Comparing the attendance rate in surveyed cooperatives with the cooperatives served by TechnoServe

Variable Attendance rate	Population groups Surveyed coops					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	6280	0.703	0.003	0.211	0.697	0.708
1	2843	0.749	0.004	0.197	0.742	0.756
Combined	9123	0.717	0.002	0.208	0.713	0.721
diff		-0.046				
t =	**-9.897**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 3: Comparing the proportion of male farmers in surveyed cooperatives with the cooperatives served by TechnoServe

Variable Male main farmer	Population groups Surveyed coops					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	6280	0.653	0.006	0.476	0.642	0.665
1	2843	0.535	0.009	0.499	0.517	0.554
Combined	9123	0.617	0.005	0.486	0.607	0.627
diff		0.118				
t =	**10.803**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	0		
			Pr(T < t) =	1		

Annex t-test 4: Comparing the proportion of female farmers in surveyed cooperatives with the cooperatives served by TechnoServe

Variable Female main farmer	Population groups Surveyed coops					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	6280	0.322	0.006	0.467	0.311	0.334
1	2843	0.441	0.009	0.497	0.422	0.459
Combined	9123	0.617	0.005	0.486	0.607	0.627
diff		-0.118				
t =	**-10.992**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 5: Comparing the rate of untrained farmers in our sample population with the cooperatives served by TechnoServe

Variable Untrained	Population groups Sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8358	0.154	0.004	0.361	0.147	0.162
1	765	0.101	0.011	0.301	0.079	0.122
Combined	9123	0.150	0.004	0.357	0.143	0.157
diff		0.054				
t =	**3.985**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 6: Comparing the attendance rate in our sample population with the cooperatives served by TechnoServe

Variable Attendance rate	Population groups Sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8358	0.154	0.004	0.361	0.147	0.162
1	765	0.101	0.011	0.301	0.079	0.122
Combined	9123	0.717	0.002	0.208	0.713	0.721
diff		0.054				
t =	**-5.928**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 7: Comparing the proportion of male farmers in our sample population with the cooperatives served by TechnoServe

Variable Male main farmer	Population groups Sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8358	0.624	0.005	0.484	0.614	0.635
1	765	0.532	0.018	0.499	0.497	0.567
Combined	9123	0.617	0.005	0.486	0.607	0.627
diff		0.092				
t =	**5.031**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 8: Comparing the proportion of female farmers in our sample population with the cooperatives served by TechnoServe

Variable Female main farmer	Population groups Sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8358	0.351	0.005	0.477	0.341	0.361
1	765	0.448	0.018	0.498	0.413	0.484
Combined	9123	0.359	0.005	0.480	0.349	0.369
diff		-0.097				
t =	**-5.378**					
			Pr(T > t) =	1		
Pr(|T| > |t|) =	**0**					
			Pr(T < t) =	0		

Annex t-test 9: Comparing the proportion of female farmers in our sample population with the cooperatives served by TechnoServe

Variable Female main farmer	Population groups Sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8358	0.351	0.005	0.477	0.341	0.361
1	765	0.448	0.018	0.498	0.413	0.484
Combined	9123	0.359	0.005	0.480	0.349	0.369
diff		-0.097				
t =	**-5.378**					
			Pr(T > t) =	1		
Pr(|T| > |t|) =	**0**					
			Pr(T < t) =	0		

Annex t-test 10: Comparing the untrained farmers' rate in our surveyed population with the cooperatives served by TechnoServe

Variable	Population groups

Untrained	Surveyed population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8503	0.155	0.004	0.362	0.147	0.162
1	620	0.084	0.011	0.277	0.062	0.106
Combined	9123	0.150	0.004	0.357	0.143	0.157
diff		0.071				
t =	**4.773**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 11: Comparing the attendance rate in our surveyed population with the cooperatives served by TechnoServe

Variable Attendance rate	Population groups Surveyed population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8503	0.713	0.002	0.209	0.708	0.717
1	620	0.774	0.007	0.173	0.761	0.788
Combined	9123	0.717	0.002	0.208	0.713	0.721
diff		-0.061				
t =	**-7.133**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 12: Comparing the proportion of male farmers in our surveyed population with the cooperatives served by TechnoServe

Variable Male main farmer	Population groups Surveyed population

Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8503	0.622	0.005	0.485	0.612	0.633
1	620	0.537	0.020	0.499	0.498	0.576
Combined	9123	0.617	0.005	0.486	0.607	0.627
diff		0.085				
t =	**4.220**					
			Pr(T > t) =	0		
Pr(|T| > |t|) =	**0**		Pr(T < t) =	1		

Annex t-test 12: Comparing the proportion of female farmers in our surveyed population with the cooperatives served by TechnoServe

Variable Female main farmer	Population groups Surveyed population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	8503	0.353	0.005	0.478	0.343	0.363
1	620	0.444	0.020	0.497	0.404	0.483
Combined	9123	0.359	0.005	0.480	0.349	0.369
diff		-0.090				
t =	**-4.539**					
			Pr(T > t) =	1		
Pr(|T| > |t|) =	**0**		Pr(T < t) =	0		

Annex t-test 13: Comparing the untrained farmers in our sample population with the 3 cooperatives surveyed

Variable Untrained	Population groups Sample population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2078	0.137	0.008	0.344	0.122	0.152
1	765	0.101	0.011	0.301	0.079	0.122

Combined diff	2843	0.127 0.036	0.006	0.333	0.115	0.140
t = **Pr(|T| > |t|) =**	**2.591** **0.010**		Pr(T > t) = Pr(T < t) =	0.995 0.005		

Annex t-test 14: Comparing the attendance rate in our sample population with the 3 cooperatives surveyed

Variable Attendance rate	Population groups Sample population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2078	0.745	0.004	0.202	0.736	0.754
1	765	0.760	0.007	0.185	0.747	0.773
Combined	2843	0.749	0.004	0.197	0.742	0.756
diff		-0.015				
t = **Pr(|T| > |t|) =**	**-1.757** **0.079**		Pr(T > t) = Pr(T < t) =	0.960 0.040		

Annex t-test 15: Comparing the proportion of male farmers in our sample population with the 3 cooperatives surveyed

Variable Male main farmer	Population groups Sample population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2078	0.537	0.011	0.499	0.515	0.558
1	765	0.532	0.018	0.499	0.497	0.567
Combined	2843	0.535	0.009	0.499	0.517	0.554
diff		0.005				

t = Pr(|T| > |t|) =	**0.216 0.829**

Pr(T > t) = 0.585
Pr(T < t) = 0.415

Annex t-test 16: Comparing the proportion of female farmers in our sample population with the 3 cooperatives surveyed

Variable Female main farmer	Population groups Sample population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2078	0.438	0.011	0.496	0.417	0.459
1	765	0.448	0.018	0.498	0.413	0.484
Combined	2843	0.441	0.009	0.497	0.422	0.459
diff		-0.010				
t = Pr(|T| > |t|) =	**-0.497 0.619**					

Pr(T > t) = 0.691
Pr(T < t) = 0.310

Annex t-test 17: Comparing the untrained farmers in our surveyed population with the 3 cooperatives surveyed

Variable Untrained	Population groups Surveyed population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2223	0.139	0.007	0.346	0.125	0.154
1	620	0.084	0.011	0.277	0.062	0.106
Combined	2843	0.127	0.006	0.333	0.115	0.140
diff		0.056				
t = Pr(|T| > |t|) =	**3.679 0**					

Pr(T > t) = 1

		Pr(T < t) =	0

Annex t-test 18: Comparing the attendance rate in our surveyed population with the 3 cooperatives surveyed

Variable Attendance rate	Population groups Surveyed population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2223	0.742	0.004	0.203	0.733	0.750
1	620	0.774	0.007	0.173	0.761	0.788
Combined	2843	0.749	0.004	0.197	0.742	0.756
diff		-0.033				
t =	**3.679**					
Pr(|T| > |t|) =	**0**		Pr(T > t) =	1		
			Pr(T < t) =	0		

Annex t-test 19: Comparing the proportion of male farmers in our surveyed population with the 3 cooperatives surveyed

Variable Male main farmer	Population groups Surveyed population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2223	0.535	0.011	0.499	0.514	0.556
1	620	0.537	0.020	0.499	0.498	0.576
Combined	2843	0.749	0.004	0.197	0.742	0.756
diff		-0.002				
t =	**-0.099**					
Pr(|T| > |t|) =	**0.922**		Pr(T > t) =	0.539		
			Pr(T < t) =	0.461		

Annex t-test 20: Comparing the proportion of female farmers in our surveyed population with the 3 cooperatives surveyed

Variable Female main farmer	Population groups Surveyed population within 3 cooperatives					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	2223	0.440	0.011	0.496	0.419	0.461
1	620	0.444	0.020	0.497	0.404	0.483
Combined	2843	0.441	0.009	0.497	0.422	0.459
diff		-0.004				
t =	**-0.160**					
Pr(|T| > |t|) =	**0.873**		Pr(T > t) =	0.563		
			Pr(T < t) =	0.437		

Annex t-test 21: Comparing the untrained farmers in our surveyed population with the sample population

Variable Untrained	Population groups Surveyed population within sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	145	0.172	0.031	0.379	0.110	0.235
1	620	0.084	0.011	0.277	0.062	0.106
Combined	765	0.101	0.011	0.301	0.079	0.122
diff		0.089				
t =	**3.208**					
Pr(|T| > |t|) =	**0.001**		Pr(T > t) =	0.999		
			Pr(T < t) =	0.001		

Annex t-test 22: Comparing the attendance rate in our surveyed population with the sample population

Variable Attendance rate	Population groups Surveyed population within sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	145	0.697	0.018	0.216	0.661	0.732
1	620	0.774	0.007	0.173	0.761	0.788
Combined	765	0.760	0.007	0.185	0.747	0.773
diff		-0.078				
t =	**3.208**		Pr(T > t) =	1		
Pr(|T| > |t|) =	**0**		Pr(T < t) =	0		

Annex t-test 23: Comparing the proportion of male farmers in our surveyed population with the sample population

Variable Male main farmer	Population groups Surveyed population within sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	145	0.510	0.042	0.502	0.428	0.593
1	620	0.537	0.020	0.499	0.498	0.576
Combined	765	0.532	0.018	0.499	0.497	0.567
diff		-0.027				
t =	**-0.581**		Pr(T > t) =	0.719		
Pr(|T| > |t|) =	**0.562**		Pr(T < t) =	0.281		

Annex t-test 24: Comparing the proportion of female farmers in our surveyed population with the sample population

Variable	Population groups

Female main farmer	Surveyed population within sample population					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0	145	0.469	0.042	0.501	0.387	0.551
1	620	0.444	0.020	0.497	0.404	0.483
Combined	765	0.532	0.018	0.499	0.497	0.567
diff		0.025				
t =	**0.553**					
Pr(|T| > |t|) =	**0.580**		Pr(T > t) =	0.710		
			Pr(T < t) =	0.290		

Annex 5: Regression output for relationship between attendance rate and best practice usage

A basic regression was used to examine the relationship between each individual best practice and the attendance rate. In these regressions, which were all run separately, the dependent variable was the percentage usage rate for each best practice. The single independent variable was the attendance rate. The coefficient represents the increase in best practice usage rates that would result if the attendance rate increased from 0% to 100%. Thus for mulch, a coefficient of 0.460 states that an increase in the attendance rate from 0% to 100% for the entire population would result in 46% of the population adopting mulch having not used it previously. A star (*) indicates whether this coefficient is statistically significant. Where there are no stars, that indicates that either the training possibly was not very effective, or the relationship is not strong enough to appear within the confines of the current dataset.

	(1)	(2)	(3)	(4)
VARIABLES	Record book	Compost	Mulch	Integrated Pest Management
Total Attendance Rate	-0.00616	0.0515	0.460***	0.284**
	(0.0448)	(0.104)	(0.113)	(0.114)
Constant	0.0435	0.683***	0.228**	0.193**
	(0.0355)	(0.0825)	(0.0896)	(0.0903)
Observations	620	620	620	620
R-squared	0.000	0.000	0.026	0.010

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Weeding	Fertiliser	Rejuvenation	Pruning	Erosion Control	Shade
Total Attendance Rate	0.172**	0.0561	0.0773	0.247**	0.169***	0.133
	(0.0703)	(0.108)	(0.115)	(0.108)	(0.0640)	(0.109)
Constant	0.763***	0.636***	0.514***	0.492***	0.785***	0.229***
	(0.0558)	(0.0860)	(0.0911)	(0.0853)	(0.0508)	(0.0867)
Observations	620	620	620	620	620	620
R-squared	0.010	0.000	0.001	0.008	0.011	0.002

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Annex 6: Regression output for relationship between best practice adopters and other variables

We also used t-tests to compare the population of BP high adopters with BP low adopters, to determine if there were statistically different differences between the two populations. Some variables were re-categorized to turn into binary variables to facilitate analysis and interpretation.

Annex t-test 25: Comparing the self-assessed positive yield response by BP high adopters and BP low adopters

T-test Variable Volume increase Group	Population groups BP Adopter	Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.731	0.038	0.445	0.655	0.807
1.000	486.000	0.907	0.013	0.290	0.882	0.933
Combined	620.000	0.869	0.014	0.337	0.843	0.896
diff		-0.176				
t =	**-5.470**		Pr(T > t) =	1.000		
Pr(|T| > |t|) =	**0.000**		Pr(T < t) =	0.000		

Annex t-test 26: Comparing the self-assessed positive large yield response by BP high adopters and BP low adopters

T-test Variable Large volume increase Group	Population groups BP Adopter	Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.172	0.033	0.378	0.107	0.236
1.000	486.000	0.372	0.022	0.484	0.329	0.416

Combined	620.000	0.329	0.019	0.470	0.292	0.366
diff		-0.201				
t =	**-4.441**					
Pr(|T| > |t|) =	**0.000**		Pr(T > t) =	1.000		
			Pr(T < t) =	0.000		

Annex t-test 27: Comparing future plans for land by BP high adopters and BP low adopters

T-test						
Variable	Population groups					
Future plans for land	BP Adopter					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.239	0.037	0.428	0.166	0.312
1.000	486.000	0.323	0.021	0.468	0.281	0.365
Combined	620.000	0.305	0.019	0.461	0.269	0.341
diff		-0.084				
t =	**-1.878**					
Pr(|T| > |t|) =	**0.061**		Pr(T > t) =	0.970		
			Pr(T < t) =	0.030		

Annex t-test 28: Comparing cooperative membership by BP high adopters and BP low adopters

T-test					
Variable	Population groups				
Cooperative membership	BP Adopter				
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals

0.000	134.000	0.216	0.036	0.413	0.146	0.287
1.000	486.000	0.354	0.022	0.479	0.311	0.397
Combined	620.000	0.324	0.019	0.468	0.287	0.361
diff		-0.137				
t =	**-3.028**					
Pr(|T| > |t|) =	**0.001**		Pr(T > t) =	1.000		
			Pr(T < t) =	0.000		

Annex t-test 29: Comparing hectares by BP high adopters and BP low adopters

T-test						
Variable	Population groups					
Hectares	BP Adopter					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.562	0.051	0.585	0.462	0.662
1.000	486.000	0.719	0.037	0.817	0.646	0.792
Combined	620.000	0.685	0.031	0.775	0.624	0.746
diff		-0.157				
t =	**-2.084**					
Pr(|T| > |t|) =	**0.038**		Pr(T > t) =	0.981		
			Pr(T < t) =	0.019		

Annex t-test 30: Comparing number of coffee trees by BP high adopters and BP low adopters

T-test					
Variable	Population groups				
Number of coffee trees	BP Adopter				
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals

0.000	134.000	226.157	48.652	563.193	129.924	322.389
1.000	486.000	345.418	21.447	472.812	303.277	387.559
Combined	620.000	319.642	19.908	495.704	280.547	358.737
diff		-119.261				
t =	**-2.476**					
Pr(|T| > |t|) =	**0.014**		Pr(T > t) =	0.993		
			Pr(T < t) =	0.007		

Annex t-test 31: Comparing the assets index by BP high adopters and BP low adopters

T-test						
Variable	Population groups					
Assets Index	BP Adopter					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	3.752	0.203	2.350	3.351	4.154
1.000	486.000	4.620	0.128	2.813	4.369	4.870
Combined	620.000	4.432	0.110	2.741	4.216	4.648
diff		-0.867				
t =	**-3.268**					
Pr(|T| > |t|) =	**0.001**		Pr(T > t) =	1.000		
			Pr(T < t) =	0.000		

Annex t-test 32: Comparing farm management by a single individual by BP high adopters and BP low adopters

T-test	
Variable	Population groups
Single farm manager	BP Adopter

Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.821	0.033	0.385	0.755	0.887
1.000	486.000	0.780	0.019	0.415	0.743	0.817
Combined	620.000	0.789	0.016	0.409	0.756	0.821
diff		0.041				
t =	**1.030**					
			Pr(T > t) =	0.849		
Pr(|T| > |t|) =	**0.303**					
			Pr(T < t) =	0.152		

Annex t-test 33: Comparing female farm management by BP high adopters and BP low adopters

T-test						
Variable	Population groups					
Female farm manager	BP Adopter					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.515	0.043	0.502	0.429	0.601
1.000	486.000	0.377	0.022	0.485	0.333	0.420
Combined	620.000	0.406	0.020	0.492	0.368	0.445
diff		0.138				
t =	**2.902**					
			Pr(T > t) =	0.998		
Pr(|T| > |t|) =	**0.004**					
			Pr(T < t) =	0.002		

Annex t-test 34: Comparing farm ownership by a single individual by BP high adopters and BP low adopters

T-test						
Variable	Population groups					
Single farm owner	BP Adopter					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	

0.000	134.000	0.485	0.043	0.502	0.399	0.571
1.000	486.000	0.405	0.022	0.491	0.362	0.449
Combined	620.000	0.423	0.020	0.494	0.384	0.462
diff		0.080				
t =	**1.656**					
			Pr(T >			
Pr(|T| > |t|) =	**0.098**		t) =	0.951		
			Pr(T <			
			t) =	0.049		

Annex t-test 35: Comparing female farm ownership by BP high adopters and BP low adopters

Variable	Population groups					
Female farm owner	BP Adopter					
Group		Mean	Std. Error	Std. Dev.	95% Confidence Intervals	
0.000	134.000	0.366	0.042	0.483	0.283	0.448
1.000	486.000	0.302	0.021	0.460	0.261	0.343
Combined	620.000	0.316	0.019	0.465	0.279	0.353
diff		0.063				
t =	**1.393**					
			Pr(T >			
Pr(|T| > |t|) =	**0.164**		t) =	0.918		
			Pr(T <			
			t) =	0.082		

Annex 7: Assets index composition

We constructed an assets index based on the questions within the survey. The weightings were based on an analysis of frequency within the survey and on how similar assets were rated by other poverty indicators.

Asset	Weighting
Number of chickens	0.1
Number of sheep	0.3
Number of pigs	0.5
Number of cows	1
Bicycle	1
Motorbike	1
Corrugated iron/tin roof	1
Cement sealed floor	1
Electricity	1
Radio	1
Television	1
Top box connection	1
Rainwater or mains water tank	1
Mobile phone	1