ECONOMIC ANALYSIS OF FEED THE FUTURE INVESTMENTS

Rural Value Chains Project – AGEXPORT

July 2013

INTRODUCTION

In July 2012, USAID/Guatemala signed a five-year award with the local group Associación Guatemalteca de Exportadores (AGEXPORT) to implement roughly half of a $42 million dollar initiative to reduce the risks of food insecurity in rural households through better yields of staple crops, diversified household income from specialty coffees or vegetables, and improved access to and availability of nutritious foods in five departments of the Western Highlands.

USAID/Guatemala conducted a cost-benefit analysis (CBA) of the project beginning in March 2012 to quantify potential costs and benefits in financial and economic terms over a standard 20-year period. The results are intended to inform decisions regarding project direction and resources. This report summarizes results from the analysis.

Team Composition

The CBA team was comprised of five members, including:

- Tom DiVincenzo – Mission Economist (USAID/Guatemala)
- Adam Sylagi – Agriculture Officer (USAID/Guatemala)
- Shamenna Gall – Agriculture Officer (USAID/El Salvador)
- Paul Rivera – Economist (California State University, Channel Islands / USAID/Washington)
- Nathan Martinez – Program Economist (USAID/Washington)

BACKGROUND

USAID/Guatemala has identified 30 municipalities in five departments in the Western Highlands (Huehuetenango, Quetzaltenango, Quiché, San Marcos and Totonicapán) as the area of greatest potential for high impact with respect to implementation of Feed the Future (FTF) interventions in agriculture production, poverty reduction and improved nutrition in rural households. Implementing partner AGEXPORT will work in 12 of these municipalities in the departments of Quiché, Quetzaltenango and Totonicapán (see Annex 1).

The Rural Value Chain Program (RVCP) with AGEXPORT will increase the number of rural households participating in value chains, increase incremental value chain sales and local employment, increase household incomes, and contribute to improved nutrition in the communities in which it works.

In addition to another rural value chains implementing partner who is working in separate municipalities within the 30 identified, the project is geographically linked with concurrent P.L. 480 Title II programs, the mission's Community Nutrition and Health Care project, and elements of the mission's education and democracy and governance portfolios. Only net benefits of the AGEXPORT project will be modeled here, however.

RVCP PROJECTED IMPACT AND TARGET BENEFICIARIES

Guatemala's FTF strategy aims to reduce rural poverty and malnutrition in the Western Highlands through market-led agricultural development, prevention and treatment of under-nutrition, and improvements to humanitarian food assistance and social safety nets. RVCP will focus on market-led agricultural development. Specifically, RVCP will support rural producers associations to expand their reach, improve their market linkages, and strengthen their members' ability to produce high-quality produce and export crops. These efforts will directly result in improved agricultural production, increased incomes and diversified crops beyond subsistence levels in rural households in 12 municipalities in the Guatemalan Western Highlands. The project has six components, which are:

I. Improved value chain participation
II. Expanded value chain participation
III. Improved agricultural productivity
IV. Expanding markets and trade
V. Increased food crop productivity and utilization
VI. Improved competitiveness of handicrafts value chain

Components I-V will directly benefit producers through a combination of greater diversity of commercial crops grown, greater productivity of those crops, and in some cases lower prices for inputs due to bulk purchasing. Component VI will not be evaluated under this CBA because it is a new area of work for AGEXPORT and at this time little detail is available on how the component will increase household incomes. As this component develops, a CBA of these efforts should be possible.

Over the five years of RVCP, activities target 10,200 households producing commercial agriculture in the target municipalities. Other households will be targeted under component VI of the project and additional households are expected to be reached through post-harvest employment, but these effects are not detailed enough to model at this time. Of these 10,200 households, roughly 80 percent are expected to adopt the productivity-enhancing techniques developed through the project. This leaves us with 8,160 households, or 60,384 individuals stemming from the average of 7.4 members of household in this region of the country. Only 20 percent of the 8,160 are expected to be reached in year one due to project roll-out. Similarly, 50 percent of that number will be reached in year two, 80 percent in year three, 90 percent in year four and 100 percent is all following years.

All targeted households will be located in those communities within the 12 target municipalities that demonstrate high levels of need (poverty and malnutrition) as well as potential (access to viable land and roads and existence of producer associations). At the end of the five years, the expected number of households affected represents roughly 9 percent of the 2011 population of 710,622 people in the 12 municipalities in which AGEXPORT will work. As stated, RVCP also aims to indirectly benefit many more households through post-harvest employment and other spillover effects of the intervention. To maintain a conservative model, however, the secondary effects of the intervention are not included, nor are the effects of other USAID/Guatemala interventions that have some overlap with RVCP.

<u>Beneficiaries by Farm Size and Income</u>

Beneficiary analysis was conducted using data from the National Institute of Statistics' (INE) National Survey of Livelihood, which contains data down to the departmental level, and the Government of Guatemala's municipal censes conducted under the Mi Familia Progresa social program. Both datasets were used to find populations living below and above the country's local poverty lines for extreme and absolute poverty in accordance with INE's work on the subject. INE ran regression analyses to find those indicators in the municipal surveys that correlate closely with household income in the departmental survey. The equations were used to find extreme and absolute poverty levels in the 12 municipalities in which AGEXPORT will work.

Of the 10,200 households targeted by RVCP, 80 percent are expected to adopt and see sustained benefits from the project. Forty percent of the beneficiaries in these communities are small farmers with an average farm size of 0.7 hectares. Another 40 percent will be medium-sized farmers with an average farm size of 1.2 hectares, and a further 20 percent will be relatively larger farms (1.5 hectares on average). A target of 30 percent of RVCP direct beneficiaries being female-headed households, roughly 2,400 of the total households will fall into this category. According to the municipal censes, about 31,400 women will be beneficiaries in total, and 56,900 (94 percent) will be indigenous based on the region's demographics.

In addition, the analysis shows that 10,000 (17 percent) of the expected beneficiaries fall below the local extreme poverty line ($1.57/day) and 56,000 (an additional 56 percent) fall between the extreme and absolute ($3.23/day) poverty lines. Calculations of the World Bank poverty lines of $1.25 per day and $2.00 per day were not possible with the municipal censes because the indicators used were correlated only with the local poverty lines.

RVCP COST BENEFIT ANALYSIS

Overview, Assumptions and Structure of the Model

This CBA quantified the costs and benefits of the intervention over the five year life of the project and the ensuing fifteen years after the project ends. The approach taken by the CBA team resulted from review of project documentation, discussions and vetting with AGEXPORT staff, as well as field visits for the recent AGEXPORT project that ended in September 2012. The field visits included interviews with AGEXPORT extension workers and small farmers in the department of Quiché for perspectives on the different aspects of implementation.

The main project deliverable will be technical assistance to the producer associations that will increase their membership, increase the productivity of their members, reduce wastage rates for horticultural crops and in some cases lower input costs due to bulk purchasing. Project components I-V are related and will be delivered to the same beneficiaries. They will therefore be treated as a single intervention. This approach results in a cleaner CBA model that is still representative of the intervention. **RVCP results in a one-time increase in these factors over four years before returning to the trends of stagnant productivity and real prices for each crop.** Gains to productivity under the intervention scenario are expected to begin in year 2 and then be evenly distributed through year 6, while reduction in input prices will be realized beginning in year 1.

Both financial and economic analyses were conducted for the intervention, although trade distortions and taxes are generally not part of farmers' costs. The difference between the two analyses is minimal, as shown below. A financial net present value (NPV) using the economic opportunity cost of capital and the modified internal rate of return are both calculated to provide additional context for the economic NPV and economic rate of return.

Taxes are generally not paid by the smallholder farmers, and therefore are not included in the on-farm cash flow. Beginning in 2013, new tax legislation will be implemented that, according to AGEXPORT staff, will mean that the associations will need to report income in such a way that small farmers who can currently avoid paying taxes on meager incomes will not be able to avoid detection henceforth. How this legislation is implemented will affect these farmers and their cash flows. However, due to the uncertainty of the law de facto, those taxes (5 percent of gross sales) are not included in this model with the understanding that the model will be updated in the future.

The Government of Guatemala provides a limited number of subsidized bags of fertilizer each year. The fertilizer scheme has wavered between coupons, partial coupons, and subsidized prices. This number of subsidized bags amounted to one to two bags of fertilizer per program beneficiary since 2010 and has been declining since 2000[1]. Each bag is one quintal or 100 pounds. Because of the limited number of subsidized bags, only some farmers in certain municipalities receive the subsidized fertilizer. Even with the small farm modeled here, farmers need 51 bags of fertilizer in the without-intervention scenario. This distortion represents a relatively small number of farmers receiving this subsidy, and therefore the fertilizer scheme is not incorporated into the model.

Because the United States is the main trading partner with Guatemala, CAFTA-DR covers the overwhelming majority of Guatemala's horticultural and coffee exports, and other minor trading of horticultural crops also falls within the CAFTA-DR region. According to the World Trade Organization, in April 2012, 39 percent of Guatemala's exports and 37 percent of Guatemala's imports were traded with the US—even more of this trade was with other CAFTA-DR partners. Furthermore, tariffs on major agricultural inputs and tariffs on agricultural exports are zero or near zero in all cases. In those cases where tariffs that affect inputs for this model are not zero, under CAFTA-DR those rates are scheduled to be phased out over ten years from Guatemala's ratification of the agreement in 2006[2]. For this reason, distortions on imports and exports for the purposes of this model are very small. A single conversion factor was estimated for non-labor inputs for farms such as fertilizers, pesticides and fungicides based on a foreign exchange premium calculated from World Bank trade data. In lieu of detailed data and in order to maintain a conservative estimation, the conversion factor counted transport costs as 100 percent tradable even though the actual figure is certainly not 100 percent. A separate conversion factor for family labor was estimated based on experience in other developing countries.

[1] Instituto de Agricultura, Recursos Naturales y Ambiente de Universidad Rafael Landivar. *Evaluacion del Programa de Fertilizantes del Ministerio de Agricultura, Ganaderia y Alimentacion.* 2013.

[2] Office of the United States Trade Representative. Legal Text of Dominican Republic – Central America Free Trade Agreement Legal Text, Schedule of Guatemala to Annex 3.3. Online at: http://www.ustr.gov/trade-agreements/free-trade-agreements/cafta-dr-dominican-republic-central-america-fta/final-text

No loans for equipment are required of these farms both because of their small size and the severe slopes on which many of these farms are perched. These slopes do not allow for tractors, tillers, or other heavy machinery that would have trouble operating at these steep angles.

Additionally, working capital is not a factor on the majority of farms this small, as producer groups will generally hold zero-interest accounts with farmers for input costs. For example, if a small farmer needs 10 bags of fertilizer before the planting season and received this fertilizer from the producer group, the farmer incurs a debt of $300. At harvest, the farmer is obliged to sell a percentage of his crop to the producer group, which will be sold on to market by the producer group. When this crop is sold, the producer group pays the farmer for the harvest minus $300 owed for fertilizer. In these cases the farmer uses no working capital.

This model attempts to address the varying size and development of producer associations across the intervention area. The model uses three types of average farms to approximate this variety: small farm (0.7 hectares), medium farm (1.2 hectares) and coffee farms (1.5 hectares). These average farms are modeled for incremental net benefit and the results are multiplied by the percent of beneficiaries that fall in each category.

As represented in this model, the portions of farms devoted to crop production sum to more than 100 percent due to crop cycles and intercropping patterns. On field visits, CBA team members noted that some farmers only grow a commercial crop during the rainy season and maize on the same parcel of land in the dry season. Others with less than 0.7 hectares rented land elsewhere in the rainy season to grow commercial crops and retreated to their small parcel of land for subsistence cropping the rest of the year. Still others grew all crops on one-third of land for half the year, another third for the second half, and left the final third fallow. This much variation in cropping practices presents a problem when representing the farms as individual annual units of production. The model that best represents the wide variety of farming behavior counts more than 100 percent of land as arable in a given year. This is the case for the small and medium farms modeled here. The larger farms that model coffee production, however, sum to exactly100 percent of the allocated land for the reasons stated below.

The **small farm model** includes production of two subsistence crops—maize and beans—for household consumption, and one commercial crop for export—snow peas in this case. While maize and beans are staples of self-consumption on nearly all farms across the country, the choice of snow peas is arbitrary as the commercial crop. In some cases, the typical farm that this model represents could grow French beans or macadamia nuts if the climate and soil are agreeable. The concept is to approximate a farm with only enough land for the two staples and one income-generating crop. For the reasons noted above, 130 percent of the farm is considered arable land in both the counterfactual and "with intervention" scenarios. These farms are small enough that only a negligible amount of shifting of production is foreseen due to productivity increases.

The **medium farm model** includes production of maize and beans for subsistence, snow peas as a representative commercial crop for export, and one commercial crop destined for the local market—in this case cabbage. CBA team members in the field reported seeing the medium-sized farmers adding a second commercial crop for the local market (for example cabbage, onion

or tomato) to their harvest to take advantage of additional land and/or family labor that was freed up due to productivity increases in other crops. Therefore, in the with-intervention scenario a local market crop is added to the production and 135 percent of the 1.2 hectares is considered arable. Without the technical support from AGEXPORT, the counterfactual scenario without the project expects these farmers to grow maize, beans and a commercial crop on the same amount of land (120 percent of 1.2 hectares) with lower productivity. The increased productivity allows them to diversify and slightly expand their production.

The **coffee farm model** is slightly larger than the medium farm model as noted during CBA team field work but is still not considered large for all intents and purposes. This model is built similarly to the small farm model except that instead of snow peas, certified organic coffee is grown as a commercial crop. Seventy percent of farm land is reserved for coffee and 30 percent for subsistence maize and beans in this model. Most land used for coffee production was reported as physically separate from subsistence plots and in many cases was assumed to be rented specifically for coffee growing. Therefore the arable land for these farms sums to 100 percent of 1.5 hectares.

Project Costs

Two principal sources will finance the project: USAID and a cost-share arrangement with the implementing partner, AGEXPORT. Expected USAID financing of AGEXPORT is approximately $23 million. AGEXPORT, the firm responsible for project implementation, agreed to enter into a cost-share arrangement that will add about $1.2 million in cash and in-kind contributions to project funding. Only $20.9 million will be considered for this analysis as component VI—work in the handicrafts value chain—is not modeled.

Although the project is divided into components, this model looks at the cash flow of each model farm without regard to project financing, and only upon summing the incremental net benefits for all beneficiaries are USAID and AGEXPORT costs subtracted to account for a total investment point of view. Total project costs in each year of implementation are used in this case.

Before project implementation, this budget can only be considered indicative. Indeed changes in the distribution are likely. Since the proposed project budget submitted to USAID was presented in fiscal year nominal dollars, the model adjusts the budget to express funds for each year in real quetzales including an adjustment in the economic analysis for Guatemala's foreign exchange premium.

Parameters

There were a number of steps required to collect the data that would be used for the analysis. A summary of each of these steps is provided below.

Production Information

Data on current production come from internal reports provided by AGEXPORT. Historical production data are used to estimate average annual percent changes. These data are found in publically available documents published annually by the Ministry of Agriculture (MAGA in

Spanish)[3]. Estimations concerning the progress of the intervention are provided by RVCP project documents that include implementation targets as well as AGEXPORT staff estimates.

In the past 5-7 years productivity of the crops modeled has declined or been stagnant[4]. The model assumes zero annual productivity growth because it is assumed that farmers will find ways to maintain yield over the long term, even if medium term trends are slightly negative. Therefore stagnant productivity would continue in the without-intervention scenario, and is assumed to be the case with the intervention after the initial gains in productivity.

Farm Budgets/Operating Costs

Data on levels and prices of inputs come from internal reports provided by AGEXPORT. Depending on the crop, inputs include:

- Irrigation
- Seeds
- Fertilizer
- Land Rent
- Pesticides
- Household Labor

Farm inputs after project implementation vary only slightly depending on the crop in question. In the case of maize and beans the quantity of fertilizer per hectare increases with-intervention, with snow peas the quantity of insecticide and fungicide decrease, and in the case of coffee the quantity of family labor used increases.

Wages are based on average reported labor costs in rural areas—less than the minimum daily wage. Family labor is considered an economic opportunity cost. Though family labor accounts for all labor in this model, the opportunity cost of this labor is imputed from hired labor costs. Therefore a switch to hired labor from family labor would not affect the model.

As stated above, RVCP does not call for, and therefore the model assumes no, heavy equipment or on-farm construction. Neither tractors nor storage areas that would require loans, payback and a depreciation schedule will be necessary to achieve the levels of productivity increases targeted. Intervention costs are borne by USAID and go to producer associations to pay for technical assistance. No loans are taken by the producers or producer associations. Farm inputs are consumed in the same season, and no machinery or other non-consumables need be depreciated in the AGEXPORT model.

Prices

Current data on product prices come from internal reports provided by AGEXPORT. Historical price data published by MAGA[5] from three, four and five years (depending on the crop) are used to estimate average annual percent changes that are applied to the without intervention scenario. Nominal prices are projected to increase for horticulture each year, but remain constant for

[3] Ministerio de Agricultura, Ganadería y Alimentación. *El Agro en Cifras 2011.* 2011.
[4] Ibid.
[5] Ibid.

coffee. The model uses real prices, however, which are increasing slightly for maize and beans and decreasing for snow peas, cabbage and coffee. In keeping with the assumptions for wages and productivity growth, real prices are assumed to be stagnant over the long-term average for those crops with more recent negative real changes in price.

Taxes, Subsidies, Exchange Rates and Inflation

Taxes are not currently paid by producers on crop sales (see information on the new tax law on page four). The producers modeled in this case are small enough to avoid taxes, and middle men or exporters generally report smaller quantities than actually purchased to compensate themselves for paying value added tax at multiple stages of the production process. As stated above, the Government of Guatemala provides a limited number of subsidized bags of fertilizer each year. Because this distortion represents a limited number of farmers receiving this small subsidy, the fertilizer scheme is not incorporated into the model. The exchange rate is applied to USAID intervention costs and to final net present value figures, and the foreign exchange premium for Guatemala was calculated to be 8 percent. USAID intervention costs are deflated by 2 percent, which is the projected average inflation rate in the US for the intervention period by the International Monetary Fund.

RESULTS OF RVCP COST BENEFIT ANALYSIS

Overview

Given the assumptions identified in the previous section, the analysis found the RVCP to have an overall positive economic and financial impact on the targeted farmers over the 20 year period. Economic analysis shows only slightly less favorable figures for NPV and ERR due to the conversion factor affecting inputs. All model farms show rapidly increasing incremental net benefits until year five—the last year of project implementation, at which point the benefit steam continues to grow but buy a much smaller margin. Initial increases in productivity due to project activities is what drives the rapid growth in incremental net benefits seen over the first five years, but the real growth in the prices of maize and beans fuels these gains thereafter. Including USAID investment costs, the project shows a positive incremental net benefit beginning in year four. The incremental NPV of each model farm (the aggregate of all the small farms, medium farms and coffee farms) and the total incremental NPV are shown below. NPVs for each model sum to more than the total NPV because USAID investment is only subtracted from the total and not from each farm model.

	NPV (in quetzales)
Small Farm Model (4,080 farms targeted)	Q 224 million
Medium Farm Model (4,080 farms targeted)	Q 452 million
Coffee Farm Model (2,040 farms targeted)	Q 50 million
Total AGEXPORT Intervention (10,200 farms targeted)	**Q 586 million**

Overall, the medium sized model farm shows the highest NPV among the three model farms due to the addition of a second commercial crop, as well as the high starting price and incremental returns to growing snow peas. Medium-sized farms show an incremental NPV of Q171,000 per farm. However, these medium-sized farmers show an incremental loss in the first year of the project because of the initial investment in cabbage in year one. The addition of this crop however, begins paying off the following year.

Small farms and coffee farms show lower incremental net benefits (Q84,000 and Q38,000 per farm), which are less than half the return per farm than for medium farms. All model farms demonstrate negative incremental returns to maize and bean production in year one due to increased up-front input quantities, mainly in fertilizer. After initial incremental losses in year one, medium farms and coffee farms become profitable in year two. Unlike medium farms and coffee farms however, small farms do not experience negative incremental returns in the first year. Lower costs of inputs for snow peas realized in the first year account for the immediate positive return. Actual returns to farms (not incremental returns) are positive for small and medium farms in all years, although maize shows negative returns in years one and two. Coffee farms receiving assistance through the project experience negative actual returns in year one of the project due to increased labor requirements in that year, while increased coffee production does not appear until year two.

Net Present Value

The model uses a standard discount rate of 12 percent to calculate the total economic NPV for the intervention including USAID investment costs. At this rate, the intervention's net present value is roughly Q586 million or $78.2 million. Within a range of five percent for the discount rate, the intervention's NPV changes as shown in Chart 1.

Chart 1.

Project Discount Rate	NPV Small Farm Model	NPV Medium Farm Model	NPV Coffee Farm Model	NPV Total
8%	312,000,000	638,000,000	72,000,000	873,000,000
12%	**224,000,000**	**452,000,000**	**50,000,000**	**586,000,000**
17%	156,000,000	310,000,000	33,000,000	368,000,000

While these changes are dramatic—a 37 percent decrease and a 49 percent increase in overall incremental NPV—the discount rate must be set at 52 percent before overall NPV is negative. Coupled with the other sensitivity analysis findings below, this indicates that the intervention is very robust to uncertainty and exogenous shocks.

The financial NPV is similar to the economic NPV due to Guatemala's open economy and few economic distortions. The financial NPV is Q 574 million.

Economic Rate of Return

While NPV serves as the ultimate barometer of intervention success, it is also worthwhile to look at the economic rate of return (ERR) of the intervention. Because intervention costs cannot be

divided by model farm—costs are not distributed on a per household basis and costs depend on crop, terrain, and other factors—the ERR is only calculated for the intervention as a whole. The ERR is 52 percent. This is much higher than any local expected rate of return on capital. The financial (internal) rate of return or IRR is very similar at 53 percent.

Selected Sensitivity Analysis

During sensitivity analysis, both the price of physical inputs and the price of labor had only a minor influence on incremental returns to the farm. Similarly, the decrease in input prices due to bulk purchasing with the project do not markedly affect the overall results.

The results are, however, sensitive to the average sizes of the small and medium farms modeled. If the farm sizes were to be half of the sizes envisioned, the overall NPV would be less than half of the current figure. But total NPV remains positive on each farm even with the lowest limits of farm size considered possible—as low as 0.1 hectares in the case of the small farms. See Charts 2 and 3.

Chart 2.

Total NPV by Size of Small Farm and Medium Farm					
	medium farm				
small farm	0.3	0.6	0.9	**1.2**	1.5
0.1	55,000,000	168,000,000	281,000,000	394,000,000	507,000,000
0.3	119,000,000	232,000,000	345,000,000	458,000,000	571,000,000
0.5	183,000,000	296,000,000	409,000,000	522,000,000	635,000,000
0.7	**247,000,000**	**360,000,000**	**473,000,000**	**586,000,000**	**699,000,000**
0.9	311,000,000	424,000,000	537,000,000	650,000,000	763,000,000
1.1	374,000,000	488,000,000	601,000,000	714,000,000	827,000,000

Chart 3.

NPV by Size of Small Farm				**NPV by Size of Medium Farm**				**NPV by Size of Coffee Farm**		
	NPV Farm 1	NPV Total			NPV Farm 2	NPV Total			NPV Farm 3	NPV Total
0.1	32,000,000	394,000,000								
0.3	96,000,000	458,000,000		0.3	113,000,000	247,000,000		0.7	23,000,000	559,000,000
0.7	**224,000,000**	**586,000,000**		0.7	264,000,000	397,000,000		1	33,000,000	569,000,000
0.9	288,000,000	650,000,000		**1.2**	**452,000,000**	**586,000,000**		**1.5**	**50,000,000**	**586,000,000**

While staple crop prices do not significantly change the results, the prices for the export crop and local commercial crop do have noticeable effects on the model, but not into negative NPV ranges for any of the farms. Coffee prices show negligible effects. See Charts 4-6.

Chart 4.

NPV by Price of Maize Q/quintal						**NPV by Price of Beans Q/quintal**			
	NPV Farm 1	NPV Farm 2	NPV Farm 3	NPV Total		NPV Farm 1	NPV Farm 2	NPV Farm 3	NPV Total
150	210,000,000	431,000,000	44,000,000	545,000,000	300	218,000,000	444,000,000	47,000,000	569,000,000
250	**224,000,000**	**452,000,000**	**50,000,000**	**586,000,000**	**400**	**224,000,000**	**452,000,000**	**50,000,000**	**586,000,000**

350	238,000,000	473,000,000	55,000,000	626,000,000	500	230,000,000	461,000,000	52,000,000	602,000,000

Chart 5.

NPV by Price of Snow Peas Q/quintal					NPV by Price of Cabbage Q/quintal		
	NPV Farm 1	NPV Farm 2	NPV Total			NPV Farm 2	NPV Total
300	184,000,000	385,000,000	479,000,000		1.5	358,000,000	492,000,000
400	**224,000,000**	**452,000,000**	**586,000,000**		**2.25**	**452,000,000**	**586,000,000**
500	263,000,000	520,000,000	693,000,000		2.5	484,000,000	617,000,000

Chart 6.

NPV by Price of Coffee Q/quintal		
	NPV Farm 3	NPV Total
700	40,000,000	576,000,000
900	**50,000,000**	**586,000,000**
1000	54,000,000	590,000,000

The number of beneficiary households reached has a major effect on the model, as does the percentage of "adopters" of the intervention. See Chart 7.

Chart 7.

NPV by Number of Targeted Households				
	NPV Farm 1	NPV Farm 2	NPV Farm 3	NPV Total
5,000	110,000,000	222,000,000	24,000,000	216,000,000
8,000	176,000,000	355,000,000	39,000,000	429,000,000
10,200	**224,000,000**	**452,000,000**	**50,000,000**	**586,000,000**
13,000	285,000,000	576,000,000	63,000,000	785,000,000
NPV by Project Adoption Rate				
	NPV Farm 1	NPV Farm 2	NPV Farm 3	NPV Total
30%	84,000,000	170,000,000	19,000,000	132,000,000
60%	168,000,000	339,000,000	37,000,000	404,000,000
80%	**224,000,000**	**452,000,000**	**50,000,000**	**586,000,000**
100%	280,000,000	565,000,000	62,000,000	767,000,000

The with-intervention changes in the spoilage rate of horticultural crops had a small effect on the overall project NPV. This was more evident for horticulture than coffee. Even in the unlikely case of increased spoilage with-project, NPV remains positive. See Chart 8.

Chart 8.

NPV by Change in Spoilage Rate - Horticulture					NPV by Change in Spoilage Rate - Coffee		
	NPV Farm 1	NPV Farm 2	NPV Farm 3	NPV Total		NPV Farm 3	NPV Total

-10%	256,000,000	514,000,000	53,000,000	683,000,000				
-7%	**224,000,000**	**452,000,000**	**50,000,000**	**586,000,000**		-5%	59,000,000	595,000,000
-2%	171,000,000	350,000,000	44,000,000	424,000,000		**0%**	**50,000,000**	**586,000,000**
2%	128,000,000	267,000,000	40,000,000	295,000,000		5%	41,000,000	577,000,000

None of the sensitivity analysis considered within the range of likelihood, however, forced the net present value of different farms into negative ranges.

CONCLUSIONS

Overall this project is financially and economically viable, reporting a very healthy NPV, and the model shows positive returns to the USAID investment beginning in year four. Farmers are well compensated for their time and effort in making these changes to their production habits.

Not surprisingly, returns on commercial crops are much higher than for staple crops. Slightly larger farms, 1.2 hectares compared to 0.7 hectares, that are able to introduce additional crops are expected to experience the greatest benefits from the RVCP intervention. This benefit is in addition to the lowered risks associated with diversified farm production—reductions in market price or declines in production that occur as a result of world price fluctuations or agricultural pests and diseases. However, the small-farmer strategy of growing staple crops for household consumption is a clear strategic decision to hedge against rising prices of these dietary needs. In fact, this decision drives the annual real increases in incremental farmer cash flow in the model as the commercial crops are projected to experience zero growth in real prices.

AGEXPORT should closely monitor those variables shown to significantly alter overall NPV to ensure that the project does not substantially waver from initial targets. The project should pay especially close attention to the average beneficiary farm size and the adoption rate of intervention beneficiaries.

At the individual farmer level, medium-sized farms and coffee farms experience a negative incremental return in year one only, while small farms experience no negative returns. Coffee farms show a Q1,400 per farm incremental loss in year one that may be negligible, but medium farms show an incremental loss of nearly Q8,200 in year one from costs of inputs to cabbage without a return until the following year. The medium farm model does not, however, experience an actual negative cash flow in year one—only an incremental negative cash flow—while the coffee farms experience an actual negative cash flow in year one due to additional family labor requirements. If this deficit were a negative monetary shock, these families modeled under coffee farming would likely need some credit to cover expenditures in year one. This is not the case, however. Based on conversations with agricultural experts at the implementing partner's headquarters, it is unlikely that families will feel an adverse effect in this case because the deficit is in their opportunity cost of labor—a resource in more abundance than cash in these households. Therefore, no additional financing to meet the households' needs should be needed.

Several additions to the CBA model will be made as the project progresses, including adding AGEXPORT's project component VI for handicraft value chain development. What would benefit the model most at the current time would be a sense of the funds flowing into and out of the producer associations for salaries, working capital and receipts from buyers. The associations are the entities directly receiving the project funding. The addition of a component for the producer groups would allow the model to directly demonstrate the linkages between the USAID funds and the beneficiaries, and potentially allow for NPV and ERR calculations per farm that include USAID investment costs and not only farmer costs. USAID/Guatemala will work with AGEXPORT to incorporate these additions at regular intervals throughout the project.

Annex 1.

The Twelve Municipalities Included in the Feed-the-Future Zone of Influence for AGEXPORT
Estimates of Population and the Incidence of Poverty, 2011

Department and Municipality	Population	Extreme poverty (%)	Poverty (%)	Not in poverty (%)
Quiché – Total	953,027	16.8%	55.0%	28.2%
Cunén	35,395	18.0%	51.0%	30.0%
Nebaj	82,101	19.0%	52.0%	29.0%
Sacapulas	46,279	6.0%	70.0%	24.0%
Uspantán	64,368	25.0%	47.0%	27.0%
Chajul	50,973	26.0%	49.0%	25.0%
San Juan Cotzal	27,195	24.0%	48.0%	28.0%
Zacualpa	43,832	4.0%	72.0%	24.0%
Chichicastenango	144,943	4.0%	75.0%	21.0%
Subtotal – 8 Municipalities	**495,086**	**13.8%**	**60.9%**	**25.3%**
Totonicapán - Total	476,369	21.0%	52.3%	26.7%
Momostenango	124,682	27.9%	47.3%	24.8%
Santa Lucía La Reforma	21,391	12.5%	69.4%	18.2%
Subtotal – 2 Municipalities	**146,073**	**25.6%**	**50.5%**	**23.8%**
Quetzaltenango	789,358	10.4%	43.3%	46.3%
San Juan Ostuncalco	51,470	19.3%	33.1%	52.4%
Concepcion Chiquirichapa	17,993	27.6%	11.7%	60.8%
Subtotal – 2 Municipalities	**69,463**	**21.5%**	**27.5%**	**51.0%**
Total – 12 Municipalities	**710,622**	**17.0%**	**55.5%**	**27.5%**

Source, INE