Working document EX-ACT VC case study

Cocoa chain analysis in Haiti

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EX-ACT VC	:	Ex Ante Carbon Balance Tool for Value Chain
Ha	:	Hectare
tCO2-e	:	Ton of CO2 equivalent
US$	:	US dollars
Yr	:	year

1. Introduction

This working document present a case study of a multi-impact appraisal of the cocoa value chain in Haiti. It allows users to concretely appreciate the functioning of EX-ACT VC, which is a tool derived from EX-ACT but providing a multi-impact appraisal of food value chain in terms of climate mitigation, climate adaptation and resilience dimension and also providing the socio-economic performances of the food chain analysed. It gives background on cocoa value chain in Haiti and a guidance for the users to use the tool.

1.1. Objectives

The main objectives of this case study is to test the tool, to verify whether the results are acceptable and to illustrate how it is possible to analyse a value chain by using EX-ACT VC. Moreover, it can help users to understand the multi-impact appraisal issued from a specific analysis (although simplified).

1.2. Data collection:

For this application on EX-ACT VC, data have been collected, used and derived from a feasibility study of a program called "Ak-kilma-tanyson" which support the reduction of vulnerability of different watershed in Haiti and the adaptation of climate-smart agroforestry system. Concerning several value chain, we only focus here on the cocoa value chain appraisal and the references terms that have been described specifically for this production. To complete the analysis, data from other sources have also been collected and used (in particular for processing and socio-economic analysis).

2. Background:

Haiti is currently a small cocoa producer in terms of volumes, producing about 5,000 tons/year (on a global production of 4 million tons) against 20,000 tons in 1960. With an average of 8 million US$ (value of exported production per year for more than 5 years), cocoa production engage the 3rd national exportation place. At least 130,000 people would directly depend on this value chain. The southern department in Haiti was historically a production zone which is no longer exploited. It remains old agroforestry systems and poorly maintained. However those area have suitable agro-ecological condition for growing cocoa and offer an important production potential.

In 2011, cocoa area represented 18,000 hectare with small area cultivated in average, between 3,000 square meters and 3 hectares. Productivity is low just reaching 300kg/ha compare to Dominican Republic where producers reach a yield of 3,000 ton per hectare, with similar agro-ecological conditions.

Moreover type and quality of cocoa play an important role in terms of economic valuation. In the region of Grande Anse in Haiti, the majority of cocoa production is not fermented, but only dried, without allowing development of flavour that European consumer look for in their exporting market. However, the department has the capacity to develop and place cocoa production on different market given the initial quality of their existing varieties. Currently, producers cannot target special consumer and don't have access to more remunerative prices (+45% for fermented cocoa).

Therefore local production in Haiti is widely under-exploited and effort can be achieve to expand this production in terms of volume produced, area cultivated and quality of the cocoa product. Despite this low productivity and performance, cocoa represents more than 60% of total small-holder income in Haiti. It is thus an important source of income which can participate to the reduction of poverty where the agricultural sector is the first source of revenue in the Haitian economy, country which is one of the poorest of the planet with 60% of the population living behind the poverty level.

Highly impacted by climate change, rural Haitian population is very vulnerable and developing sustainable value chain can be a starting point for reducing ecological degradation (soil erosion, water management…), increase agricultural productivity, contribute to improving small holder income and acquire new asset to facing climate shocks.

To develop this value chain in the southern department in Haiti it is require to pursue rehabilitation and plantation of cocoa, to train producers to fermentation process in order to commercialize cocoa with creation of value added on high-end market, to structure stakeholders and to value production by certification.

Within this case study, an ex-ante multi-impact appraisal is realised to estimates climate mitigation induced by the current situation of the value chain and the upgrading scenario; the climate resilience brought by an upgrading scenario and the socio economic performance induced by both situation. Thus, comparing both results will allow us to identify to what extent the upgrading scenario can brings solution for rural population of southern Haiti in terms of mitigation and adaptation to climate change.

3. Methodologies and tool used:

EX-ACT VC is a tool derived from EX-ACT (Ex-Ante Carbon Balance Tool), developed by FAO in 2009. EX-ACT VC is an agricultural-forestry, land use, processing and transportation framework of 8 Excel modules that provides co-benefits appraisal of crop-based value chain in developing countries on GHGs emissions, climate resilience and income.

The EX-ACT VC aims at helping designing performant and sustainable value chain. The methodology provides here both a quantified socio-economic appraisal of value chain at micro and meso level (by agent, by group and for the whole chain) and an environmental carbon-balance appraisal of the value chain impact, in terms of climate mitigation, adaptation and value chain resilience. Thus:

- The **impact on climate mitigation** is reflected through quantitative indicators, derived directly from the EX-ACT tool. These indicators are used to obtain and analyse the mitigation impacts in terms of tCO2-e of the project. The carbon footprint of the product is calculated for the whole value chain and at different needed stage, aiming at analysing the environmental performance of the chain. The equivalent economic return is also determined and could be an important aspect to be considered when attempting, for example, to access to payments for environmental services.

- **Value chain resilience** is assessed using simple quantitative but also qualitative indicators. Adaptation indicators measure the reduction of vulnerability of people, livelihoods and ecosystems to CC.
- S**ocio-economic impact** of the value chain is assessed in terms of value added, income and job generated using a socio-economic appraisal of the value chain.

4. Developing a sustainable cocoa value chain.

The project wants to develop new agroforestry plantation, to improve previous cocoa plantation and train producers to fermentation practices on 5 years in the region of Grande Anse in the southern department of Haiti.

The baseline scenario is the current situation where cocoa plantation is grown traditionally and low agroforestry land cover.

Three activities takes places in the upgrading production scenario, characterised in three different modules in the EX-ACT VC tool: **Land use change, Agricultural practices** and **Processing.**

4.1. Module Land use change:

The first activity consists in developing new agroforestry cocoa plantation on degraded land that have been abandoned and not maintain in the southern department of Haiti, where agro-ecological conditions are suitable for developing cocoa production.

In the section non forest land use change, 100 ha of new cocoa plantation can be added in the area transformed from degraded land – initial use, to Perennial/ Tree Crop – final land use for the upgrading scenario.

Figure 1: Land Use change Module - section Non forest land use change

	Area transformed (ha)			
Fill with your description	Current situation	Upgrading project	Initial land use	Final land use
New cacao plantation	0	100	Degraded Land	Perennial/Tree Crop
Description	0	0	Select Initial Land Use	Select Final Land Use

4.2. Agricultural practices modules:

A complementary activity of this upgrading scenario consists on improving current cocoa plantation, that are not enough productive compare to Dominican Republic plantation which has the same agro-ecological conditions. 600 ha are concerns by this change and occurs consequently an increase of the yield observed from 250 kg to 600 kg per hectares. As you can see below, the perennials generated from degraded land (Land Use Change module), is automatically introduced in this module, concerning the upgrading project scenario.

Figure 2: Agricultural practices module - section Perennial systems

	Residue/ biomass burning	Yield (t/ha/yr)	Area concerned	
			Current situation	*Upgrading project*
Perennials generated from LUC	NO	0.6	0	100
Perennials staying as perennials:				
Cacao traditional (agroforestry)	NO	0.25	600	0
Cacao improved (agroforestry)	NO	0.6	0	600
Description	NO	0	0	0
		Total area	**600**	**600**

4.3. Module Agricultural input:

No mechanization is observed on cocoa plantation, meaning that there is no energy consumption. It is mainly explained because of the size of the plot are in average 0.3 ha. Therefore, this improvement requires more labour force for managing fertility, trimming trees … and additional input. Access to fertilizer is also an important point of this project, involving improvement of cocoa plantation. Manure application, chemical fertilizer and herbicides are applied on cocoa plantation, following the average amount you can observed on the following figures:

Figure 3: Production input - Section fertilizer consumption

	Specify NPK parts (%)			Current situation (Kg/ha)	Upgrading project (Kg/ha)
List of specific fertilizers (kg/ha	**N**	**P**	**K**		
Please enter your specific NPK fertilizer					
Urea	47%			0	0
Lime				0	0
Sewage	5%	N		0	0
Compost	4%	1.5%	1.2%	0	1000
TSP (super triple phosphate)	0%	46%	0%	50	200
NPK	0%	23%	19%	50	200
Description	0%	0%	0%	0	0
Pesticides					
Herbicides (kg of active ingredient per year)				0.4	1.5
Insecticides (kg of active ingredient per year)				0.0	0.0

4.4. Processing

After the farmers have harvested the cocoa pods from the tree, some of the most crucial work begins to make fine, high-grade chocolate, which is an important activity to set up in the upgrading scenario. The beans must be carefully fermented to bring out the very best flavours and using wood boxes and more labour force. No matter the location of the sweatboxes, it is important that this happen as quickly as possible, since the beans begin to germinate as soon as the fruit has been picked. The fermentation needs woods pallets representing 50kg per ton of cocoa fermented that replaces usual plastic used to dry beans (representing 3kg per ton of cocoa).

Jute bags are used afterwards to pack the fermented beans and to transport it to the wholesaler, representing 2kg per ton of cocoa production.

With a good fermentation management, production loss decrease from 5 to 3%

4.5. Transportation.

The boxes used for coca fermentation are located in the local coop, where the bean are mixed with beans from other local farms during and after fermentation, 10 km away in average from the 2,100 farm producing cocoa.

Targeting the European market with high-end chocolate, production is then transported from processing facilities to the closer harbour by truck, exported to Europe by international water container, and then to European wholesaler and retailers mostly by truck. Non conditioning type is consider for the production.

Figure 4: Transport module - section type of transportation

Place of departure	Type of transport	Nb of km
Farm	*Between 1 and 2*	
	Truck in country	10
Processing/storage	*Between 2 and 3*	
	Truck in country	70
Harbour initial		
	International ship	6000
Harbour final		
	Truck out country	150
Wholesaler		
	Truck out country	25
Retailers		

4.6. Socio-economic analysis:

This analysis wants to only focus on climate resilience and socio-economic performance benefiting to the population in Haiti. Therefore, socio-economic performance of European wholesaler and retailers will not be analysed in this case study, also because the scheme of both type of operator start being very more complex, due to other type of transformation to chocolate and a lot of different operator.

The upgrading project scenario, developing fermented cocoa beans allow producer to target a new international market with more remunerative prices in the range of +45% comparing to ordinary cocoa beans. The tool allow users to put this additional remuneration at the different level of the value chain in Haiti. Producers and processing facilities (local cooperatives) sell the production with more 45% on the price. Cost of input and consumable are calculated using prices in local currency and in unit per tons of product and setting out the different quantity put in the previous module. Below an example of the socio-economic data that have to be entered for the production phase.

As it was highlighted previously, labour force increase within the upgrading value chain and has to be complete in the different section of the economic analysis module in man-day per hectare or per ton of production. For instance, an increase from 28 to 53 man-day per hectare is assumed for the production part within the upgrading project scenario. Prices are filled up in

the module in local currency and remain the same between both situations. Every quantity are setting out from the previous modules. Users have to specify the locale currency rate, and cost are calculated either per hectare or per ton of production.

Figure 5: Economic analysis - section production

Current situation	Quantity (kg or L /ha/an)	Unit	Price : Local currency	Production cost (USD/ha)
Fertilizer			MGF	
Urea	0	kg		0.0
Lime	0	kg	0	0.0
Sewage	0	kg	0	0.0
Compost	0	kg	0	0.0
TSP (super triple phosphate)	50	kg	7	7.9
NPK	50	kg	11	13.1
Description	0	kg	0	0.0
			only prices to enter	
Pesticides				
Herbicides	0.4	kg of active ingredient per year	44.7	0.5
Pesticides	0.0		0	0.0
Fungicides	0.0		0	0.0
Fuel consumption				
Gasoil/Diesel	0.0		0	0.0
Gasoline	0.0		0	0.0
Gas (LPG/ natural)	0.0		0	0.0
Pls fill if other	0.0		0	0.0
Labor per ha *(man-days)*	*enter also labour*			
Land preparation-tillage	5	*MD/ha*	87	10.0
Seeding- input procurement	2		87	4.0
Weeding - treatment	5		87	10.0
Manure- compost delivery	0		87	0.0
Harvesting- farm transport	8		87	16.0
Other tasks	8		87	16.0
Total	**28**			

Upgraded value chain	Quantity *(kg or L /ha/an)*	Production cost (USD/ha)
Fertilizer		
Urea	0	0.0
Lime	0	0.0
Sewage	0	0.0
Compost	1000	0.0
TSP (super triple phosphate)	200	31.42
NPK	200	52.4
Description	0	0.0
Pesticides		
Herbicides	1.3	1.3
Pesticides	0.0	0.0
Fungicides	0.0	0.0
Fuel consumption		
Gasoil/Diesel	0.0	0.0
Gasoline	0.0	0.0
Gas (LPG/ natural)	0.0	0.0
Pls fill if other	0.0	0.0
Labor per ha		
Land preparation-tillage	10	20.0
Seeding- input procurement	8	16.0
Weeding - treatment	15	30.0
Manure- compost delivery	0	0.0
Harvesting- farm transport	10	20.0
Other tasks	10	20.0
Total	**53**	

4.7. Climate resilience:

Users have to specify an assessment between 0 and 4 for every questions asked in this module. It is a qualitative appraisal of what extent does upgrading this cocoa value chain improve the buffer capacity of the value chain to natural shocks, of the production, of the households in relation to food security, the resilience and the self-organization of households and the market resilience and the adaptation capacity to the value chain. An assumption for every sub-index was done in this case, but can be discussed. (E.g. Appendix 1)

Figure 6: Climate resilience module - section buffer capacity induced by crop production

Qualitative appraisal of climate resilience induced		
Data entry for qualitative appraisal of climate resilience induced by value chain to be done in light blue cells		
Buffer capacity of the value chain to natural shocks	**Expert group Assessment (0-4)**	*Indicator Weighting (0-3)*
To what extent does upgrading the value chain improve land cover? (e.g. agroforestry, cover crops etc.)	0	*1*
To what extent does upgrading the value chain reduce soil erosion?	2	*2*
To what extent does upgrading the value chain improve soil conditions (e.g. soil moisture, soil structure etc.)?	2	*2*
To what extent does upgrading the value chain improve efficient use of water?	3	*2*
To what extent does upgrading the value chain save water?	3	*2*
To what extent the value chain area is protected from climate shocks	0	*2*
To what extend the value chain infrastructure - building investments are climate-proof	0	*2*
Sub-Result	**20**	**low**

5. Results:

When clicking on VC results, user can review the multi-impact appraisal realised in this analyse.

5.1. Climate mitigation dimension:

Both situation create a sink of carbon because of current perennial plantation. However, improving and expanding agroforestry cocoa plantation create a higher sink, and is at the origin of a mitigation impact of 552 tCO_2-eq per year corresponding to 0.8tCO_2 reduced per year and per hectare for the whole project area.

The carbon footprint of the value chain is currently low but even lower within the upgrading project scenario which reduce the tCO_2 per ton of product of 0.7. The detailed carbon footprint, shown below, highlight the impact of the processing activity in terms of GHG emissions per ton of product, because of new wood boxes used for fermentation while, it is currently used only plastics to dry the beans. However, comparing to the current situation, even if the processing activity generate GHG emission, the global carbon footprint is lower within an upgrading project scenario.

With a carbon cost of 10 US$ per tCO_2-e, the upgrading project scenario allow to earn 8US$ / year / ha, equivalent value of the mitigation impact induced by the expansion of the cocoa plantation.

Figure 7: Detailed carbon footprint

Carbon footprint at the different levels of the Value Chain	*Emissions (tCO2/t product)* Current VC	Improved VC	Balance
PRODUCTION	-2.610	-3.309	-0.699
PROCESSING	0.011	0.022	0.011
TRANSPORT	1.299	1.299	0.000
PRODUCT LOSS	-0.008	-0.008	0.000
RETAIL	0.000	0.000	0.000
TOTAL	-1.308	-1.996	-0.688

5.2. Value chain resilience :

In terms of quantitative appraisal of value chain resilience induced by upgrading the cocoa value chain, it is highlight that the previous agroforestry system already generated benefits in terms of land slide and flood resilience. However the plantation of the new cocoa trees on degraded land are at the origin of a higher number of hectares with increased soil carbon, which help facing drought and erosion. This improvement benefits to 2,000 households that are becoming more resilient to climate change.

Figure 8: Climate resilience, quantitative appraisal

Climate Resilience dimension (s)	Current situation	Improved VC	
Hectares of land managed under climate-resilient practices	600	700	ha
Hectares with improved tree and vegetal coverage (land slide, flood resilience)	600	700	ha
Number of hectares with increased soil carbon (drought and erosion resilience)		100	ha
Number of HH having become more climate resilient		2000	HH

In terms of qualitative appraisal, the results give that the global climate resilience generated by the value chain is medium. It could be explained by the buffer capacity of the cocoa production which is assessed being low.

5.3. Socio-economic performances of the value chain.

The socio economic analysis only correspond to the value chain in Haiti, from the production to the harbour initial for exportation.

The aggregated socio-economic performance show an important increase in terms of value added and gross production value within the upgrading project scenario. The detailed socio-economic results given in the previous part in this module show that this value added is mainly generated at processing level, with the fermentation of the cocoa beans. Indeed, fermentation allow a raise of 45% of selling prices and correspond in the upgrading scenario of more than the half of the total value added created. The distribution of income is consequently better for farmers (from 71 US$ to 209 US$) as well as for operators in the processing activity (from 1,351 US$ to 3,464 US$).

Figure 9: Aggregated socio-economic performances

Aggregated Socio-economic performances	Current situation	Value chain upgrading project	Balance	
Value added	267	1138	871	000 US$
Gross production value	281	1209	928	000 US$
Total job generated	83	194	111	Jobs created

The number of employment generated is increasing within an upgrading scenario, giving higher access to income in rural areas and mainly in the production sector. Indeed, to apply new agroforestry systems, new work force is needed. It is at the origin of 81 additional jobs created.