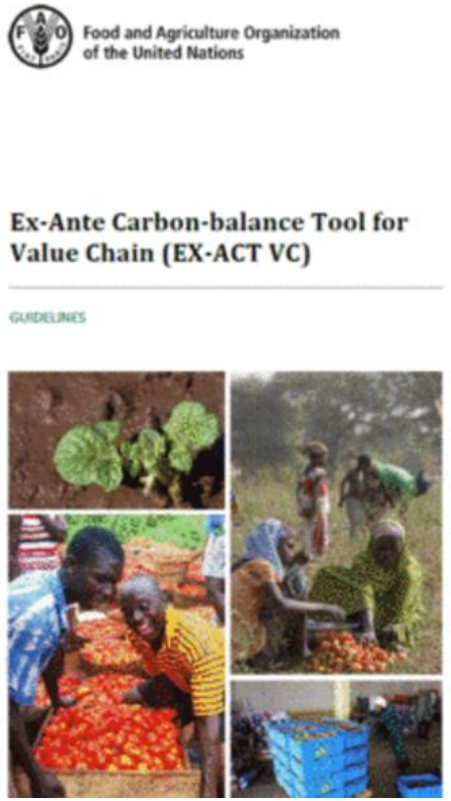
Food and Agriculture Organization of the United Nations

EX-ACT VALUE CHAIN

OCTOBER 2019

MULTI-IMPACT APPRAISAL OF GHG EMISSIONS, CLIMATE MITIGATION, RESILIENCE & INCOME GENERATED THROUGH DEVELOPMENT OF AGRICULTURAL VALUE CHAINS



OUTLINE

- What is EX-ACT VC? - Why a new tool?
- Objectives
- Framework
- Methodology
- Structure - Up-graded EX-ACT modules - New EX-ACT VC modules
- Results

EX-ACT in brief

Definition

- A set of linked Microsoft Excel sheets, structured in nine modules.
- A land-based accounting system, measuring carbon stock changes (emissions or sinks of CO_2) as well as GHG emissions, per unit of land in tonnes of CO_2–equivalents per hectare per year.

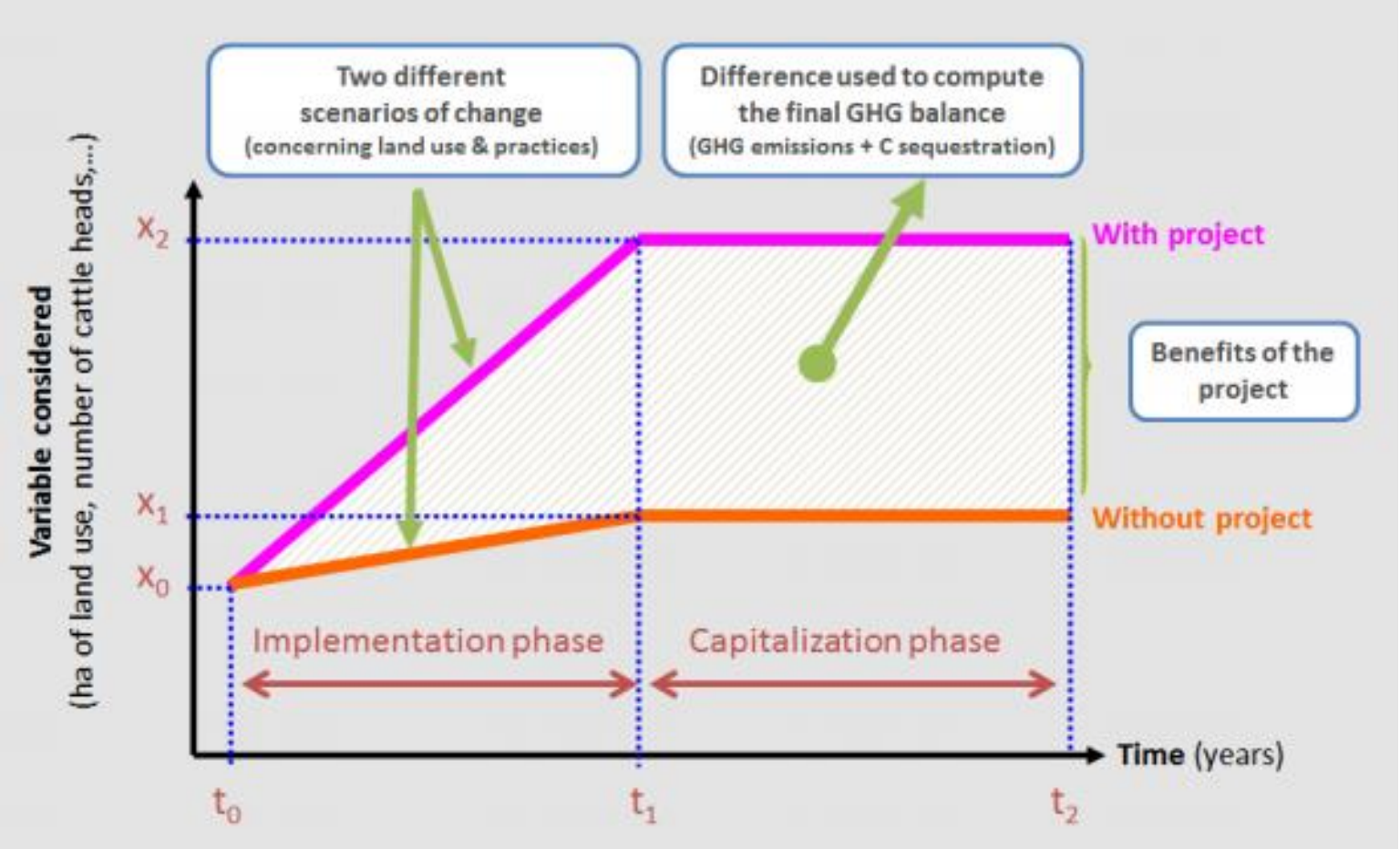
Objectives

- To provide ex-ante appraisal of the impact of agriculture and forestry development projects on GHG emissions and carbon sequestration (i.e. ***carbon balance***).
- To combine cost-efficiency and climate mitigation.

Main logic

- Comparison between a ***project scenario*** and a ***business-as-usual*** or ***baseline scenario***.

Building development scenarios



EX-ACT focus

- Forestry (deforestation, afforestation/reforestation, forest management)
- Other land use changes
  - Annual crops
  - Perennial crops/agroforestry
  - Flooded rice
  - Set aside
  - Grassland
  - Degraded land
  - Other
- Adoption of improved agronomic practices and management options
- Livestock management
- Peatland (drainage, rewetting, fire, peat extraction)
- Coastal wetlands (mangroves, seagrass meadow and tidal marshes)
- Inputs (fertilizers, pesticides, energy consumption) & investments (construction of new infrastructure, i.e. irrigation, buildings, roads)
- Fisheries & aquaculture

Watershed management

Sustainable forest management

Value chain commercialization

Cropland & grassland rehabilitation

Sustainable cropland intensification

Livestock intensification

Climate resilience & adaptation

Aquaculture & fisheries development

Extension services

Climate change mitigation

Irrigation development

Agroforestry systems

Coastal management

Why a new tool?

- Growing trend towards ***greener*** local, national and international economies.

  Increasing demand to develop ***sustainable food value chains (SFVC)***
  - International funds providers (World Bank, IFAD, AFD, Euro2020, FAO, IFAD)
  - New local and international initiatives (Aci, CmiA, WBF, RSSP)

→ To eradicate poverty in rural areas, increase populations' and ecosystems' resilience and de-carbonise the global economy

- Growing request for ***multi-level performance*** and ***climate*** appraisal tools.
- Need for an ***all-encompassing*** and ***up-to-date technology***.
- Need for a ***stronger impact*** in terms of policy decision-making, encompassing micro- and macro-dimensions.

Why to use such a tool?

1

Improve food system performance in terms of climate resilience

Produce food differently through climate smart agriculture and waste reduction

2

Align with international climate policy and greening trend

Reduce the impacts of food value chain on the environment: contributing to the Paris Agreement

3

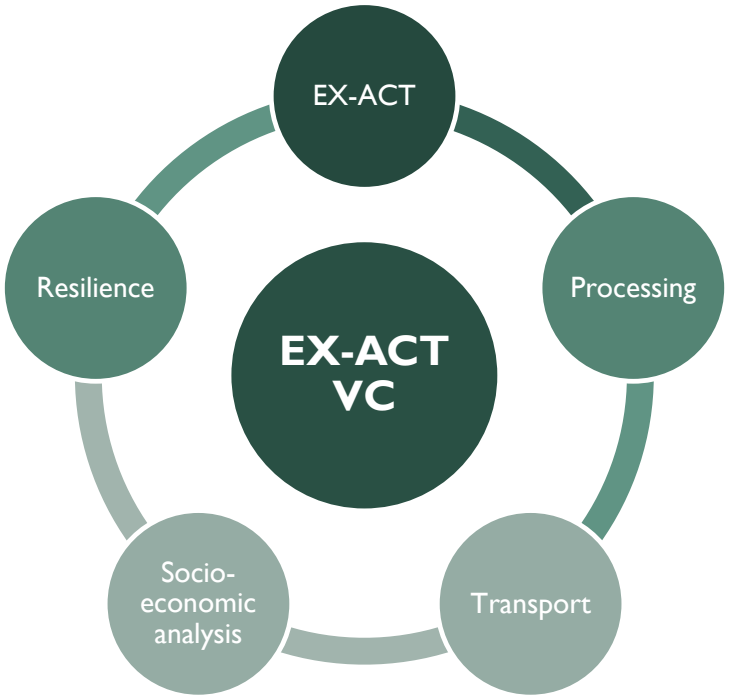
Improve socio-economic performance

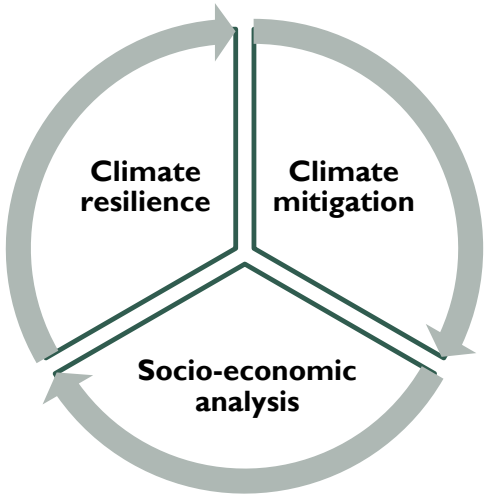
Increase value added
&
Generate employment

To link FAO's different strategic objectives
→ Eradicate hunger and poverty in the world ←

What is EX-ACT VC?

- To undertake studies on Value Chain Analysis in developing countries
- Focus on the 3 pillars of sustainability and a comprehensive analysis
- Based on EX-ACT while complementing it with post-production processes, a resilience and a socio-economic analysis
- Outputs: State of affairs of the current and upgraded value chain in terms
  - Climate mitigation
  - Climate resilience
  - Socio-economic performances





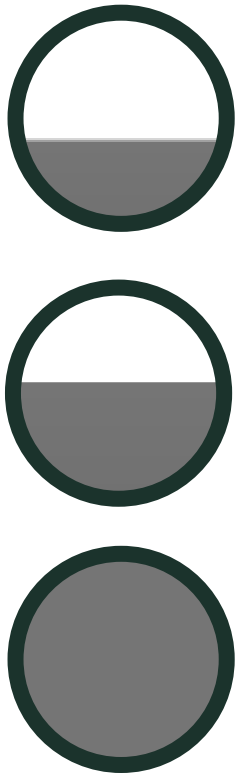
FRAMING QUESTIONS

- Is the economic growth inclusive?
- Is the VC socially sustainable?
- Is the VC environmentally sustainable?
- Increase resilience?

- Value added
- Income
- Jobs creation
- At the different stage of the VC does it contribute to climate change mitigation? Does it reduce negative impact on the environment (inventory of GHG, resources used such as water and energy)
- Buffer capacity of the watershed, project area, of the system of production, HH in relation to food security, resilience & HH's self organization, market resilience & adaptation

Objectives of EX-ACT VC

A multi-benefit appraisal to tackle simultaneously the multiple challenges faced by rural population



GHG emission & Carbon footprint

+

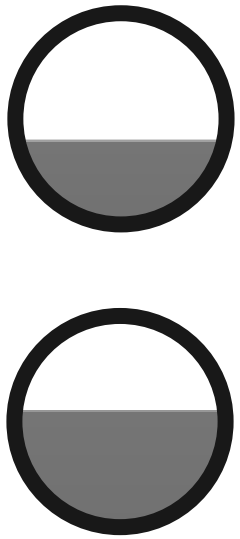
Socio-economic analysis

+

Climate resilience

- **Decrease GHG emissions**
- **Agriculture production and productivity**
- **Reduce poverty and food security**
- **Promote rural employment**
- **Agri-food system resilient to CC**

Relevance of the Socio-economic analysis



Simple model for Climate mitigation and adaptation

+

Socio-economic analysis

Synergy in terms of data entry

+

General downstream analysis for value chain

Aggregation of actors

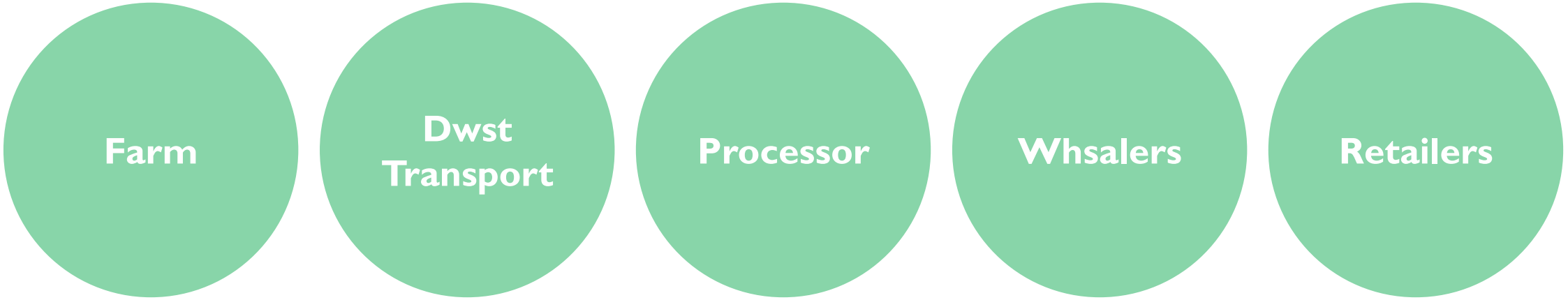
Reaching scale in the agricultural sector

Macro & micro analysis

Higher impact in term of policy decision

SOCIO ECONOMICS OUTPUTS RETAINED

1. Gross production value GPV (farmgate price)
2. Inputs = Intermediate production factors (IPF) + labor + taxes + credit cost
3. Gross margin GM = GPV – inputs
4. Value added (VA) = GM + taxes + credit cost + labor = GPV - IPF
5. Gross income = VA - taxes – labor
6. Employment generated – value added – gross income between the two scenario



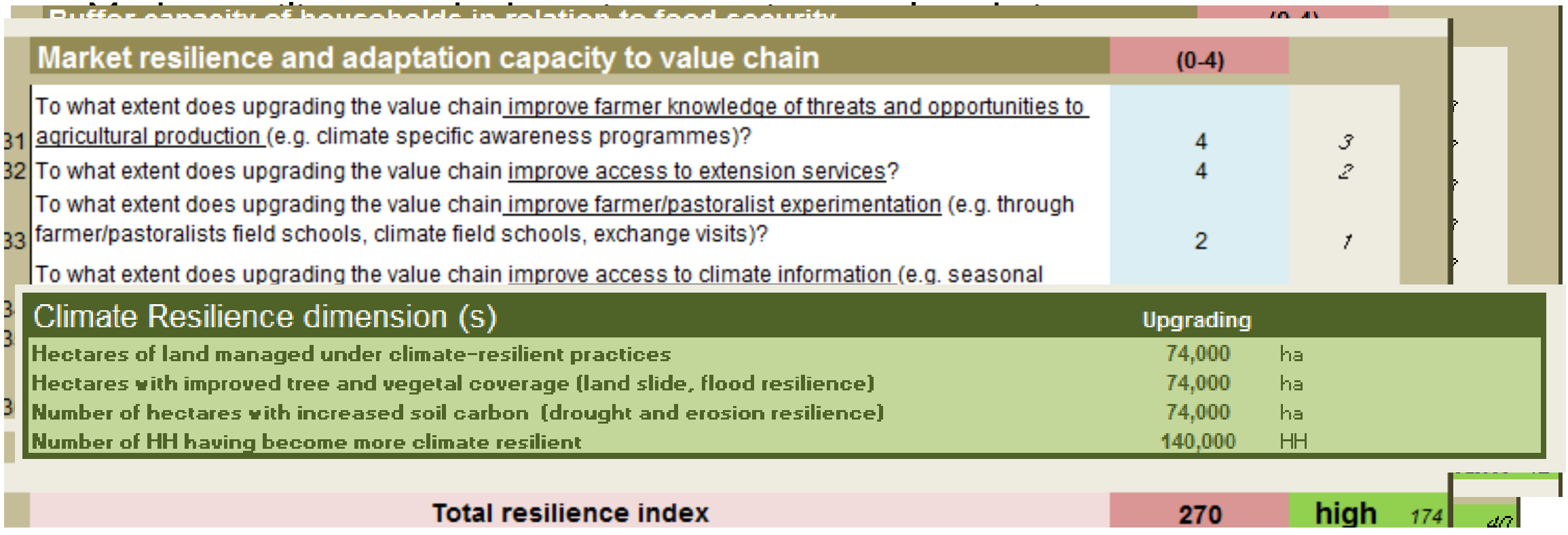
Value Added:

- A measure of the accumulation of wealth and the contribution of the production process to economic growth
- Defined as
  - gross production value - wealth consumed in the production process
  - *the value that each agent, at each stage of the value chain, adds to the value of inputs during the accounting period of the food production process*

= Value of the output – value of the intermediate inputs used

RESILIENCE

- Buffer capacity of watershed, landscape and project area, of systems of production and of households in relation to food security
- Resilience and self-organisation of households



Market resilience and adaptation capacity to value chain	(0-4)	
To what extent does upgrading the value chain improve farmer knowledge of threats and opportunities to agricultural production (e.g. climate specific awareness programmes)?	4	3
To what extent does upgrading the value chain improve access to extension services?	4	2
To what extent does upgrading the value chain improve farmer/pastoralist experimentation (e.g. through farmer/pastoralists field schools, climate field schools, exchange visits)?	2	1
To what extent does upgrading the value chain improve access to climate information (e.g. seasonal		

Climate Resilience dimension (s)	Upgrading	
Hectares of land managed under climate-resilient practices	74,000	ha
Hectares with improved tree and vegetal coverage (land slide, flood resilience)	74,000	ha
Number of hectares with increased soil carbon (drought and erosion resilience)	74,000	ha
Number of HH having become more climate resilient	140,000	HH

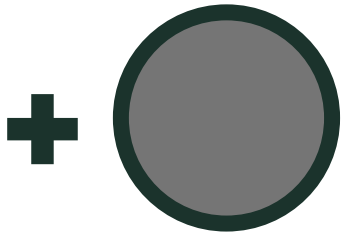
Total resilience index	270	high	174

EX-ACT VC FRAMEWORK

Greening sustainable food value chain

FAO, 2014: a sustainable food value chain is considered as

"The full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society, and does not permanently deplete natural resources."



Climate resilience dimension

A manageable framework for comprehensive appraisal

A double challenge: multi-performant without excessive complexity

EX-ACT VC framework

Analysis

- *Current situation* **of the value chain (baseline scenario) vs** *upgraded value chain* **(project scenario)**

Value chain

- **Crop – agroforestry – fishery – aquaculture – livestock**
- **Simple food value chains or segments of more complex value chains**

✓ **Who are the potential users targeted to use the tool ?**

- Technical ministry (Ministry of Agriculture, Ministry of Rural development…)
- Project designers to provide support to a value chain or a segment of the value chain
- Policy makers
- Policy analyst

✓ **Which country are we targeting?**

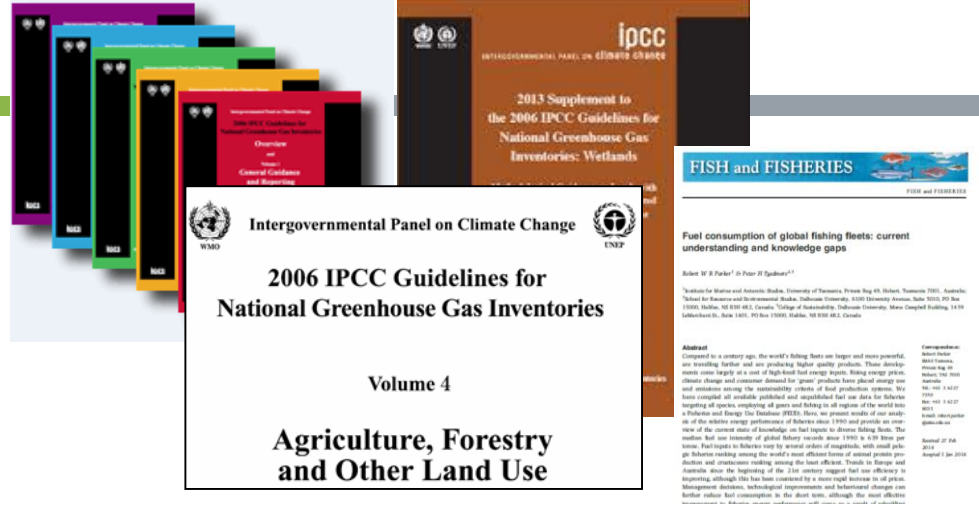
Every country that is underperforming in their food sector, underdeveloped country, disadvantaged region in the world,

For Developing countries : facing environmental and socio-economic issues and poverty rate blocking access to food security.

Methodology

✓ **Climate mitigation dimension**

- Default value from IPCC (2006), Lal (2004) at the agricultural level
- Default data at the processing and transportation level with studies from Berneers-Lee & Hoolohan (2012) and Weber & Mathews (2008)



Fuel consumption of global fishing fleets: current understanding and knowledge gaps

An indicator framework for assessing livelihood resilience in the context of social–ecological dynamics

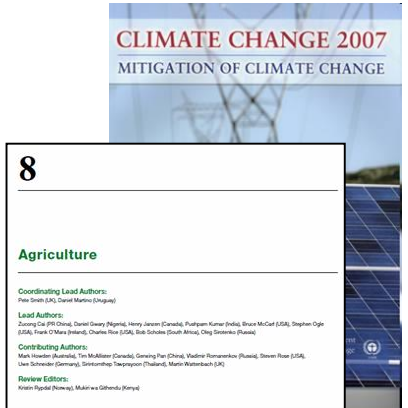
Chinwe Ifejika Speranza *, Urs Wiesmann, Stephan Rist

Centre for Development and Environment, Institute of Geography, University of Bern, Hallerstrasse 10, CH-3012 Bern, Switzerland

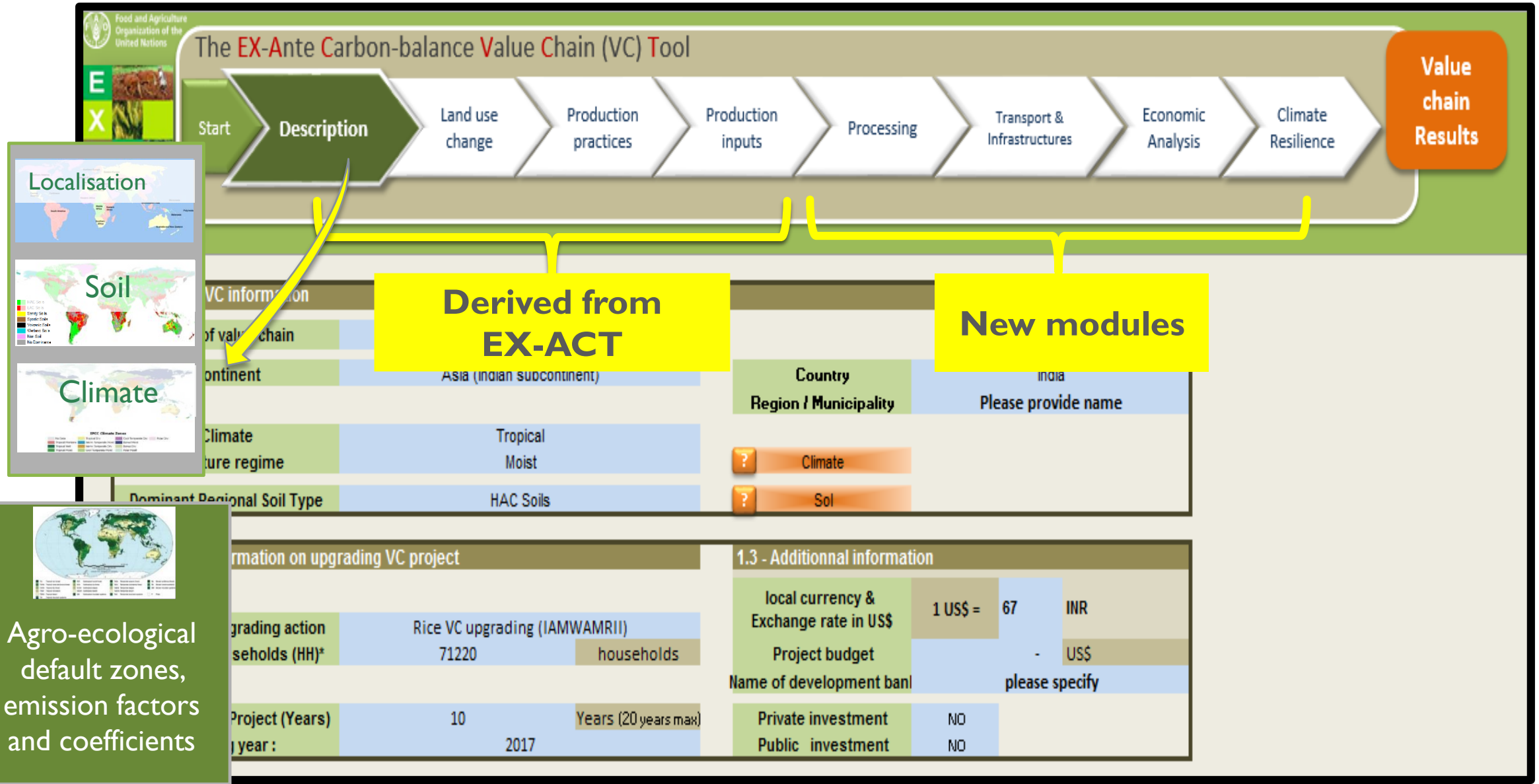
✓ **Socio-economic performance**

- Value added
- Volume of employment generated

} ***Impact on poverty reduction***



Structure


The EX-Ante Carbon-balance Value Chain (VC) Tool
Start
Description
Land use change
Production practices
Production inputs
Processing
Transport & Infrastructures
Economic Analysis
Climate Resilience
Value chain Results
Localisation
Soil
Climate
Derived from EX-ACT
New modules
Asia (Indian subcontinent)
Country
India
Region / Municipality
Please provide name
Tropical
Moist
Climate
HAC Soils
Soil
Rice VC upgrading (IAMWAMRII)
71220
households
10
Years (20 years max)
2017
1.3 - Additionnal information
local currency & Exchange rate in US$
1 US$ =
67
INR
Project budget
-
US$
Name of development banl
please specify
Private investment
NO
Public investment
NO
Agro-ecological default zones, emission factors and coefficients

Up-graded EX-ACT modules

Land use change

Forest land use change

Non-forest land use change

Irrigation

Production practices

Annual systems

Perennial systems

Flooded rice systems

Livestock management

Production loss

Fisheries

Aquaculture

Production inputs

Energy consumption

Fertilizer/Pesticide consumption

Feeding practices

Processing

Energy and water consumption for processing, storing and conditioning on land

Processing after harvest, including storage, packaging and transformation steps

Production loss and processing rate (transformation)

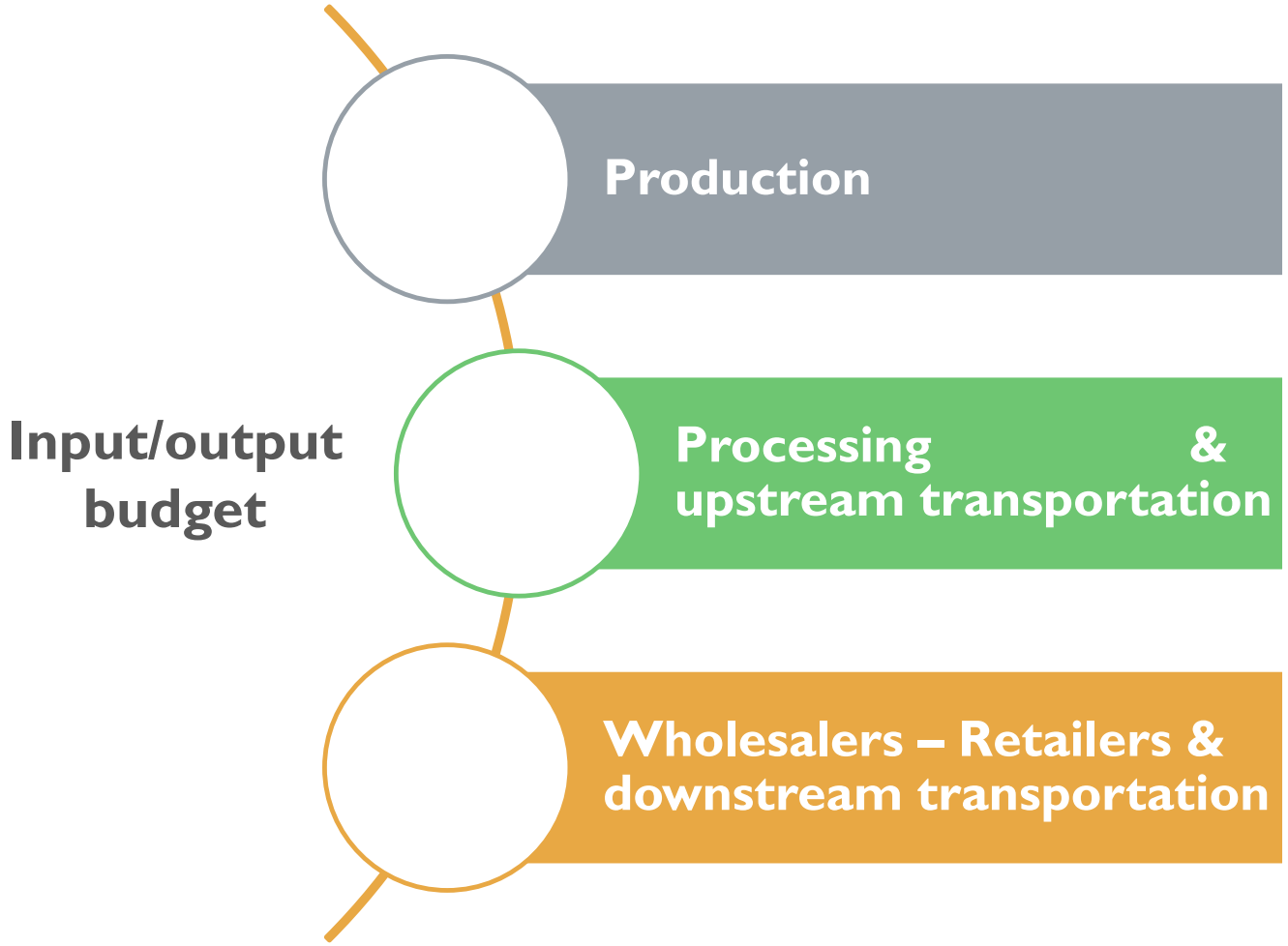
Methane emissions from industrial wastewater (untreated, treated, anaerobic reactor – bioenergy)

Transport & infrastructures

Type of transportation	Conditioning during transportation	Production loss at the transport level	Building and infrastructure
• Truck • Rail • Ship • Air	• Ventilation, • refrigeration • none	• For each step of the VC	• Housing • Agricultural and industrial building • Roads

Transport is assumed constant between the two scenarios

Economic analysis



Price in local currency

Quantities from data coming automatically from previous modules

Labour analysis: man-day per ha or per tonne of production

Available for both scenarios

Climate resilience

- Qualitative data entry
- 39 questions on buffer capacity (watershed, production, households, markets), self-organisation, resilience and adaptation capacity (households, markets)
  - 5 sub-groups = 5 qualitative index
- Expert group assessment
- Indicator weighting

	Buffer capacity of watershed, landscape and project area	Expert group assessment (0-4)	Indicator weighting (0-3)
1	To what extent does upgrading the value chain improve land cover? (e.g. agroforestry, cover crops etc.)	0	1
2	To what extent does upgrading the value chain reduce soil erosion?	2	3
3	To what extent does upgrading the value chain improve soil conditions (e.g. soil moisture, soil structure	2	3
4	To what extent does upgrading the value chain improve efficient use of water?	3	3
5	To what extent does upgrading the value chain save water?	3	3
6	To what extent the value chain area upgraded is protected from climate shocks ?	0	2
7	To what extend the value chain infrastructure - building investments are climate-proof ?	0	2
8	To what extend the upgrading value chain reduce negative impact on natural resources (land, coastal...)?	0	0
9	To what extend the upgrading value chain reduce waste water effluent?	0	0
	Sub-Result	30	low 34

Management of production loss at the farm, storage and transport levels

3.3. Production loss and water management at the farm level

	Current	Upgrading
Percentage of wasted production or mortality rate	8%	4%

5.3 - Production loss and processing rate at processing and storage level

	Current	Upgrading
Total loss on PPS* level	2%	1%
Processing rate (if any transfo)		

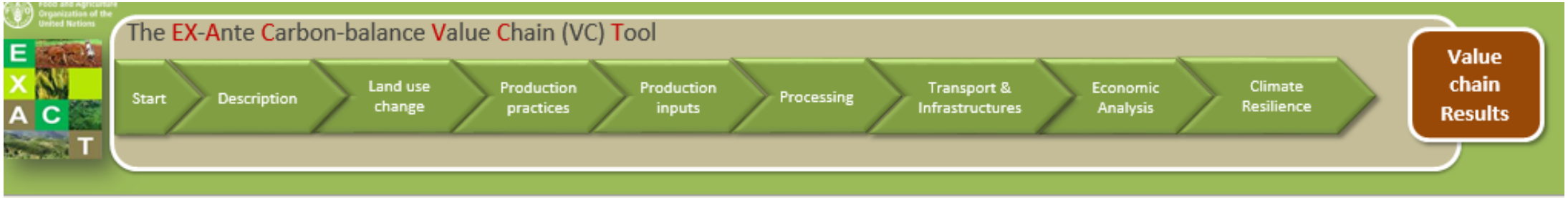
*PPS = Processing, Packaging, Storage

6.1 - Type of transportation

We assume the transport will not change during the implementation phase

	Place of departure	Type of transport	Type of conditionning	Nb of km	% of loss current	% of loss upgrading
0	Farm	*Between 1 and 2*				
Farm		Truck in country	None	20	0%	0%
A	Processing/storage	*Between 2 and 3*				
Processing/storage		Truck in country	None	75	0%	2%
B	Wholesaler					
Wholesaler		Truck in country	None	20	0%	0%
C	Retailers					
Retailers		Please select type of transport	Please select	0	0%	0%
D	Please select initial place					
Please select initial place		Please select type of transport	Please select	0	0%	0%
E	Please select initial place					
Please select initial place		Please select type of transport	Please select	0	0%	0%
F	Please select initial place					

Results: mitigation and carbon footprint



			Upgrading	Current
Project:	Rice VC upgrading (IAMWAMRII)	Production (tonne)	908637.63	1079809.152
country	India	Yield (t ha^{-1} yr^{-1})	7	8
region	Please provide name	Hectares		142440
Budget (US$)	0	Households		71220
Year	2017			

Climate Mitigation dimension of the Value Chain	Current	Upgrading	Balance
GHG impact (tCO_2-e per year)	2,732,053.4	2,199,374.3	
GHG impact (tCO2-e per year per hectare)	19.2	15.4	-3.7
Carbon footprint of production (tCO_2-e per tonne of product)	2.7	1.9	-0.9
Annual tCO_2-e [emitted (+) / reduced or avoided (-)]		-532,679.1	
Annual tCO_2-e from renewable energy		0.0	
Equivalent project cost per tonne of CO_{2-e} reduced or avoided (in US$ per tCO_2-e)		0.0	
Equivalent value of mitigation impact per year (US$ 30/tCO_2-e)		15,980,373.1	
Equivalent value of mitigation impact per year per ha (US$ 30/tCO_2-e per year per ha)		112.2	

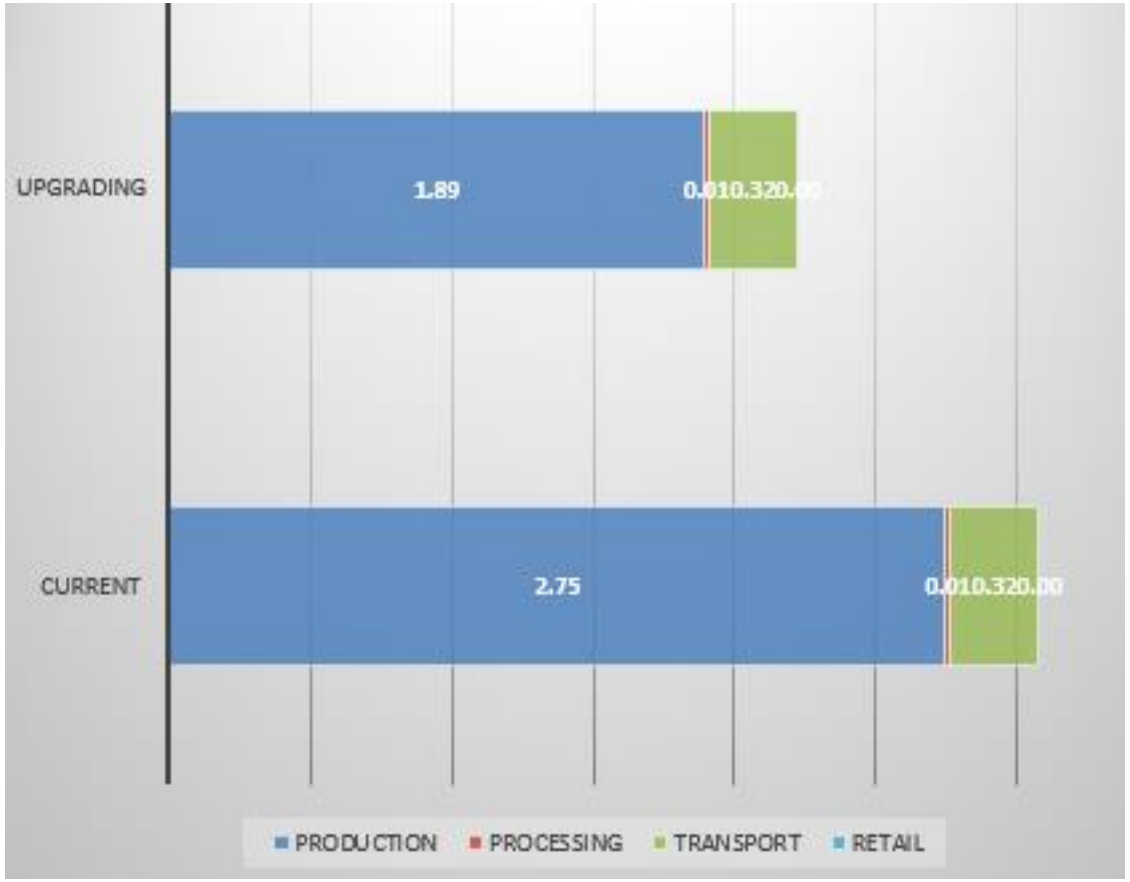
Carbon footprint at the different levels of the Value Chain	*Emissions (tCO2/t product)* Current	Upgrading	Balance
PRODUCTION	2.75	1.89	-0.85
PROCESSING	0.01	0.01	0.00
TRANSPORT	0.32	0.32	0.00
RETAIL	0.00	0.00	0.00
TOTAL	3.08	2.22	-0.85

Results: climate resilience

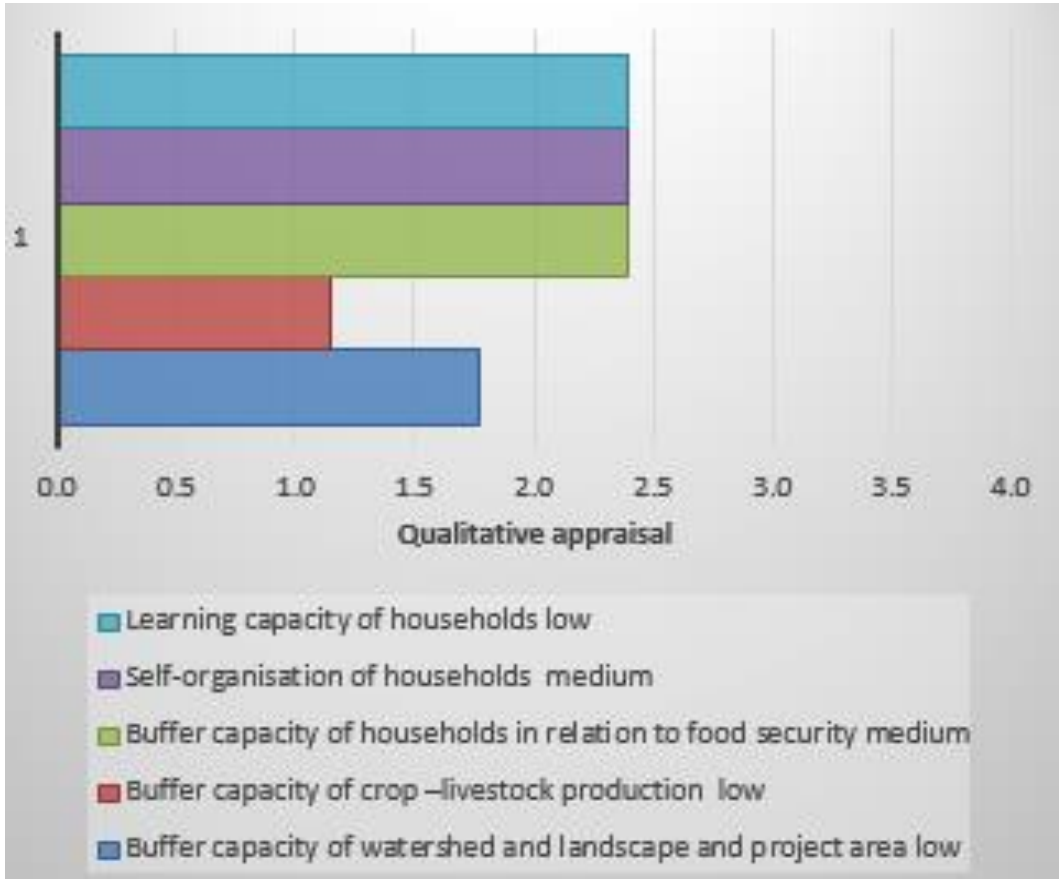
Climate Resilience dimension (s)	Upgrading		
Hectares of land managed under climate-resilient practices	142,440	ha	113952
Hectares with improved tree and vegetal coverage (land slide, flood resilience)	0	ha	
Number of hectares with increased soil carbon (drought and erosion resilience)	0	ha	
Number of HH having become more climate resilient	71,220	HH	

Resilience index of the value chain upgrading	Upgrading		
Buffer capacity of watershed and landscape and project area	low	Buffer capac	1.8
Buffer capacity of crop -livestock production	low	buffer capac	1.1
Buffer capacity of households in relation to food security	medium	Buffer capac	2.4
Self-organisation of households	medium	Self-organis	2.4
Learning capacity of households	low	Learning cap	2.4
Global climate resilience generated by Value chain	**low**		

Carbon footprint



Climate resilience



Results: socio-economic performance

4 socio-economic indicators:

- **Output**
  - intermediate inputs
- **= Value added**
  - wages & salaries
- **= Gross margin**
  - taxes
  - interest charges
- **= Gross profit**

Derived for a micro level analysis
- Per beneficiary (production level)
- Per operator (from processing to retailers)

Gross production value*

- intermediate inputs

= Value added*

- labour, bank, interest taxes

= Gross income*

Labour generated

= Nb of man-day per ha or tonne of product / 250 days

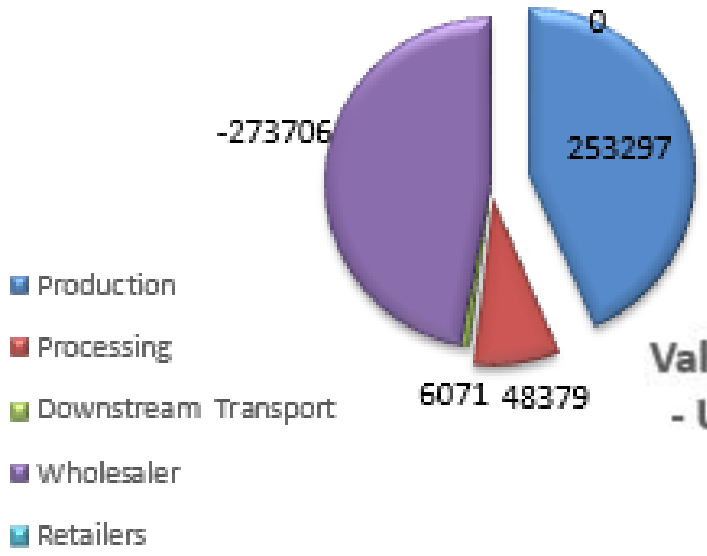
Gross margin

= Production value – total costs

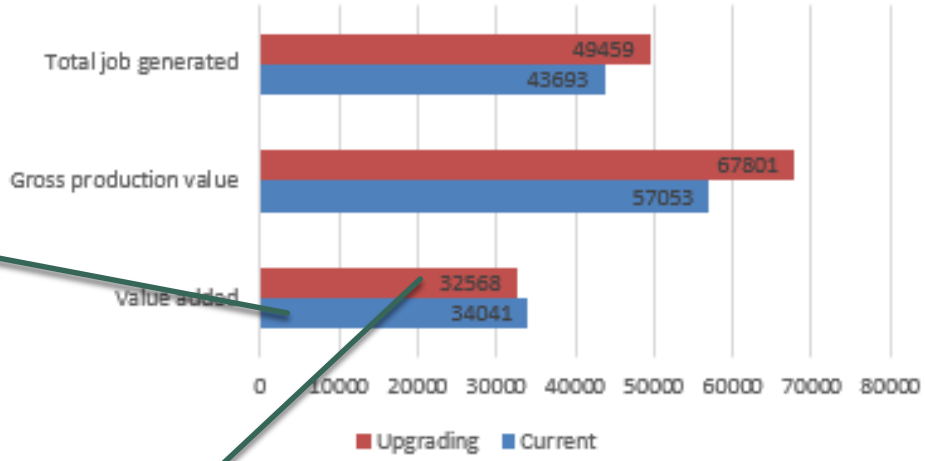
	Socio-economic performances of the value chain	Current	Upgrading	Balance	
	Production level				
	Nb of HH	0	71220		
	Nb of employement-eq	40453	45581	5128	jobs
16%	Gross production Value (GPV)	**271683**	**322863**	51180	000 US$
13%	Value Added (VA)	**253297**	**292375**	39078	000 US$
14%	Gross Income (GI)	**233071**	**269585**	36514	000 US$
-3%	VA / tonne of product	**279**	**271**	-8	US$
13%	VA / ha	**1778**	**2053**	274	US$
14%	Gross income / HH	**3273**	**3785**	513	US$
	Processing and upstream transportation level				
	Nb of operator-eq	359	355		
	Nb of employement-eq	2297	2730	433	Jobs
26%	Gross processed production value (GPPV)	**51844**	**69617**	17773	000 US$
27%	Value added	**48379**	**66287**	17908	000 US$
10%	Gross income	**45919**	**51144**	5225	000 US$
11%	VA / tonne of product	**103**	**115**	13	US$
11%	Gross income / operator	**127941**	**143892**	15951	US$
	Downstream transportation level				
	Nb of operator eq	157	191		
	Nb of employement-eq	471	574	103	jobs
18%	Gross production value	**6655**	**8108**	1454	000US$
18%	Value added	**6071**	**7397**	1326	000 US$
14%	Gross income	**5733**	**6693**	960	000 US$
0%	VA / operator	**12881**	**12881**	**0**	US$
-4%	Gross income / operator	**12165**	**11655**	**-509**	US$
	Wholesaler				
	Nb of operator eq	4	4		
	Nb of employement-eq	471	574	103	jobs
18%	Gross production value	**-273128**	**-332787**	-59659	000 US$
18%	Value added	**-273706**	**-333491**	-59785	000 US$
18%	Gross income	**-274002**	**-333902**	-59900	000 US$
18%	VA / operator	**-68426494**	**-83372688**	-14946194	US$
18%	Gross income / operator	**-68500521**	**-83475543**	-14975022	US$

Aggregated Socio-economic performances	Current	Upgrading	Balance	
Value added	34041	32568	-1473	000 US$
Gross production value	57053	67801	10748	000 US$
Total job generated	43693	49459	5766	Jobs created

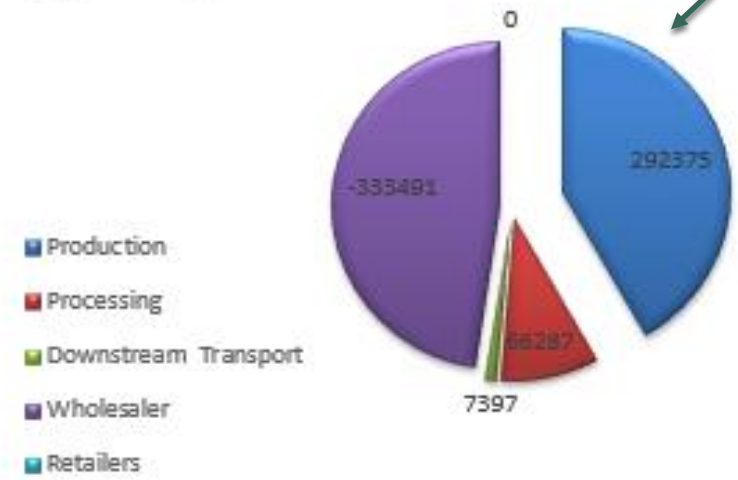
Value added (000 US$) - Current situation



Aggregated socio-economic performances (VA & GPV 000US$)



Value Added (000 US$) - Upgrading Scenario



VALUE CHAINS CASE STUDIES 2017 - 2019

- Rice – SRI India 2017
- Coffee Haiti 2017
- Cocoa Haiti 2017
- Banana Peru
- Banana Ecuador
- Regional Shea value chain West Africa (8 countries) 2018- 2019 with GCF
- Cocoa Value Chain joined Study Ghana and Ivory Coast (2019-2020) TCP support
- Potato value chain Malawi 2019
- Cashew Regional Value chain Study (8 countries) with COM-CASHEW and ACA
- Regional Gum Arabic Value chain study (6 countries) 2019- 2020
- Rice Value chain Policy study on Ghana, IC,.Mali just started
- Dairy sector – Turkey (EBRD)
- Dairy VC Kenya
- Tuna VC

COFFEE VALUE CHAIN – HAITI

Agregate Value chain at farm/HH level	Upgraded value chain	
Coffee value chain revival Haiti Value chain		Unit
Area covered for crop	90,000	ha
Annual total food production	38,976	tonne
Gross production Value	85,747	000 US$
Value Added (VA)	81,319	000 US$
Labor costs	20,614	000 US$
Tax and Bank interest	0	US$
Gross Income (GI)	60,705	000 US$
Value Added / tonne of product	2,086	US$
Value added / ha	904	US$
Gross income / HH	434	US$
Total days of labour in man days	8010000	MD
Total employments equivalent	32040	Units
BALANCE:		
Additional employments generated	**13,160**	
Incremental value added	**47,009**	**000 US$**
Incremental Gross Income of beneficiaries	**36,807**	**000 US$**

Looking at the whole GHG emissions and carbon sequestration, the CFP of the revival coffee from production to processing, is about -11 tCO_2-e per tonne of green coffee, while at the processing level and transport level is respectively 0.15 and 0.21 tCO_2-e per tonne of green coffee, figure 5. Processing level emissions are a major source emissions from energy consumption and principally from the generation of wastewater from pulping, fermentation and washing of cherry coffee.

Figure 5: EX-ACT VC screenshot on details of the carbon footprint for production, processing and transport of the value chain

Carbon footprint at the different levels of the Value Chain	CO_2-e per tonne of produc		Balance
	Current	Upgrading	
PRODUCTION	-3.03	-10.78	-7.75
PROCESSING	0.15	0.15	0.00
TRANSPORT	0.21	0.21	0.00
TOTAL	-2.66	-10.42	-7.76

Socio-economic performances of the coffee value chain.

Revival of the Haitian coffee sector increases the value added generated at every level of the value chain, gross production value and gross income available for farmers and operator among the green coffee value chain.

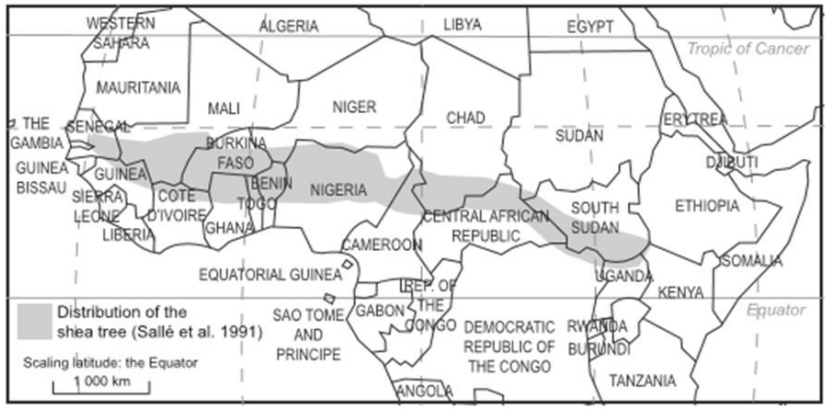
Looking at the production level, the value added per hectare of product increases from US$429 to US$904 at the production level between the two situations (+111 percent).

The strongest impact is on gross income per households which is 154 percent higher between the current scenario and the upgrading value chain, i.e. US$171 to US$434.

Increased surface areas of coffee cultivation and renewal of old trees boost the production from 16 560 tonne per year to 38 976 tonne per year, owing to get coffee of better quality and increase price market.

Additionally it also impact the work on field and allow to generate 13 160 employment equivalent.

REGIONAL SHEA VALUE CHAIN –WEST AFRICA



Shea Value Chain as Key Pro-Poor Carbon-Fixing Engine in West Africa

shea has an enormous potential to mitigate climate change in West Africa. At present, the shea value chain fixes 1.5 million tons of CO_2 every year. Relative to production volumes, every ton of shea kernels produced has a negative carbon footprint of 1.04 tons of CO_2.

With an expansion strategy to increase shea tree population in agroforestry areas by 7 million additional trees per year, the CO_2 fixed could increase up to 9 million tons of CO_2e per year, leading to an aggregated carbon fixing impact of 180 million tons of CO_2e over 20 years.

This translates to a carbon footprint of - 8 tons CO_2e for every ton of shea kernel produced. This positive environmental impact of the value chain stems from its production system: shea trees grow naturally and are integrated with crops on smallholder farms, creating an agroforestry landscape that acts like a carbon sink. Expansion of agroforestry areas acts as a multiplying factor

REGIONAL SHEA VALUE CHAIN –WEST AFRICA

Through shea parklands expansion, gross income per woman collector could increase to US$ 127/ year, while the value added per day of work will reach US$ 2.30.

The global value chain will reach US$ 593 million, representing 6% growth per year between 2019 and 2032 and a value added of US$ 452 million by 2032.

The public investment needs are estimated to be around US$ 153 million.

Shea value chain provides an efficient carbon fixing mechanism with a cost of US$ 0.85 per ton of CO_2 fixed.

The economic value of such a positive externality is around US$ 270 million per year, making the value chain a high mitigation return on investment.

Socio-economic performances of the value chain	Current	Upgrading	Balance	
Production level : Collecting women and local butter processing				
Nb of HH	0	3,017,640		
Nb of employement-eq	408,617	665,719	257,102	jobs
Gross production Value (GPV)	226,990	459,844	232,855	000 US$
Value Added (VA)	178,043	383,441	205,398	000 US$
Gross Income (GI)	178,043	383,441	205,398	000 US$
VA / tonne of product	193	255	62	US$
VA / HH	75	127	52	US$
Gross income / HH	75	127	52	US$
Intermediary agents and transportation level				
Nb of operator eq	6,224	9,241		
Nb of employement-eq	6,608	9,856	3,248	jobs
Gross production value	27,551	49,504	21,953	000US$
Value added	15,235	29,775	14,541	000 US$
Gross income	12,694	25,976	13,282	000 US$
VA / operator	2,306	3,021	716	US$
Gross income / operator	2,090	2,636	545	US$
Downstream processing Actors				
Nb of operator-eq	12	23		
Nb of employement-eq	614	1,057	442	Jobs
Gross processed production value (GPPV)	31,234	84,092	52,858	000 US$
Value added	9,903	39,138	29,235	000 US$
Gross income	7,534	34,914	27,380	000 US$
VA / tonne of product	160	277	116	US$
Gross income / operator	627,821	1,517,985	890,164	US$
Aggregated Socio-economic performances	**Current**	**Upgrading**	**Balance**	
Value added	203,181	452,354	249,173	000 US$
Gross production value	285,774	593,440	307,666	000 US$
Total job generated	415,839	676,631	260,792	Jobs created

Thank you for your attention!

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