



# **Technology Transfer to Small Farmers Program (PTTA)**

**(HA-L1059; 2562/GR-HA and HA-G1025; GRT/GA-12884-HA)**

## **Project Completion Report (PCR)**

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### **Electronic Links**

1. [Development Effectiveness Matrix \(DEM\)](#)
2. [Final version of the Progress Monitoring Report \(PMR\)](#)
3. [PCR Checklist](#)

### **Optional Electronic Links**

1. Ex post Cost-Analysis Report
2. Impact Evaluation Report
3. [QRR Results and Procedures Report](#)
4. Minutes of the project's Exit Workshop and/or written feedback from the Government (including the overall assessment of the Bank performance, if available)

## Acronyms and Abbreviations

BAC	Bureau Agricole Communal
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
FAO	Food and Agriculture Organization
GAFSP	Global Agriculture and Food Security Program
GoH	Government of Haiti
IADB	Inter-American Development Bank
IRAM	Institut de Recherches et d'Applications des Méthodes de développement
MARNDR	Ministry of Agriculture, Natural Resources and Rural Development
M&E	Monitoring and Evaluation
PCR	Project Completion Report
PITAG	Programme d'Innovation Technologique en Agriculture et Agroforesterie
PNIA	Plan National d'Investissement Agricole
PSM	Propensity Score Matching
PTTA	Projet de Transfert de Technologies aux Agriculteurs
RCT	Randomized Controlled Trials
RESEPAG	Renforcement des Services Publics Agricoles
RGA	General Agricultural Census
SNS	National Seeds Service ( <i>Service National Semencier</i> )
UIS	Update to the Institutional Strategy
USAID	United States Agency for International Development
USD	United States Dollars

## BASIC PROJECT INFORMATION

### HA-L1059 Technology Transfer to Small Farmers

Country Beneficiary Haiti	Loan Instrument Investment Loan	Borrower HA-HA - REPUBLIQUE D'HAITI	Loan(s) 2562/GR-HA	Sector Agriculture And Rural Development	Sub-Sector Agricultural Technology Adoption
Date of Board Approval Aug 31, 2011	Date of Eligibility for First Disbursement Apr 18, 2012	Date of Closure (CO) Apr 30, 2019	Loan Amount - Original 15,000,000.00	Loan Amount - Current 14,989,417.33	Pari Passu
Total Project Cost 15,000,000.00	Months In Execution from Approval 92	Months In Execution from First Disbursement 84	Original Date of Final Disbursement Oct 12, 2016	Actual Date of Final Disbursement Dec 31, 2017	Cumulative Extension(Months)

### Ratings of project Performance in PMRs



Has This Project Received Funds from another Project?

☐ Yes ☒ No

Has This Project Sent Funds to Another Project?

☐ Yes ☒ No

Development Effectiveness Classification

No	PMR Date	PMR Stage	Classification	Actual Disbursements (As of Dec 31)
1	Jul 24, 2014	Second period Jan-Dec 2013	Problem	3,471,728.00
2	May 06, 2015	Second period Jan-Dec 2014	Satisfactory	10,799,521.00
3	Apr 13, 2016	Second period Jan-Dec 2015	Satisfactory	21,944,512.00
4	Apr 07, 2017	Second period Jan-Dec 2016	Satisfactory	35,000,000.00
5	Apr 27, 2018	Second period Jan-Dec 2017	Satisfactory	35,000,000.00
6	May 15, 2019	Second period Jan-Dec 2018	Satisfactory	35,000,000.00

## ^Bank Staff



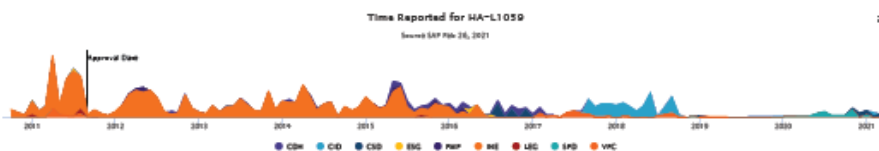
Positions	At PCR Apr 30, 2019	At Approval Aug 31, 2011
Vice-President VPS	Rodriguez-Ortiz,Ana	Levy,Santiago
Vice-President VPC	Rosa, Alexandre	Vellutini,Roberto
Country Manager	Zavala Lombardi,Veronica E. (CID/CID)	Jose Agustin Aguerre
Sector Manager	Bonilla,Juan Pablo (CSD/CSD)	Alexandre Meira da Rosa
Division Chief	Martel,Pedro V. (CSD/RND)	Hector Malarin
Country Rep	Gomez-Acebo,Felipe (CID/CHA)	Almeida,Eduardo Marques (CCB/CHA)
Project Team Leader	De Salvo,Carmine Paolo (RND/CHA)	Damais,Gilles Georges (RND/CHA)
PCR Team Leader	De Salvo, Carmine Paolo (RND/CH/	

## ^Staff Time and Cost



Stage Project Cycle	# of Staff Weeks	USD (including Travel and Consultant Costs)
Preparation	18.84	94,024.99
Supervision	79.47	682,310.63
<b>Total</b>	<b>98.31</b>	<b>776,335.62</b>

## ^Time



### STATEMENT OF THE DEVELOPMENT OBJECTIVES OF THE PROGRAM:

The general objective of the Program was to contribute to sustainably improve small farmers' agriculture income and food security in northern regions of Haiti. The Program had one specific objective: promoting improved and sustainable agriculture technology adoption.

## I. INTRODUCTION

- 1.1. Agriculture plays a key role in the Haitian economy, in particular for the rural population. In 2010, the agricultural sector represented about 25% of the gross domestic product (GDP), 50% of overall employment (66% in rural areas), and 75% of employment among low income households. Over one million families owned mainly small-scale subsistence farms, with an average farm size of less than one hectare (Ha).
- 1.2. At the same time, the majority of Haitians lived below the poverty line (55% of the population), and the impact of poverty and of extreme poverty was far more important in rural areas, where 88% of individuals lived below the poverty level and 59% earned less than US\$1 a day (MARNDP-PNIA, 2010).
- 1.3. One of the key challenges faced by Haitian farmers was a poor access to modern technologies and to sustainable farming practices. The 2008-2009 General Agricultural Census (RGA), for instance, shows that only 7% of farmers used mechanical equipment. Similarly, less than 5% of households nationwide (except in the Artibonite Department where it reaches 30%) used fertilizers and pesticides.<sup>1</sup> In addition, the absence of quality control and norms for agricultural inputs, and especially seeds which are sold by a small number of providers in a non-competitive market, reduced even further farmers' incentive to invest in improved technologies. Overall, this resulted in low levels of productivity as well as land degradation and increased vulnerability to both natural hazards and food insecurity.
- 1.4. In 2010, however, the potential for growth and income generation of the agricultural sector was considered high, thanks to an increasing demand for agricultural products from domestic (where more than 50% of caloric requirements were imported at the time and as a result of population growth) and export markets.
- 1.5. Building on this opportunity, the [Agriculture Policy Document for 2010-2025](#) reflects the intention of the Haitian Government, as well as of the private sector, donors, and civil society to provide more medium- and long-term support to the agricultural sector, to modernize and enhance the competitiveness of family agriculture and agribusinesses, and to improve food security and the sustainability of the sector, among others.
- 1.6. In 2009, the Ministry of Agriculture, Natural Resources, and Rural Development of Haiti (MARNDP) decided to improve technological adoption among farmers through an innovative mechanism of "smart subsidies". The aim was to provide financial support to farmers in order to cover a share of the cost of adoption of economically-viable technological packages, which encouraged not only agriculture intensification, but also soil conservation and the sustainable management of natural resources. This mechanism was implemented as part of the Natural Disaster Mitigation Program in Priority Watersheds (2187/GR-HA), financed by a US\$30 million Grant from the Bank, and reached 11,000 farmers in three watersheds.
- 1.7. In 2011, in order to support the Government of Haiti (GoH) in its strategy to improve agricultural competitiveness, the Bank approved a US\$15 million grant (HA-L1059) and then signed with the GoH a contract (2562/GR-HA) for a five (5) years operation named the Technology Transfer to Small Farmers Program (PTTA). The PTTA was co-financed

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<sup>1</sup> IHSI; *Enquête sur les Conditions de Vie des Ménages en Haïti*, 2001.

by the Global Agriculture and Food Security Program (GAFSP) with a US\$ 25 million grant (HA-G1025), thus bringing the Program's total budget to US\$ 40 million. The Program was to be executed by a dedicated Implementation Unit, or Executing Agency, from MARNDR.

- 1.8. The general objective of the PTTA was to contribute to sustainably improve small farmers' agricultural income and food security in northern regions of Haiti through the following specific objective: promoting improved and sustainable agricultural technology adoption. Two components were developed and implemented to reach this specific objective. Component 1 focused on the promotion and agricultural technology through the provision of non-reimbursable financial support to 35,631 farmers who agreed to adopt technological packages from a menu set by the Executing Agency. Component 2 focused on strengthening the National Seeds Service (SNS) through the establishment of a functioning laboratory for seeds quality, the conduct of evaluations and diagnoses, the strengthening of six (6) SNS staff and the elaboration of two (2) procedure manuals for seed quality controls.
- 1.9. This Project Completion Report (PCR) presents the results and achievements of PTTA (both HA-L1059 and HA-G1025), but also the challenges that it faced and the lessons that have been learnt as part of its execution.



## II. CORE CRITERIA. PROGRAM PERFORMANCE

### 2 Relevance

#### a. Alignment with country development needs

- 2.1. As described in the introduction, the initial context of intervention was characterized by a low-productivity agricultural sector, explained to a large extent by a poor access to modern technologies and sustainable farming practices. At the same time, an increasing demand for agricultural products from both domestic and export markets enhanced the sector's potential for growth and income generation.
- 2.2. In the Agriculture Policy Document for 2010-2025, the GoH identified the following constraints and weaknesses to the development of the agricultural sector: (i) degradation of natural resources (water, soils, forests), leading to the progressive reduction of the land productive capacity; (ii) limited access to agricultural inputs; (iii) lack of access to finance in rural areas; and (iv) inadequate input standards and quality control systems. Based on this, the GoH put forward two key policy objectives: (i) increase the local supply of agricultural products to meet the domestic nutritional demand, and (ii) improve the income of 500,000 farms. The GoH also prioritized some areas of intervention in order to achieve these policy objectives, which included the strengthening of various value chains such as rice, bananas, and vegetables.
- 2.3. The specific objective of the Program, namely the promotion of improved and sustainable agricultural technology adoption, was directly aligned with Haiti's development needs. The PTTA was designed so as to tackle the very constraints and weaknesses identified by the GoH. More specifically, the first component aimed at addressing problems related to the degradation of natural resources and the limited access to agricultural inputs and finance, while the second component was intended to deal with the lack of adequate input controls and quality standards. In addition, it aimed at strengthening specific and high-potential value chains (e.g. coffee, cocoa, citrus, etc.).
- 2.4. In 2013, the GoH published a [three-year agricultural recovery program document \(2013-2016\)](#) in which MARNDR presented the limited access to relevant agricultural practices (or technological packages) as one of the key challenges for agricultural development. The PTTA was directly aligned with one of the objectives of this document, namely the need to improve agricultural productivity in order to increase food security and incomes of rural households.
- 2.5. To strengthen institutional linkages and synergies with other projects and programs, the PTTA was implemented by MARNDR as part of a wider framework which included another program named "*Renforcement des Services Publics Agricoles*" (RESEPAG), financed by the World Bank. PTTA and RESEPAG relied on the same smart subsidies approach and were both managed by the same Executing Agency.
- 2.6. In conclusion, the PTTA's specific objective and design were both fully aligned with the country's development needs and priorities, at the time of approval, during the entire implementation, and at the time of closure.

## **b. Strategic Alignment**

- 2.7. During the design phase, the Program was fully aligned with the Bank's Country Strategy Update approved in July 2010 (GN-2465-2), in which agriculture is considered as one of the main pillars of economic growth for the reconstruction of the country. Moreover, this document specifically mentions that the Bank's programs would promote farming techniques that would reduce soil erosion and boost productivity, which is directly aligned with the specific objective of the PTTA.
- 2.8. During its implementation, the Program was also aligned with the [Bank's Country Strategy with Haiti for 2011-2015](#), in which agriculture continued to be a priority sector of intervention. The Program's specific objective would indeed significantly contribute to enhance the Bank's strategic objective set out in this document, which is "to protect the environment, respond to climate change and improve food security".
- 2.9. Moreover, the promotion of improved and sustainable agriculture technologies contributed to the expected output under the "Protecting the environment, responding to climate change, promoting renewable energy and enhancing food security" strategic priority of the Bank for 2012-2015, established by the Ninth General Increase in the Resources of the IADB (IDB-9).
- 2.10. The Program was also consistent with the Update to the Institutional Strategy (UIS) of the Bank, approved in 2015, as it dealt with the challenges of Social Exclusion and Inequality by strengthening productivity, and income generation of small holder farmers, one of the most vulnerable population in Haiti. Moreover, through the distribution of technological packages, the Program directly tackled the challenge of low productivity and lack of innovation. Finally, the Program was aligned with the cross-cutting theme "climate change and environmental sustainability", as it provided technologies for sustainable farming activities (in particular the agroforestry packages), and with the "Annual growth rate of agricultural GDP" indicator of the priority area "Protecting the environment, responding to climate change, promoting renewable energy, and enhancing food security".
- 2.11. At the time of closure, the Program's specific objective was fully aligned with the [Bank's Country Strategy with Haiti for 2017-2021](#), which has a strong focus on agriculture. One of the two pillars of this latest strategy is indeed to increase productivity in the agricultural sector through, in particular, technology transfer and the provision of financial support to farmers.

## **c. Relevance of Design**

- 2.12. **Figure 1** illustrates the vertical logic of the Program. The general objective was to contribute to sustainably improve smallholder farmers' agricultural income and food security in northern regions of Haiti. For this purpose, the Program aimed at achieving one specific objective: promoting improved and sustainable agricultural technology adoption.
- 2.13. The Program expected to achieve its specific objective, namely promoting the adoption of improved and sustainable agricultural technology, through two interconnected channels. On the one hand, the Program aimed at distributing vouchers, or financial incentives, to 30,000 farmers (**Output 1.1**), thus covering an area equivalent to an estimated 15,000 Ha. Because of the Ministry's limited technical and operational capabilities on the field, private operators would be hired to implement this activity. Areas of intervention would be selected based on their potential for agricultural intensification of the crop(s) of interest. In

each area, farmers would then be selected using a set of pre-defined eligibility criteria such as: (i) to be willing to cultivate the crop(s) of interest; (ii) to have an official ID and to reside in the area of intervention; (iii) to have a plot of at least 0.25 Ha available and to agree to have it geo-referenced; and (iv) to apply the technological package. For each selected farmer and through the voucher system, the Program would finance 80% of the total cost of adopting the technological package she/he selected over an area of 0.5 Ha, in an attempt to address the farmer's financial constraints, risk aversion and uncertainty about the profitability of these packages. Each technological package would focus either on a specific monocrop (rice, for instance), or on a set of complementary crops (in the case of agroforestry, in particular, which included banana, cocoa, yam, coffee, etc.), and the associated vouchers would be used by farmers to purchase various agricultural inputs (seeds, fertilizer, etc.) and services (plowing, etc.) necessary for implementing (or adopting) this package on their plots (see **Table A** for the complete list of technological packages). According to the Program's theory of change, the distribution of vouchers would encourage the adoption of technological packages (**Outcomes 2.1** and **2.2**) which would, in turn, lead to higher agricultural yields both at the farm level (**Outcomes 1.1**) and for the specific crops associated with the technological packages (**Outcomes 1.2, 1.3, 1.4** and **1.5**).

- 2.14. On the other hand, the Program aimed at providing technical support to the SNS. Indeed, prior to the Program, most agricultural producers did not use improved planting materials but simply seeds saved from the previous season; there was no quality control on agricultural inputs, especially seeds, which were provided by a very limited number of providers in a non-competitive market; this lack of norms and quality control on seeds undermined the farmers' interest to invest in improved technologies. Thus, the Program aimed at providing technical support to the SNS through the conduct of evaluations and diagnoses of seeds and input markets (**Output 2.1** – as described in **Annex 1**, the target for this output was increased from 1 at approval to 2 at startup plan without affecting the Program's vertical logic), the establishment of a functioning laboratory for seeds quality (**Output 2.2** – the indicator associated with this output has changed from “number of seed samples analyzed for quality control by the laboratory” at approval to “laboratory for seeds quality control established and functioning” at startup plan, without affecting the Program's vertical logic), the strengthening of 4 of its staff (**Output 2.3**), the elaboration and implementation of procedures for seeds quality control (**Output 2.4**), and the development and approbation of a national policy and a strategy for the seed sector (**Output 2.5** - as described in **Annex 1**, the target for this output was decreased from 2 at approval to 1 at startup plan without affecting the Program's vertical logic). In the Program's theory of change, a strengthened SNS would then be able to register all the seed providers around the country and to inspect them annually (**Outcome 3.1**) in order to ensure the quality of the seeds they provide.
- 2.15. In sum, the availability of improved seeds and other productivity-enhancing agricultural technologies, and the financial incentive provided by vouchers would encourage the adoption, or remove the constraints to the adoption, of these technologies by farmers (the Program's specific objective).
- 2.16. At the impact level, the Program aimed at improving in a sustainable way the agricultural income and food security of small farmers in northern regions of Haiti. The adoption of improved, sustainable (agroforestry packages, in particular, were expected to mitigate erosion and therefore reduce fertility losses) and productivity-enhancing agricultural technologies would indeed not only increase farmers' agricultural net income (**Impact 1.1**),

but also improve farmers' food security levels (**Impact 2.1**) through better availability and access to food. These two indicators would be measured through a rigorous impact evaluation combining both experimental and quasi-experimental methods in order to obtain unbiased and attributable results.

**Figure 1: Vertical Logic of the Program**

**General Objective:** Contribute to sustainably improve small farmers' agricultural income and food security in northern regions of Haiti

OUTPUTS	INTERMEDIATE OUTCOMES	OUTCOMES	IMPACTS
Specific Objective: Promoting improved and sustainable agricultural technology adoption			Increase Farmers’ Median Agricultural Net Income  Improve Farmer’s Food Security Levels
Component 1			
Farmers who received vouchers for the technologies being promoted	Increase adoption of technological packages	Increase agricultural productivity	
Component 2			
Evaluation of the role of public sector in the seed and input market completed		Contribute to institutional building and capacity development creating SNS capacity to control seed quality	
Laboratory for seeds quality control established and functioning			
Training to develop human capital for SNS			
Procedures for seeds quality control are implemented			
National policy and strategy for the seed sector approved			

- 2.17. **Table 1** presents the Results Matrix of the Program at approval (i.e. as it appears in the [POD](#)), startup plan (i.e. as it appears in the first PMR after eligibility that shows the “P”: Second period Jan-Dec 2013) and at completion. Three minor changes were made between approval and the startup plan, which did not affect the Program’s vertical logic: at the outcome level, the number of crops for which the “average gross margins” was to be estimated, was reduced to four crops (coffee, cocoa, rice and corn) because the technological packages would predominantly focus on these four crops; at the output level, the indicator associated with **Output 2.2** was changed from the “number of seed samples analyzed for quality control by the laboratory” to “laboratory for seeds quality control established and functioning” because it was anticipated that the former might not be able to materialize by the end of the Program; and still at the output level, **Output 1.1** went from being reported both in “number of farmers” and “number of hectares”, to being only reported in “number of farmers” so as to facilitate monitoring. There was no change (including reformulation) in the Results Matrix between startup plan and completion, except that **Impact 1.1** was no longer reported at Program completion because it did not significantly differ from **Outcome 1.1**. The “agricultural net income” (**Impact 1.1**) and the “gross margins” (**Outcome 1.1**) were both indeed to be measured as the value of production net of input costs (the only difference was that the former would include the value of livestock, while the latter would not). The PCR will thus report on all indicators as they appear in the startup plan, except **Impact 1.1**.

Overall, the Program’s specific objective and vertical logic are aligned with country development needs and priorities (IDB country strategy) both at the time of approval and closure. The vertical logic of the Program is also clear, robust and demonstrates the relevance of the operation.

**Table 1. Results Matrix (@ approval, Startup plan, and @ completion)**

Indicators	At approval <sup>2</sup>			Startup plan <sup>3</sup>			At program completion (PCR)			Comments
	Unit of measure	Baseline	P	Unit of measure	Baseline	P	Unit of measure	Baseline	A	
General objective: Contribute to sustainably improve small farmers' agriculture income and food security in the northern region of Haiti										
Impacts										
Increase Farmer's Median Agricultural Net Income										
1.1 Income = (Crop Value + Livestock Value)- Input Costs	USD	190	237.5 (+25%)	USD	190	230	N/A			This indicator was no longer reported at Program completion because it did not differ from <b>Outcome 1.1</b> .
Improve Farmer's Food Security Levels										
2.1 Proportion of target population (30,000 families) below the minimum level of dietary consumption	Index	29.2%	22%	Index	29%	22%	Index	29%	29% <sup>4</sup>	The impact evaluations of PTТА indicate no impact on food security.
Specific objective: Promoting improved and sustainable agricultural technology adoption										
Outcomes										
Increase agricultural productivity										
1.1 Percentage difference in agricultural gross margins between beneficiaries (who adopted the technology) and control group	Index	0%	>30%	Index	0%	30%	Index	0%	47% <sup>5</sup>	Impact evaluations

<sup>2</sup> Data source: POD.

<sup>3</sup> Data source: PMR "Second period Jan-Dec 2013"; it is the first PMR after eligibility that shows the P.

<sup>4</sup> The "A" corresponds to the baseline value because the impact evaluation has shown that the Program had no impact on food security.

<sup>5</sup> Weighted average of measured differences in agricultural gross margins for agroforestry (+63%) and other packages (0%). More details in Effectiveness section.

Indicators	At approval			Startup plan			At program completion (PCR)			Comments
	Unit	Baseline	P	Unit	Baseline	P	Unit	Baseline	A	
1.2 Average gross margins for selected crops for beneficiary farmers	US\$/Ha	Coffee: 1716 Cocoa: 1463 Citrus: 438 Cashew: 1500 Pineapple: 1250 Rice: 980 Corn: 372 Yam: 2250 Plantain: 700 Carrot: 1175 Onion: 2188 Tomato: 2500 Chili: 1238 Beet: 1875 Pastures: 2100	Coffee: 2450 Cocoa: 2359 Citrus: 1313 Cashew: 3000 Pineap.: 3800 Rice: 1400 Corn: 875 Yam: 3813 Plantain: 1300 Carrot: 6000 Onion: 3763 Tomato: 4000 Chili: 4000 Beet: 3300 Pastures: 3675	US\$/Ha	Coffee: 1716 Rice: 980 Cocoa: 1463 Corn: 372	Coffee: 2450 Rice: 1400 Cocoa: 2359 Corn: 875	US\$/Ha	Coffee: 1716 Rice: 980 Cocoa: 1463 Corn: 372	Coffee: 2621 Rice: 1,374 Cocoa: 2141 Corn: 283	In the absence of data from the Program, the end-of-project data comes from a similar project (RESEPAG) which was implemented in the south of Haiti at the same time. The data was collected in June 2020 and is expressed here in 2018 US\$.
<b>Beneficiary farmers have adopted improved and sustainable technologies</b>										
2.1 Nb. of beneficiary farmers that have adopted new selected technologies	Farmer	0	18,000	Farmer	0	18,000	Farmer	0	19,378 <sup>6</sup>	MARNDR
2.2 Nb. of hectares of beneficiaries where new technologies are adopted	Ha	0	9,000	Ha	0	9,000	Ha	0	8,525 <sup>7</sup>	MARNDR
<b>Contribute to institutional building and capacity development creating SNS capacity to control seed quality.</b>										
3.1 Percentage of registered seed providers who have been inspected by SNS at least once a year and following the approved protocol.	%	0	100	%	0	100	%	0	0	MARNDR

<sup>6</sup> According to the Program's final evaluation (Roosevelt SAINT-DIC, January 2018), 73,3% of beneficiary farmers who have planted trees (agroforestry, citrus, coffee, cocoa) have adopted the package and so kept them, i.e. 73.3% of 26,436 farmers.

<sup>7</sup> 73.3% of 11,630 Ha.



### 3. Effectiveness

#### a. Statement of program development objectives

- 3.1. As originally stated in the Grant proposal approved by the Bank, the objective of the Program was to contribute to a sustainable improvement of agricultural income (+25%) for beneficiary farmers and an improvement of the food security (a decrease of the malnutrition rate from 29.2% to 22%) in the North region of Haiti.

#### b. Results Achieved

##### Outputs

- 3.2. **Table 2** presents the Results Matrix achieved at the time of Program's completion. Achieved outputs are presented in **Annex 1**.
- 3.3. For Component 1, the Program was initially expected to provide vouchers to 30,000 small farmers in the North and Northeast departments (**Output 1.1**). This initial quantitative objective was calculated based on the estimated cost of each technological package and an average farmed area. The Program exceeded the target, distributing technological packages to 35,631 farmers (40% of whom were women).

**Table A: Distribution of Beneficiaries by Technological Package**

Package	Area (Ha)	Beneficiaries
Agroforestry	11,630	26,436
Vegetables	1,790	4,342
Rice	1,523	3,331
Irrigation (Caracol)	9	12
Sweet potatoes	251	599
Peanuts	396	811
Sisal	100	100
<b>Total</b>	<b>15,699</b>	<b>35,631</b>

- 3.4. For Component 2, an evaluation (**Output 2.1**) of the role of the public sector in the seeds and input market has been performed in 2013.<sup>8</sup> The delay for this first deliverable, one year, was due to initial limited technical and fiduciary capacity of the Executing Agency. Following this evaluation, the Food and Agriculture Organization of the United Nations (FAO) developed a National Policy and Strategy for the Seed Sector (**Output 2.5**) and two Procedures Manual for Seed Quality Control (**Output 2.4**). The Laboratory for Seed Quality Control (**Output 2.2**) was inaugurated on June 12, 2018 and four (4) of its staff members were able to complete a Master's degree (**Output 2.3**) during the Program.

<sup>8</sup> Evaluation du rôle du secteur public sur le marché des intrants agricoles en Haïti. Jefferson Germain, Olivier Jenn-Treyer - IRAM, 2013.

## **Outcomes and Impacts**

- 3.5. Four different impact evaluations were carried out to measure **Outcomes 1.1** through **1.5**, as well as the impact indicators:
- Two Randomized Controlled Trials (2014-2015) testing the effectiveness of smart subsidies for rice and horticulture (or vegetables) in the Northeast department and in Saint Raphaël (North department).
  - Two Propensity Score Matching evaluations (2016) testing the effectiveness of smart subsidies on peanut production and agroforestry in the Northeast and Limbé (North department).
- 3.6. RCTs allow for the identification of the causal impact of a program on the variables of interest. The two RCTs conducted on the PTТА (Gignoux et al., 2017) focused on the two technological packages that were distributed early by the Program: rice and horticulture (both annual crops). They were designed to measure three main indicators: (i) agricultural yields, production values and profits; (ii) technology adoption; and (iii) food security. The Propensity Score Matching (PSM) evaluations, on the other hand, aimed at measuring the impact of the peanut technological package (another annual crop) and of agroforestry technological packages (perennial crops) on the same set of indicators.
- 3.7. The results of these different impact evaluations indicate that only the agroforestry technological packages had a significant positive impact on the value of production (+38%) and profits (+63%).<sup>9</sup> The other packages did not. Since agroforestry packages represent 74% of all the packages distributed by the Program in terms of area covered (11,630 Ha covered with agroforestry over a total of 15,698 Ha) and that agroforestry packages led to a 63% increase in profits<sup>10</sup>, the average increase in agricultural gross margins<sup>11</sup> for the Program was 47% (**Outcome 1.1**), which represents more than 100% of the target.
- 3.8. Different factors can explain the disappointing results of annual crops packages (rice, horticulture, and peanuts). The annual crops packages did not transfer any innovation: farmers were already applying the techniques promoted as part of annual crops packages<sup>12</sup>. The Program also based its expected results on improved seeds which were supposed to be inspected by the Laboratory for Seed Quality Control. It didn't take place because the Laboratory was not launched on time (see below). This might have resulted in poor or average quality seeds reaching farmers' fields, thus limiting the potential production increase. Moreover, the irrigation issues in different areas might have also impacted the yield of annual crops. Finally, delays in the distribution of vouchers might also have negatively impacted agricultural practices (forcing farmers to postpone planting

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<sup>9</sup> A summary of the impact evaluation results is provided in "[Technology Transfer to Small Farmers Program in Haiti \(PTTA\) – Implementation, Evaluation and Lessons Learned](#)", May 2018.

<sup>10</sup> Defined as: value of sales – input costs (including vouchers).

<sup>11</sup> Also defined as: value of sales – input costs.

<sup>12</sup> A key constraint at the design stage, identified both by MARNDР and the Bank, was the absence of applied agricultural research in Haiti, which would have provided new technologies for the PTТА to transfer. Instead, PTТА followed a second-best approach which consisted of promoting sets of best practices already known within the Ministry of agriculture and applied with (documented) success in some parts of the country. In areas where PTТА intervened with annual crop packages, the extent to which these practices were already being applied by farmers before the project was underestimated. Conversely, in agroforestry areas, it proved to be a good approach.

dates, in particular) and therefore yields. In addition, some farmers did not properly apply the packages because they did not receive the necessary technical assistance.

- 3.9. **Outcomes 1.2 through 1.5** were measured using data from another project (RESEPAG) financed by the World Bank, which took place in the south of Haiti over the same period of time, and which also distributed smart subsidies to agroforestry and rice farmers. PTTA did not measure these indicators because, in Haiti, such crops are rarely cultivated as monocrops, which makes it difficult to estimate gross margins per individual crop. The structure of the data collected by RESEPAG, however, allowed for the estimations of gross margins of some individual crops. Using RESEPAG's data, we estimated average gross margins for coffee (US\$2,621), rice (US\$1,374), cocoa (US\$2,141) and corn (US\$283). For rice, coffee and cocoa, end-of-project values are higher than baseline values. For corn, it is the opposite. Because this data comes from another project (though it is similar to PTTA) and another area of intervention, it is difficult to attribute these changes to the Program. For coffee and cocoa, however, the changes observed are in line with results from the Program's impact evaluation (significant impact on the productivity of agroforestry crops such as coffee and cocoa) so they will be used as such in the column "% achieved" in **Table 2**. For rice, the change observed contradicts the findings of the impact evaluation, so this indicator will be considered "not achieved" in **Table 2**. The same applies to corn, which was not supported by the Program.
- 3.10. 19,378 farmers ended up adopting the new selected technologies (**Outcome 2.1**), which exceeds the target of 18,000 (more than 100% of the target achieved). According to the impact evaluations, the Program's annual crops packages didn't have any effect on outcome and impact indicators. As a result, **Outcome 2.1** focuses on beneficiaries of agroforestry packages only: 26,436 farmers (**Table A**). Of those, it is estimated in the Program's final evaluation that 73.3% adopted the technologies, which represents 19,378 farmers.<sup>13</sup> This represents an estimated area covered with the technologies of 8,525 Ha (**Outcome 2.2**; 73.3% of 11,630 Ha), which is almost equivalent to the Program's target of 9,000 Ha (95% of the target achieved).
- 3.11. **Outcome 3.1** was not achieved for two interconnected reasons (0% of the target achieved). On the one hand, important delays experienced in the implementation of **Output 2.2** (laboratory established and functioning), which was only completed at the very end of the Program, didn't leave enough time to start seeds' providers inspections before the Program's closure. On the other hand, there were too many institutional weaknesses at SNS (including lack of qualified staff, organizational weaknesses, etc.) and around it (political support, in particular, was lacking) to start developing and implementing such a complex and large-scale inspection program within the timeframe of the Program. In sum, **Outcome 3.1** was not achieved primarily because of execution delays and it is reasonable to assume that inspections will slowly unroll soon after the Program's completion (more details in the Sustainability section).
- 3.12. As described in more details in the following paragraphs, according to the impact evaluations, the Program did not lead to any improvement in food security levels (**Impact 2.1**). As a result, it is assumed that the end-of-Program value ("A") remains the same as the baseline value: 29% of the target population still below the minimum level of dietary consumption.

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<sup>13</sup> Évaluation Finale du PTTA. Roosevelt SAINT-DIC - January 2018.

**Table 2: Results Matrix Achieved**

Impact/Indicator	Unit of Measure	Baseline value <sup>14</sup>	Baseline year	Targets and Actual Achievement <sup>15</sup>		% achieved	Means of verification
General objective: Contribute to sustainably improve small farmers' agriculture income and food security in the northern region of Haiti							
Impact #1: Increase Farmer's Median Agricultural Net Income							
1.1 Increase in Income = (Crop Value + Livestock Value) - Input Costs	USD	190	2001	P	230	N/A	
				A	N/A <sup>16</sup>		
Impact #2: Improve Farmer's Food Security Levels							
2.1 Proportion of target population (30,000 families) below the minimum level of dietary consumption	%	29.2%	2000	P	22%	0%	Impact evaluations
				A	29%		
Specific objective: Promoting improved and sustainable agricultural technology adoption							
Outcome #1: Increase agricultural productivity							
1.1 Percentage difference in agricultural gross margins between beneficiaries (who adopted the technology) and control group	%	0%	2011	P	30%	+100%	Impact evaluations
				A	47%		
1.2 Average gross margin for coffee	USD / Ha	1,716	2010	P	2,450	+100%	Data from RESEPAG (World Bank; June 2020) expressed in 2018 US\$.  As described above, “% achieved” for rice and corn is set to 0%.
				A	2,621		
1.3 Average gross margin for rice	USD / Ha	980	2010	P	1,400	0%	
				A	1,374		
1.4 Average gross margin for cocoa	USD / Ha	1,463	2010	P	2,359	76%	
				A	2,141		
1.5 Average gross margin for corn (maize)	USD / Ha	372	2010	P	875	0%	
				A	283		

<sup>14</sup> Source: POD.

<sup>15</sup> Where: P = planned at startup plan (source: PMR "Second period Jan-Dec 2013"; it is the first PMR after eligibility that shows the P); A = last PMR.

<sup>16</sup> This indicator was no longer reported at Program completion because it did not differ from **Outcome 1.1**.

Impact/Indicator	Unit of Measure	Baseline value <sup>17</sup>	Baseline year	Targets and Actual Achievement <sup>18</sup>		% achieved	Means of verification
Outcome #2: Beneficiary farmers have adopted improved and sustainable technologies							
2.1 Beneficiary farmers that have adopted new selected technologies	Producers	0	2011	P	18,000	+100%	Monitoring and evaluation reports
				A	19.378		
2.2 Hectares covered with the technologies	Ha	0	2011	P	9,000	95%	Monitoring and evaluation reports
				A	8,525		
Outcome #3: Contribute to institutional building and capacity development creating SNS capacity to control seed quality							
3.1 Proportion of registered seed providers who have been inspected by SNS at least once a year and following the approved protocol	%	0	2011	P	100	0%	Monitoring and evaluation reports
				A	0		

<sup>17</sup> Source: POD.

<sup>18</sup> Where: P = planned at startup plan (source: PMR "Second period Jan-Dec 2013"; it is the first PMR after eligibility that shows the P); A = last PMR.

### **c. Counterfactual Analysis**

- 3.13. The impact evaluations focused on Component 1, and more specifically on the voucher or smart subsidy delivery mechanism, as it was expected to yield short-term benefits to farmers which could be measured directly at the farm level and which could be attributable to the Program through the identification of a control group, or counterfactual.
- 3.14. The smart subsidy delivery mechanism in Haiti was designed as a way to facilitate technology transfer to small agricultural producers in order to increase productivity, raise income and improve food security. The expected mechanism behind this change is the following: a reduction of financial constraints through the provision of a subsidy with a voucher to finance access to technological packages, including technical assistance and agricultural inputs, increases technology adoption among beneficiary farmers. Then the adoption of these technologies will increase income and food security through productivity improvements. Some of the additional income will be invested in similar technologies for the next agricultural cycle to maintain higher productivity levels. The additional demand for technology creates incentives for other suppliers to enter the market, improving competition and reducing oligopolistic behavior.
- 3.15. Minde and Nlovu (2007) describe “smart” subsidies as those involving (i) specific targeting to farmers who would not otherwise purchase the technologies (or to areas where adding the technologies can contribute most to yield improvements), (ii) measurable impacts, (iii) achievable goals, (iv) a results orientation, and (v) a timely duration of implementation, i.e., being time-bound or having a feasible exit strategy. In addition, some guiding principles of “market smart” subsidies, based on previous experiences, were incorporated in the design and implementation of PTTA, namely: i) promote the factor or product as part of a wider strategy that includes complementary inputs and strengthening of markets; ii) favor market-based solutions that do not undermine incentives for private investment; iii) promote competition and cost reductions by reducing barriers to entry for technology providers; iv) recognize that effective demand from farmers is critical for long-run sustainability; v) insist on economic efficiency as the basis technology promotion efforts; vi) empower farmers to make the decisions about productivity enhancement farm management practices; vii) devise an exit strategy to limit the time period of public interventions; and viii) pursue local integration in order to benefit from the economies of scale.
- 3.16. Studies of similar interventions confirm the expected results. Duflo, Kremer and Robinson (2008) conducts an impact evaluation of the use of fertilizer during six growing seasons in Kenya using a randomized selection process of beneficiary farmers. They established that while fertilizers can be very profitable when used correctly, one reason why farmers may not use fertilizers and hybrid seeds is that official recommendations are not well suited for every farmer. It also appears that using even a small amount of fertilizer yields high returns.
- 3.17. In Malawi, the Agricultural Subsidy Input Program (AISP), in a similar agricultural context as in Haiti, allows the annual distribution of about 175,000 metric tons (mt) of fertilizer and 4,500 mt of improved maize seeds through a voucher scheme at a cost to government and donors of about US\$91 million. The impact evaluation of the program by Minde, Jayne, Crawford, Ariga and Govereh (2008) finds that the subsidized fertilizer and seed program, combined with abundant and well-distributed rainfall, led to positive impacts

including increased maize output, improved household food security and lower food prices than would have prevailed without the subsidy. Besides, the intervention also increased private sector participation in input distribution.

- 3.18. The Technological Support in the Agricultural Sector (PATCA) financed by the Bank in 2004 in the Dominican Republic is similar to PTTA. The authors use propensity score matching to analyze the impact of accessing PATCA technologies on agricultural productivity. The survey used for this analysis included 1,572 farmers operating in crop growing, breeding or milk production. The results show that PATCA technologies improved the productivity of rice producers and breeders. However, they did not find any significant impact on other producers.
- 3.19. The World Bank's Development Impact Evaluation team (DIME) was in charge of the design and implementation of the impact evaluation of PTTA. Together with a dedicated research team from the Paris School of Economics (PSE), DIME worked under the supervision of MARNDR and of the Bank to develop an impact evaluation methodology suitable to the local context and able to generate robust and relevant findings.
- 3.20. Four different impact evaluations were designed and implemented in order to measure the Program's outcomes and impacts. Each impact evaluation focused on specific technological packages implemented in specific areas:
  - A randomized phase-in at the habitation (or village) level to measure the impact of rice technological packages in the Northeast Department;
  - A randomized phase-in at the individual level to measure the impact of the horticulture technological packages in Saint Raphaël (North Department);
  - A propensity score matching (PSM) to measure the impact of peanut technological packages in the Northeast Department;
  - A PSM to measure the impact of agroforestry technological packages in Limbé (North Department).
- 3.21. The two RCTs conducted on the PTTA (Gignoux et al., 2017) focused on the two technological packages that were distributed early on by the Program: rice and horticulture (both annual crops). They were designed to measure the impact of the Program on three main indicators: (i) agricultural yields, production values and profits; (ii) technology adoption; and (iii) food security. For the former, three household surveys were conducted: a baseline in the fall of 2013, a first follow-up in February 2015 and a second follow-up in August 2015. The final sample size included 515 households, 240 in the treatment group and 275 in the control group. For the latter RCT, there was no baseline survey. Vouchers were distributed to the treatment group in the fall of 2014 and surveys were administered in May 2015 to 329 households: 160 in the treatment group and 169 in the control group.
- 3.22. The Propensity Score Matching (PSM) evaluations, on the other hand, aimed at measuring the impact of the peanut technological package (another annual crop) and of agroforestry technological packages (perennial crops) on the same set of indicators. For the former, there was no baseline survey. Vouchers were distributed to the treatment group between March and April 2016, and surveys were administered in December 2016 to 373 households: 97 in the treatment group and 276 in the control group. Similarly, for

the latter, there was no baseline, vouchers were distributed to the treatment group between January and June 2015, and surveys were administered in November 2016 to 290 households: 100 in the treatment group and 190 in the control group.

- 3.23. In terms of attribution, RCTs offer the best possible unbiased impact estimates, which means that 100% of the changes observed can be attributed to the intervention with a high degree of confidence. RCTs are, however, not always feasible. In the case of both the peanut and the agroforestry technological packages, beneficiaries had already been identified by the Program and the treatment (i.e. participation in the Program) could thus no longer be randomly allocated (implying a risk of selection bias). Instead, control groups had to be constructed based on a set of observable characteristics from the two treatment groups using a PSM approach. While this methodology can't control for potential differences in unobservable characteristics, it does still offer reliable and quite robust impact estimates. Changes measured with this methodology can be attributed to the Program under the assumption that unobservable characteristics do not significantly differ between the treatment and the control groups. It is a quite reasonable assumption to make for both the peanut and the agroforestry technological packages considering that, for both packages: (i) farmers were selected based on a number of key observable characteristics such as the type of crops grown and the land size under cultivation (all of them being quite homogeneous in each area of intervention); and (ii) due to budget constraints, the Program was not able to distribute vouchers to all eligible farmers in each area, thus creating an opportunity to identify comparable counterfactuals for both technological packages. The main results of these different impact evaluations are summarized in **Table B**.
- 3.24. According to these results, only agroforestry technological packages have had an economic impact. Rice, horticulture and peanuts packages did not lead to any significant impacts.
- 3.25. The analysis of the data collected on agroforestry technological packages highlights positive impacts on the number of cultivated plots, total value of production, agricultural income and profits, labour use and investment in perennial crops. More specifically, the value of production increased by 38% and profit by 63% (**Outcome 1.1**). The impact of agroforestry technological packages on food security was not measured because the time gap between the distribution of vouchers and the administration of surveys (ranging from 1 to 2 years) was deemed insufficient to allow potential food security results to materialize. In other words, it is not that agroforestry technological packages had no impact on food security, but instead that surveys were administered too early for that impact to be detected. It is indeed reasonable to expect, in the longer-run, that such packages, which have a significant positive impact on production and profits, will also improve food security.
- 3.26. Regarding rice packages, treatment farmers' yields and production values both in 2014 (the year in which vouchers were distributed) and 2015 (the following year) were actually lower than in the control group. It was likely caused by a significant decline in input use (about 1/3) in 2014, particularly urea and sulphate, due to a combination of factors. Farmers in the treatment areas were regular users of many of the subsidized inputs already prior to the intervention. An investigation of their spending suggests that farmers used vouchers as substitutes rather than as complements to their own spending. Following an increase of input prices in 2014, vouchers could only buy inputs in smaller quantities than farmers previously used. Also, there were no vouchers for sulfate, one of the most popular fertilizers. Finally, lower input use may also be attributed to the late



delivery of seed vouchers, affecting farmers' chances to sow at the right time. Interestingly, however, there was no negative impact on agricultural profits for rice.

- 3.27. For horticulture, the impact evaluation shows that, while the intervention led to some reallocation of crops, it did not induce farmers to expand their horticulture cultivation and it did not lead to any significant change in total production value.
- 3.28. Regarding the peanut technological package, only one statistically significant difference was observed between the treatment and control groups after the intervention: while 86% of control households engaged in agricultural work during the season when vouchers were distributed, they were 97% in the treatment group.

**Table B: Impact evaluations summary<sup>19</sup>**

Target crop (Eval. Method)	Yield	Value of production	Profits <sup>20</sup>	Input use	Food security
Rice (RCT)	The Program resulted in a significant decrease in annual <sup>21</sup> rice yields among treatment farmers compared to the control group	The Program resulted in a significant decrease in the treatment farmers' production values compared to the control group	No difference	The Program resulted in a significant decrease in the use of inputs among treated households	No difference
Horticulture (RCT)	No difference	Overall, no difference. A significant decrease in the production value for Buenabite	Overall, no difference. Significantly negative impact for Buenabite	Increase in fertilizer use was only significant in Buenabite, while treatment and control farmers in Merlene used similar amounts of fertilizer. Significant decrease in pesticide use	No difference
Peanut (PSM)	No difference	No difference	No difference	Inputs use was significantly higher among treated households	No difference
Agroforestry (PSM)	N/A	Positive and significant impact. The total value of crop production (including actual and expected crop production) was 38% higher in the treatment group	Positive and significant impact. Treatment farmers' profits (including actual and expected profits) from crops were 63% higher than the control farmers'	No difference	N/A

3.29. The interventions of Component 2 were expected to benefit to the country as a whole, thus making it impossible to identify a control group and to attribute with a high degree of precision the changes observed to the Program itself. Moreover, some of the important outputs of this Component, including the financial support of second-degree university education and the establishment of a national seeds' laboratory, were expected to be completed during the final years of the Program and thus to generate a measurable impact only after the end of the Program.

<sup>19</sup> ["Technology Transfer to Small Farmers Program in Haiti \(PTTA\) – Implementation, Evaluation and Lessons Learned"](#), May 2018.

<sup>20</sup> To calculate profits, the cost of inputs paid for with vouchers was included in total input cost.

<sup>21</sup> As opposed to the seasonal analysis, for which the difference was not significant.

#### **d. Unanticipated Outcomes**

- 3.30. The results of the rice technological package's RCT indicate that treatment farmers were much less likely to have requested or taken loans (mostly informal), to finance the purchase of inputs in particular, not only in the year in which they received vouchers but also in the following one. Underlying reasons are not so clear, but one likely explanation is that farmers chose to stay away from new loans (and more generally from investments in fertilizer), possibly because of the particular risky climatic environment in both years. Although farmers in both treatment and control experienced bad weather, farmers in treatment had lower loan burdens as a result of the intervention, which may have made it easier for them to move away from high-intensity farming and the risks it entails during bad weather episodes.
- 3.31. According to the impact evaluation of agroforestry technological packages, income from livestock sales decreased in the treatment group. The trend observed may be desirable from the farmer's perspective, as livestock is a source of capital. It is possible that the subsidies allowed beneficiaries to hold on to their livestock, unlike their control counterparts who, lacking capital for agricultural purchases, may have felt compelled to sell it in greater quantities.

In sum, all outputs were either fully met or exceeded their targets. To a large extent, the specific objective, namely promoting improved and sustainable agricultural technology adoption, was achieved with 19,357 farmers adopting new selected technologies (more than 100% of the target) over an area of 8,525 Ha (95% of the target), and benefiting, for 74% of them, from higher values of production and profits. During the Program's execution, it was not possible, however, to measure any improvement in food security and institutional strengthening at SNS. This can be explained by the fact that such changes usually take longer to materialize.

#### 4. Efficiency

- 4.1. The ex-ante economic evaluation (2011) of the Program expected an Economic Rate of Return rate of 33% over 15 years. This rate was based on the expected extra income for farmers, generated by the packages.
- 4.2. The objective of the ex-post economic analysis is to measure the Program's economic viability at the end of its execution, based on estimates of all the incremental costs and benefits that can be attributed to it.
- 4.3. Incremental benefits are benefits which can be linked directly to the Program and which would not have arisen in its absence. Estimates of incremental benefits come from the Program's impact evaluations: the main finding is that agroforestry packages led to additional profits (+63%), while other packages had no impact. Agroforestry profits include profits from crops such as banana and yam, which materialize less than 12 months after plantation, as well as from perennial crops such as coffee and cocoa, which start materializing 4 years after plantation and are fully materialized 5-to-6 years after plantation. Based, primarily, on these agronomical considerations, the Program's final evaluation makes the conservative assumption that the overall increase in agroforestry profits materializes as follows: 50% in years 2 and 3 after having received the vouchers, 75% in year 4, and 100% starting from year 5 (cumulative).<sup>22</sup> In addition, while cocoa and coffee trees produce for an average of 15 years after plantation, banana trees and yams need to be replaced every 5 and 3 years, respectively. As a result, in order to maintain a constant flow of incremental benefits over the period of analysis (20 years in total, including the Program's duration), recurrent private costs (more details below) are incorporated to account for the replacement of banana trees and yams over that period.
- 4.4. Incremental costs, on the other hand, correspond to expenditures which would not have been incurred in the absence of the Program such as the actual Program expenditures (see **Table 3**) and associated recurrent costs. The ex-post economic analysis takes into account the actual Program expenditures, US\$ 39,713,805, minus the amount spent on vouchers, US\$26,220,000 according to the Program's final evaluation (which corresponds to 78% of expenditures of **Output 1.1**), because this amount is already factored into the profit (or benefit) calculations. Recurrent costs, on the other hand, represent all the additional costs that arise from the existence of the Program, and that must be covered by beneficiary farmers themselves (such as costs to replant banana trees and yam) or by the GoH (such as operation and maintenance costs associated with new infrastructures as well as salaries of newly trained staff).
- 4.5. For the entire Program, the Net Present Value (NPV) is US\$86,110, the Internal Rate of Return (IRR) 12.21% and the benefit-cost ratio 1.01, which indicates that the Program was economically viable.
- 4.6. A sensitivity analysis is conducted in order to see how the viability of the Program is affected by changes in some of the main hypotheses. The analysis of agroforestry data was conducted using four different PSM algorithms. The 63% increase in profits estimate is the most conservative one. The other three algorithms show increases in agroforestry profits of 64.3%, 75.8% and 81.5%, which, in turn, increase the Program's IRR to 13.91%, 17.29% and 21.73%, respectively. A sensitivity analysis is also conducted to identify the breakeven point, where the NPV equals 0 and the IRR equals 12%: keeping costs

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<sup>22</sup> Évaluation Finale du PTTA. Roosevelt SAINT-DIC - January 2018.

constant, a decrease in expected benefits of 3% would make the NPV equal to 0. In other words, we would need an increase in agroforestry profits of at least 60.85% in order to make this intervention economically viable. The sensitivity of these results is particularly important to consider in the current context, characterized by a long-lasting socio-economic crisis, worsened by the Covid-19 pandemic. While it remains unclear how the current context will affect the profitability of agroforestry crops, any significant change in production costs (increase) and/or selling prices (decrease) is likely to threaten the sustainability of the Program's results.

**Table 3: Costs of the Program**

									Component Revised Cost
<b>1 Extension of direct payment system</b>									\$32,846,856.00
Outputs		2012	2013	2014	2015	2016	2017	2018	Cost
1.1 Farmers who received vouchers for the technologies being promoted	P	\$0.00	\$2,722,563.00	\$6,508,487.00	\$10,674,250.00	\$13,094,700.00			\$33,000,000.00
	P(a)	\$0.00	\$500,000.00	\$7,000,000.00	\$8,000,000.00	\$16,479,468.00	\$2,561,574.00		\$32,846,856.00
	A	\$16,565.00	\$1,018,776.00	\$3,921,926.00	\$11,563,265.00	\$13,764,750.00	\$2,408,005.00	\$1,005,226.00	\$33,698,513.00
									Component Revised Cost
<b>2 Technical support to Seed National Service</b>									\$1,812,651.00
Outputs		2012	2013	2014	2015	2016	2017	2018	Cost
2.1 Evaluation of the role of public sector in the seeds and input market completed	P	\$0.00	\$30,000.00			\$20,000.00			\$50,000.00
	P(a)	\$0.00	\$30,000.00	\$10,000.00		\$0.00			\$49,707.00
	A	\$0.00	\$22,601.00	\$27,106.00	\$0.00	\$0.00	\$64,359.00	\$0.00	\$114,066.00
2.2 Laboratory for seeds quality contro established and functioning	P	\$0.00	\$537,600.00	\$592,200.00	\$192,600.00	\$137,600.00			\$1,460,000.00
	P(a)	\$0.00	\$150,000.00	\$250,000.00	\$250,000.00	\$820,351.00	\$504,167.00		\$833,166.00
	A	\$0.00	\$0.00	\$120.00	\$264,529.00	\$64,350.00	\$440,210.00	\$372,515.00	\$1,141,724.00
2.3 Seed National Service's human capital strengthened	P	\$0.00	\$100,000.00	\$200,000.00	\$100,000.00	\$0.00			\$400,000.00
	P(a)	\$0.00	\$40,000.00	\$20,000.00	\$60,000.00	\$251,031.00			\$400,000.00
	A	\$0.00	\$2,500.00	\$48,973.00	\$97,496.00	\$123,132.00	\$159,290.00	\$0.00	\$431,391.00
2.4 Procedures manual for seeds quality control elaborated	P	\$0.00	\$40,000.00						\$40,000.00
	P(a)	\$0.00	\$40,000.00	\$13,750.00	\$13,750.00	\$13,750.00	\$13,750.00		\$40,000.00
	A	\$0.00	\$26,250.00	\$0.00	\$0.00	\$0.00	\$89,640.00	\$0.00	\$115,890.00
2.5 National policy and strategy for the seed sector approved	P		\$25,000.00			\$25,000.00			\$50,000.00
	P(a)		\$40,000.00	\$40,000.00	\$200,000.00	\$247,152.00	\$150,855.00		\$489,778.00
	A	\$0.00	\$0.00	\$0.00	\$178,141.00	\$160,782.00	\$43,978.00	\$0.00	\$382,901.00
									Component Revised Cost
<b>3 Administration, audit, evaluation</b>									
Other Cost		2012	2013	2014	2015	2016	2017	2018	Cost
Total Cost Administration, audit, evaluation	P	\$100,000.00	\$903,300.00	\$768,900.00	\$568,900.00	\$2,533,900.00			\$4,875,000.00
	P(a)	\$100,000.00	\$450,000.00	\$684,000.00	\$930,000.00	\$1,680,537.00	\$828,715.00		\$3,773,568.00
	A	\$85,329.00	\$974,433.00	\$593,484.00	\$492,131.00	\$799,476.00	\$657,088.00	\$227,379.00	\$3,829,320.00
Total Cost		2012	2013	2014	2015	2016	2017	2018	Total Cost
	P	\$100,000.00	\$4,358,463.00	\$8,069,587.00	\$11,535,750.00	\$15,811,200.00			\$39,875,000.00
	P(a)	\$100,000.00	\$1,250,000.00	\$8,017,750.00	\$9,453,750.00	\$19,492,289.00	\$4,059,061.00		\$38,433,075.00
	A	\$101,894.00	\$2,044,560.00	\$4,591,609.00	\$12,595,562.00	\$14,912,490.00	\$3,862,570.00	\$1,605,120.00	\$39,713,805.00

## 5. Sustainability

### a. General Sustainability Aspects

- 5.1. The timeframe for this sustainability assessment is 10 years after Program's closure (same as in the ex-post cost-benefit analysis of the Program), which corresponds to the period during which benefits associated with the Program are expected to be realized. The assessment focuses primarily on the sustainability of changes induced by agroforestry technological packages and by the strengthening of SNS, and on the sustainability of the smart subsidy delivery mechanism itself.
- 5.2. The sustainability of changes induced by agroforestry technological packages, namely the increase in the value of production and profits, depends on different factors:
- Technical factors: The quality of agricultural inputs purchased with vouchers, and of seedlings (citrus, coffee, cocoa, etc.) in particular, is crucial to ensure the appropriate implementation of agroforestry technological packages, and the materialization and durability of their associated benefits. However, according to the Program's finale evaluation, the average survival rate of agroforestry seedlings is quite high at 73.3%. Another threat to the sustainability of agroforestry results is the spread of pests and/or diseases affecting agroforestry crops in a context where phytosanitary services are weak. It represents a low probability risk with a high negative impact. But the ties between farmers and Communal Agricultural Bureau (or BAC, for its French acronym), MARNDR's local field offices, which have been strengthened throughout the Program should mitigate this risk.
  - Environmental factors: As discussed above, agroforestry technological packages are expected to improve farmers' resilience to climate change. They remain, however, vulnerable to extreme adverse climatic events such as hurricanes, especially the first few years after plantation. Such events represent a low probability risk with a high negative impact.
  - Economic factors: Last but not least, the current economic crisis affecting Haiti and made worse by the Covid-19 pandemic is likely to have a negative impact on farmers' income and profit.
- 5.3. The sustainability of *expected* changes induced by the strengthening of SNS, on the other hand, depends on the following factors:
- Technical factors: SNS's human capital has been strengthened by the Program. But the ability of SNS to improve significantly and over time the quality of seeds in Haiti will also depend on: (i) the work of extension services to promote and encourage the adoption of improved and/or certified seeds; and (ii) the capacity of SNS to enforce norms and regulations. This represents a low probability risk with a low negative impact. The Program mitigated these risks by strengthening BACs, which are co-responsible for the provision of extension services, and by having MARNDR officially approve and endorse a legal framework for the seed sector.
  - Financial factors: It is crucial that MARNDR provides SNS with an annual budget large enough in order for SNS: (i) to keep its four (4) newly trained staff on board by

providing them attractive salaries; and (ii) to be able to properly inspect seed providers on a regular basis. In the current economic context, this represents a medium probability risk with a medium negative impact.

- 5.4. The sustainability of the smart subsidy delivery mechanism itself depends primarily on financial factors as financial resources are very limited, the demand for subsidies is high and so is their costs (for instance, the average cost of an agroforestry package is 45,236HTG, or US\$665 in 2018-US\$ equivalent). But it also depends on the political will of the GoH to implement a coherent agricultural subsidy policy. Traditionally, MARNDR has subsidized the price of agricultural inputs, and fertilizers in particular, by intervening on the supply side. Private suppliers would simply act as subcontractors and execute supply contracts signed with the GoH. The uncertainty and unpredictability of the market (both in terms of prices and quantities) not only made private suppliers reluctant to invest in this particular field, but also contributed to slowly kick private suppliers out of the mechanism and let MARNDR play an increasingly bigger role (including in the distribution of fertilizers). This also led to limited fertilizer availability on the local market (and important geographical disparities within Haiti), clientelist behaviors in the selection of beneficiaries, speculation and illegal re-exports of fertilizers to the Dominican Republic. All in all, this approach failed to increase the annual consumption of fertilizers, which has remained constant since the year 2000.<sup>23</sup> In the three-year agricultural recovery program document (2013-2016), the GoH committed to make a transition from this supply-side subsidy approach to the smart subsidy delivery mechanism, as the one implemented by PTTA. The results achieved by PTTA will help build legitimacy and support for this transition, even though some concerns remain with regard to the capacity of this new mechanism to benefit a significant share of Haitian farmers and not just a few thousands. To conclude, these financial and political factors are medium probability risks for the sustainability of the smart subsidy delivery mechanism with a high negative impact.
- 5.5. It is also important to highlight that the Bank and MARNDR have designed and are currently in the process of implementing a new program, [PITAG](#), which also promotes the adoption of improved and sustainable agricultural technology. PITAG incorporates lessons learnt and recommendation for actions from the PTTA, and will contribute to the sustainability not only of PTTA's results, but also of the smart subsidy delivery mechanism.

#### **b. Environmental and Social Safeguards**

- 5.6. The Grant proposal document states that the program was classified as Category B and that Bank guidelines for this category were duly respected.
- 5.7. An Environmental and Social Management Report (ESMR) was prepared at the start of the Program. It anticipated some positive environmental and social impacts, for agroforestry packages in particular, such as improvements in soil conservation, soil fertility, water retention and carbon capture. Two low-probability risks during execution were also identified: (i) chemical pollution of soils and waterways through the misuse of agricultural inputs, fertilizers, pesticides and inadequate imported seeds; and (ii) erosion caused by non-adapted agricultural practices. The ESMR recommended trainings, which were implemented, to both farmers and public entities involved in the Program's execution in order to mitigate these negative impacts. In addition, careful attention was given to the

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<sup>23</sup> Evaluation du rôle du secteur public sur le marché des intrants agricoles en Haïti. Jefferson Germain, Olivier Jenn-Treyer - IRAM, 2013.



type of chemical products to use and the quantity to apply when designing technological packages. Supervision visits of beneficiary farmers' plots were also organized both by MARNDR and the Program's field private operators to ensure the appropriate application of technological packages. All these measures seem to have adequately mitigated the above-mentioned negative impacts.

- 5.8. During the Program's execution, some non-anticipated issues also arose, with potential social consequences. Two, in particular, are worth mentioning: (i) vouchers with a fixed value in a context of rising input prices led to some rice producers being unable to obtain the recommended (and promised) amount of fertilizers; and (ii) the quasi non-existence of private technical assistance providers made it difficult for beneficiaries of horticulture packages to receive technical support. In order to mitigate the former, the Executing Agency developed a more thorough and detailed agricultural input price tracking system. For the latter, the Program relied on technological packages less dependent on external technical support, such as agroforestry packages.
- 5.9. Public consultations were organized at the end of the Program (and in preparation of PITAG) in different areas of intervention to discuss what did work and what did not during its execution. Stakeholders (beneficiary farmers, for the most part) did not report any other significant environmental and social issue linked to the Program.

The biggest risks to the sustainability of changes induced by the Program and of the smart subsidy delivery mechanism itself are Haiti's ongoing socio-economic crisis, worsened by the Covid-19 pandemic, and the lack of public financial support to both SNS and the smart subsidy delivery mechanism. These risks will, however, and for the most part, be mitigated in the near future by investments from PITAG. The main environmental and social risks identified at the design stage did not materialize. Some issues during execution did arise but the Executing Agency was quick to react so as to mitigate their negative impacts. Safeguards performances was thus satisfactory.

### **III. NON-CORE CRITERIA. PROGRAM PERFORMANCE**

#### **6. Bank Performance**

- 6.1. Overall, the Bank's performance was satisfactory during the design and implementation of the Program. The Program was designed based on rigorous technical studies, which were conducted to assess the economic viability of the proposed interventions and to select specific value chains with the highest potential for agricultural intensification using the information available at the time and based on the conditions which were then prevailing. It was also based on a manageable number of components and outputs, which helped reduce operational and administrative costs. Given Haiti's complex work environment, limiting the number of components and outputs also facilitated the regular monitoring of activities by the Bank to ensure an efficient, effective and timely execution of the Program, in line with defined objectives and targets, and to detect and solve potential problems early on.
- 6.2. The Bank's supervision took place through regular meetings with the Program's Executing Agency, the collection of data to monitor financial and physical outputs, and frequent field visits in various areas of intervention. Overall, the good relationship between the Bank (including Sector's, Financial Management and Procurement Specialists) and the Program's Executing Agency was praised by both sides and considered a key factor behind the Program's successful implementation. No-Objection requests were also treated in a timely manner by the Bank.
- 6.3. Financial management by the Bank was also satisfactory. The Program's Executing Agency indicates that the Bank responded quickly to disbursement requests and provided adequate support whenever requested.
- 6.4. It is also worth highlighting the Bank's continuous effort to ensure that the Program could be subject to a sound impact evaluation, despite the numerous technical and operational challenges faced on the field. As a result, the four rigorous impact evaluations described above were successfully implemented, including Haiti's first RCT. In addition, these impact evaluations were complemented by qualitative evidence coming from three agro-economic diagnostic studies financed by the Bank's supervision budget and which helped considerably understand as well as contextualize the real (i.e. unbiased) impact of the Program.

## **7. Borrower Performance**

- 7.1 Overall, the Borrower's performance was satisfactory during the Program's preparation and execution. MARNDR played a key role in the design of the Program by providing close guidance to align the Program's objectives with sectorial needs and national development objectives. The Ministry also assisted with the elaboration of the Program's technical details such as the identification of productive value chains, the selection of the intervention areas with the highest agricultural potential (North and North-East departments), as well as the identification of institutional weaknesses and needs to strengthen the SNS.
- 7.2 The Program was executed by an Executing Agency at MARNDR. To strengthen institutional linkages and synergies with other projects and programs, PTTA was implemented as part of a wider framework, which included another program named "Renforcement des Services Publics Agricoles" (RESEPAG), financed by the World Bank. These two programs adopted the same smart subsidies approach and were managed by the same Executing Agency. The Executing Agency was composed of a team of civil servants and consultants with long standing experience working in Haiti's agricultural sector, in agricultural research and innovation, as well as in financial and project management.
- 7.3 The Borrower, including the Executing Agency, complied with all agreements and covenants (including the environmental and safeguard policies). Overall, the Executing Agency carried out its responsibilities and tasks entitled in a responsible, timely, efficient and participatory manner. Regarding the latter, the Executing Agency regularly met with Program's stakeholders (and beneficiary farmers, in particular) from all areas of intervention, either directly on the field, or during focus groups or workshops aimed at discussing some of the Program's specific issues.
- 7.4 Some execution delays at the start of the Program, for Component 2 in particular, were caused by procurement delays. The Program's Executing Agency, however, with support from the Bank managed to overcome these limitations. The Program even contributed to the implementation of a central procurement unit within MARNDR, which then progressively took over the management of procurement processes for RESEPAG as well as other Bank's programs. Some limitations and weaknesses in the monitoring and evaluation (M&E) system were also observed. To ensure the effective monitoring and reporting of financial and physical achievements, and to facilitate the flow of information and data, an information management system (SIGI) was designed. Unfortunately, technical and conceptual issues in the design and implementation of the system made it impossible to use during the course of the Program, despite the Bank's efforts to overcome those issues by meeting on numerous occasions with both the Executing Agency and the firm in charge of designing SIGI, and by recommending the Executing Agency to hire an IT specialist. Instead the Executing Agency had to rely on Excel spreadsheets, despite their limitations in terms of information sharing and transparency, and the higher risk of data entry errors. A monitoring officer from the Executing Agency was assigned to regularly track and report implementation progresses and challenges. A regular and close monitoring was especially important for Component 1, whose implementation was under the responsibility of private operators. However, the presence of the monitoring officer on the field turned out to be insufficient and, in the end, the Executing Agency ended up relying more on data reported by private operators themselves. A more systematic monitoring of the quality of agricultural inputs and services provided to farmers should also

have taken place. This would have helped detect and tackle technical and operational challenges earlier on.

## 8. FINDINGS AND RECOMMENDATIONS

**Table 4: Findings and Recommendations**

Findings	Recommendations
<b>Dimension 1: Technical-sectorial dimension</b>	
Some technological packages did not generate extra income (because they were not adapted and/or did not provide a real innovation to beneficiaries).	Investments have to be made in applied agricultural research so as to develop and test new agricultural technologies. The package selection should be done through iterative and participative field tests. This approach would limit the fact that some practices were already used in some locations and ensure that appropriate conditions are in place for new technologies to be implemented.
	Some technological packages (e.g. rice) require more than just agricultural inputs such as seeds and fertilizers to thrive. Some additional investments in infrastructures (in irrigation systems, for instance) and/or equipment (such as water pumps) might be needed.
	Technical assistance needs to be strengthened to support farmers effectively and continuously. The operators could thus be divided in two, with a service dedicated to technical assistance (agronomists) and a service dedicated to the administrative management of the subsidies. In addition, demonstration plots should be created and co-managed by the BAC in order to strengthen the exit strategy of the operation. These technical support units should work closely with a dedicated public research unit of the Ministry.
	Farmers should participate in the financing of the packages in order to ensure higher adoption rates.
Rigorous impact evaluations are difficult to implement but provide valuable information and lessons to the program in question as well as future/other programs.	A program's impact evaluation must be designed while designing the program itself so as to ensure that the impact evaluation can be as rigorous as possible, without imposing any constraint on execution. In addition, it is crucial to have at least one person within the Executing Agency working full-time to ensure the appropriate implementation of the impact evaluation.
	Complementing quantitative evaluations with more qualitative approaches such as agro-economic diagnostic studies provides useful context information, helps interpret quantitative results and can be useful to grasp longer-term and harder-to-measure impacts such as environmental externalities.
A strong M&E system is crucial to monitor program implementation and help respond quickly to potential problems.	The work of M&E officers should primarily take place on the field and goes beyond simply reporting program indicators. M&E officers should play a key role in the identification of unanticipated problems.
<b>Dimension 2: Organizational and managerial dimensions</b>	
The Ministry's local representatives have limited operational and technical capabilities.	Relying on private operators to implement Component 1 (and work jointly with the Ministry's local representatives) has proven successful. Over 35,000 farmers received vouchers (the target was 30,000) and it was done in compliance with all the norms and processes set out in the Ministry's Incentives Manual.

Execution delays and input prices inflation had a negative effect on the effectiveness of annual crop packages.	The information system needs to be improved in order to make the information transfer faster, to facilitate results synthesis and to enable automatic updates of key project information and data. This would reduce execution delays, improve problem identification and reduce reaction times.
	The design, implementation and monitoring of the voucher delivery system should ensure that the value of vouchers is not eroded by delays, inflation or supply chain distortions. When applicable, financial institutions need to be held accountable for delays. Mobile banking could help improve some processes.
	Similarly, when applicable, agricultural inputs suppliers need to be held responsible for delays. A full control has to be implemented with potential penalties for suppliers not complying with contract agreements.
	External and independent evaluations have to be conducted on a regular basis in order to identify new challenges and propose effective adjustments.
	The complaint system should be improved by creating faster procedures for the identification of challenges and the design of solutions.
<b>Dimension 3: Dimensions related to public processes and actors</b>	
The most vulnerable beneficiaries (women, in particular) might not be able to maintain technological packages without any additional financial support. <sup>24</sup>	An exit strategy via rural microfinance could be designed. The microfinance institutions (MFI) could be involved in the distribution of vouchers in order to create a first business link between vulnerable farmers and MFI.
As shown in the horticulture RCT, the lack of information about the Program's implementation has made access to inputs unpredictable for farmers and limited the extent to which they could effectively restructure their investment decisions.	Farmers should be clearly informed of the benefits they are entitled to and for how long, so that they can hold suppliers accountable, and determine the size of personal investment to complement the amounts received in the form of subsidies.
<b>Dimension 4: Fiduciary dimensions</b>	
Efficient procurement team and processes are crucial for program execution.	Before the start of the program, an institutional and technical assessment of the procurement team should be conducted to identify relevant reinforcement and capacity strengthening needs. More generally, procurement processes need to be mapped out entirely (especially those under the responsibility of third-party public entities) in order to identify potential bottlenecks and anticipate mitigation measures.
<b>Dimension 5: Risk management</b>	
Climatic risks are common in agriculture and can cause significant income losses for farmers. The most vulnerable might hesitate to invest in new practices.	A weather index microinsurance could be tested as a complement to the voucher system.

<sup>24</sup> Évaluation Finale du PTTA. Roosevelt SAINT-DIC - January 2018.

## ANNEX 1 – Outputs Achieved

Output/Indicator	Unit of Measure	Baseline value	Baseline year	Targets and Actual Achievement <sup>25</sup>		% achieved <sup>26</sup>	Means of verification
Component 1: Extension of direct payment system							
1.1 Farmers received vouchers for the technologies being promoted	Producers	0	2011	P*	30,000	+100%	Monitoring report
				P	30,000		
				A	35,631		
Component 2: Technical Support to SNS (National Seed Service)							
2.1 Evaluation of the role of public sector in the seeds and input market completed	Document/report	0	2011	P*	1	100%	Monitoring report
				P	2		
				A	2		
2.2 Laboratory for seeds quality control established and functioning	Operational laboratory	0	2011	P*	N/A <sup>27</sup>	100%	Monitoring report and photographs
				P	1		
				A	1		
2.3 Seed National Service's human capital strengthened	People	0	2011	P*	4	100%	Monitoring report and copies of Master diploma
				P	4		
				A	4		
2.4 Procedures manual for seeds quality control elaborated	Manual	0	2011	P*	1	+100%	Procedures manual
				P	1		
				A	2		
2.5 National policy and strategy for the seed sector approved	Document/report	0	2011	P*	2	100%	Policies proposal
				P	1		
				A	1		

<sup>25</sup> Where: P\* = planned at approval (source: POD); P = planned at startup plan (source: PMR "Second period Jan-Dec 2013"; it is the first PMR after eligibility that shows the P); A = last PMR.

<sup>26</sup> Relative to P.

<sup>27</sup> The indicator associated with this output has changed from "number of seed samples analyzed for quality control by the laboratory" at approval to "laboratory for seeds quality control established and functioning" at startup plan, without affecting the Program's vertical logic.