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Report No: ICR00119

IMPLEMENTATION COMPLETION AND RESULTS REPORT

TF-A8221 and TF-B6154

ON

GRANTS

FROM THE GLOBAL AGRICULTURE AND FOOD SECURITY PROGRAM

IN THE AMOUNT OF US$ 32.28 MILLION EQUIVALENT

TO THE

REPUBLIC OF RWANDA

FOR THE

SUSTAINABLE AGRICULTURAL INTENSIFICATION AND FOOD SECURITY PROJECT

FEBRUARY 2025

Agriculture and Food
Eastern And Southern Africa

CURRENCY EQUIVALENTS

(Exchange Rate Effective Aug 31, 2024)

Currency Unit =	
FRW 1,329 =	US$ 1
US$ 1.35 =	SDR 1

FISCAL YEAR
July 1 - June 30

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ABBREVIATIONS AND ACRONYMS

BCC	Behavior Change Communication
CIP	Crop Intensification Program
CPS	Country Partnership Strategy
CSA	Climate-Smart Agriculture
EFA	Economic and Financial Analysis
EIRR	Economic Internal Rate of Return
ESMF	Environmental and Social Management Framework
EX-ACT	Ex Ante Carbon-Balance Tool
FAO	Food and Agriculture Organization of the United Nations
FAB	Farming as a Business
FCS	Food Consumption Score
FFS	Farmers Field School
FM	Financial Management
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GOR	Government of Rwanda
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GRS	Grievance Redress System
ICR	Implementation Completion and Results Report
ICT	Information and Communication Technology
LWHP	Land Husbandry, Water Harvesting, and Hillside Irrigation Project
M&E	Monitoring and Evaluation
MINAGRI	Ministry of Agriculture and Animal Resources
NISR	National Institute of Statistics of Rwanda
NPV	Net Present Value
NSA	Nutrition-Sensitive Agriculture
NST	National Strategy for Transformation
O&M	Operations and Maintenance
PDO	Project Development Objective
PSTA	Strategic Plan for Agriculture Transformation (Plan Stratégique pour la Transformation Agricole)
RAB	Rwanda Agriculture and Animal Resources Board
RF	Results Framework
RPF	Resettlement Policy Framework
RSB	Rwanda Standards Board

RSSP	Rural Sector Support Project
SACCO	Savings and Credit Cooperative
SAIP	Sustainable Agricultural Intensification and Food Security Project
SHG	Self-Help Group
SPIU	Single Project Implementing Unit
SSIT	Small Scale Irrigation Technology Development Program
TA	Technical Assistance
WUA	Water Users Association

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DATA SHEET

BASIC DATA

Product Information

Operation ID P164520	Operation Name Sustainable Agricultural Intensification and Food Security Project
Product Investment Project Financing (IPF)	Operation Short Name SAIP
Operation Status Closed	Approval Fiscal Year 2019
Original EA Category Partial Assessment (B) (Approval package - 14 Sep 2018)	Current EA Category Partial Assessment (B) (Restructuring Data Sheet - 27 Apr 2023)

CLIENTS

Borrower/Recipient Republic of Rwanda	Implementing Agency Rwanda Agriculture and Animal Resources Board (RAB)

DEVELOPMENT OBJECTIVE

Original Development Objective (Approved as part of Approval Package on 14-Sep-2018)

To increase agricultural productivity, market access, and food security of the targeted beneficiaries in the project areas.

Current Development Objective (Approved as part of Additional Financing Package Seq No 2 on 30-Jun-2021)
To increase agricultural productivity, market access, and food security of the targeted beneficiaries in the project areas.

FINANCING

Financing Source	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Administered Financing	32,285,295.00	32,285,295.00	32,285,295.00
TF-B6154	5,985,295.00	5,985,295.00	5,985,295.00
TF-A8221	26,300,000.00	26,300,000.00	26,300,000.00
Total	**32,285,295.00**	**32,285,295.00**	**32,285,295.00**

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Type	Amount Disbursed (US$M)	Key Revisions
27-Apr-2023	Portal	28.24	• Results • Loan Closing Date Extension

KEY DATES

Key Events	Planned Date	Actual Date
Concept Review	10-Nov-2017	21-Nov-2017
Decision Review	24-May-2018	24-May-2018
Authorize Negotiations	31-Jul-2018	31-Jul-2018
Approval	17-Sep-2018	14-Sep-2018
Signing		19-Sep-2018
Effectiveness		14-Dec-2018
ICR/NCO	27-Feb-2025	26-Feb-2025
Additional Financing Sequence.02	Not Applicable	30-Jun-2021
Restructuring Sequence.01	Not Applicable	27-Apr-2023
ICR Sequence.01 (Final)	--	25-Feb-2025
Operation Closing/Cancellation	31-Aug-2024	31-Aug-2024

RATINGS SUMMARY

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Substantial

ISR RATINGS

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	10-Apr-2019	Satisfactory	Satisfactory	1.22
02	26-Jul-2019	Satisfactory	Satisfactory	1.22
03	21-Oct-2019	Satisfactory	Satisfactory	3.76
04	15-Apr-2020	Satisfactory	Satisfactory	5.26
05	09-Nov-2020	Satisfactory	Satisfactory	8.52
06	07-May-2021	Satisfactory	Moderately Satisfactory	9.77
07	09-Dec-2021	Satisfactory	Moderately Satisfactory	12.22
08	30-May-2022	Satisfactory	Moderately Satisfactory	18.45
09	04-Dec-2022	Satisfactory	Satisfactory	23.45
10	21-Jun-2023	Satisfactory	Satisfactory	32.29
11	19-Dec-2023	Satisfactory	Satisfactory	32.29
12	25-Jun-2024	Satisfactory	Satisfactory	32.29
13	30-Aug-2024	Satisfactory	Satisfactory	32.29

SECTORS AND THEMES

Sectors

Major Sector	Sector	%	Adaptation Co-benefits (%)	Mitigation Co-benefits (%)
FY17 - Agriculture, Fishing and Forestry	FY17 - Agricultural Extension, Research, and Other Support Activities	21	49	51
	FY17 - Irrigation and Drainage	26	50	50

	FY17 - Other Agriculture, Fishing and Forestry	5	0	0
	FY17 - Public Administration - Agriculture, Fishing & Forestry	16	30	31
FY17 - Industry, Trade and Services	FY17 - Agricultural markets, commercialization and agri-business	28	0	0
FY17 - Information and Communications Technologies	FY17 - ICT Services	4	46	54

Themes

Major Theme	Theme (Level 2)	Theme (Level 3)	%
FY17 - Environment and Natural Resource Management	FY17 - Climate change	FY17 - Adaptation	30
		FY17 - Mitigation	31
FY17 - Finance	FY17 - Finance for Development	FY17 - Agriculture Finance	68
FY17 - Human Development and Gender	FY17 - Gender		33
	FY17 - Nutrition and Food Security	FY17 - Nutrition	25
FY17 - Urban and Rural Development	FY17 - Rural Development	FY17 - Rural Infrastructure and service delivery	61
		FY17 - Rural Markets	68

ADM STAFF

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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. **At appraisal in 2018, Rwanda had had over a decade of strong economic growth and poverty reduction, driven by post-conflict reconstruction efforts, robust agriculture performance and policy reforms[1] on growth and sustainability.** From 2000 and 2017, Rwanda's economy grew at 7.2 percent annually. Per capita income rose from US$242 to US$774. With over 70 percent of the population engaged in agriculture, the sector was and remains the backbone of Rwanda's livelihood, and key for poverty reduction and food and nutrition security. Per the approved Project Appraisal Document (PAD), agriculture provided employment and contributed substantially to the country's Gross Domestic Product (GDP), contributing 31 percent to the GDP, and accounting for 35 percent of the poverty decline. Agricultural output grew at an average of 5.3 percent annually, doubling in value by 2016. In 2017, the sector generated US$252 million in agricultural and agro-processed exports, representing 52 percent of total goods exports.

2. **Rwanda's agricultural sector had significantly transformed, marked by increased productivity in staple crops[2], better access to inputs, and technological advancements guided by strong policy frameworks**. Vision 2020 (2000), aimed to shift agriculture from subsistence to a market-oriented high-value sector. The Strategic Plan for the Transformation of Agriculture (PSTA) was implemented in several phases[3] to achieve this goal. Under the Crop Intensification Program (CIP) (2007), with the introduction of quality seed varieties and better agronomic practices maize yield increased from 0.5 to 2.5 tons per hectare, bean yield, a primary protein source for Rwandans, from 0.8 to 1.5 tons per hectare, and Irish potatoes from 6 to nearly 20 tons per hectare by 2017. The Green Growth and Climate Resilience Strategy, (2011), incorporated Climate Smart Agriculture (CSA) into agricultural planning and integrated adaptation actions[4] into its Intended Nationally Determined Contribution. Women, 57 percent of the agriculture labour force[5], were empowered through the gender strategy (2003). The National Strategy for Transformation (NST1; 2017-2024) and the National Agriculture Policy (NAP; 2018-2030) prioritized agricultural modernization, food security, nutrition-sensitive agriculture (NSA), productivity, climate resilience, and private-sector-led growth aiming to transform agriculture into a productive, and market-oriented industry by 2030, making Rwanda a middle-income country by 2035 and a high-income nation by 2050.

3. **Despite progress, the agriculture sector still faced challenges realizing its full potential**. Staple crop yields were plateauing[6] due to suboptimal use of production factors[7]. Production potential and growing food demand remained unmet due to small plots[8], limited arable land, over-reliance on rain-fed subsistence farming, and climate vulnerability. Limited access to irrigation and mechanization, low irrigation levels[9], soil erosion, inadequate rural

[1] driven by both government initiatives and international partners
[2] maize, beans, potatoes, and cassava
[3] PSTA1 (2004-2008), PSTA2 (2009-2012), PSTA3 (2013-2017) and PSTA4 (2018-2024.
[4] sustainable pest management techniques, soil conservation, land husbandry, irrigation and water management, value addition of agriculture produce, and access to market
[5] PAD
[6] cassava, maize, wheat, potatoes, and beans were at 40–50 percent of their productivity potential (PAD)
[7] labor-intensive farming methods and limited use of modern technology
[8] Over 60 percent of households cultivated less than 0.6 ha, 15 percent of rural households farmed less than 0.1 ha. Female-headed households cultivated only 1.32 percent of national cultivable land (PAD).
[9] less than 20 percent of agricultural land was irrigated. (PAD)

infrastructure, limited access to finance and credit for smallholder farmers, and low market accessibility hindered productivity and income growth. Post-production challenges (poor storage and drying techniques) affected food safety and quality. Key VCs lacked competitiveness, value addition and agri-processing capacity. Private investment was low due to the finance sector's reluctance to lend to agribusinesses and challenges in aggregating small farmers for competitiveness. Diversification into higher-value crops was limited by insufficient farmer knowledge, risk aversion, and a focus on food staples under the CIP. Undernourishment and stunting (chronic malnutrition), at 38 percent was deemed high by international comparison, and 17.8 percent of young children (6–23 months)[10] lacked a minimum acceptable diet due to poverty[11], food insecurity and lack of knowledge about proper nutrition and feeding practices. Although the Food Consumption Score (FCS) improved from 65 percent in 2006 to 74 percent[12] by 2015, reliance on rain-fed farming left many susceptible to climate shocks, impacting food availability and the economy.

4. **The World Bank had been a key partner in supporting the transformation of Rwanda's agricultural sector through investment operations**. Two key projects concluded in 2018 included the: (i) Land Husbandry, Water Harvesting, and Hillside Irrigation Project[13] (LWHP) (P114931), which boosted the productivity and commercialization of hillside agriculture in target areas; and (ii) Third Rural Sector Support Program (RSSP 3),[14] which focused on sustainable intensification and economic diversification, to increase and stabilize rural incomes. The Government of Rwanda (GoR) requested further World Bank support to build on their successes, consolidate results, and address gaps. Consequently, the Sustainable Agricultural Intensification and Food Security Project (SAIP) was designed targeting four nutrition-sensitive value chains: (i) fruits and vegetables for domestic, regional, and international markets; (ii) maize and (iii) Irish potato for domestic and regional markets; and (iv) beans for domestic markets. VC selection criteria included market and growth potential[15]; development impact[16]; and strategic feasibility[17]. Project sites were selected from LWHP and RSSP 3 irrigation schemes and their catchment areas based on food security and nutrition needs; market potential and access; cooperative/groups readiness; and agronomic suitability and potential for productivity.

Theory of Change (Results Chain)

5. SAIP targeted rural households across LWHP and RSSP 3 sites[18], directly benefiting 45,688 farmer households (38,606 under the original funding and 7,082 under the AF). SAIP aimed to improve livelihoods and food security by increasing agricultural productivity, value addition, and market access through three pathways. The *social capital pathway* strengthened farmer organizations (FOs) organized into Self Help Groups (SHG), cooperatives, and Water User Associations (WUAs) to become independent and well-managed institutions able to service their members. *The sustainable production pathway* promoted sustainable intensification strategies for resilient agriculture. The *business and market development pathway* enhanced cooperatives' roles in business and market development, improved post-harvest processes and value addition, and created inclusive market linkages. The PAD did not include a schematic representation of the ToC. The below is implicit from the PAD description.

[10] PAD

[11] many Rwandans lived below the poverty line, limiting their access to nutritious food. High costs of quality food forced families to rely on cheaper, less nutritious options.

[12] PAD. Also see reference on change in FCS methodology measurement in section B.

[13] approved in December 2009 and successfully completed in December 2018.

[14] Part of a three-phase adaptable program loan. RSSP 1 became effective in 2001; RSSP2 in 2008 and RSSP3 in 2012.

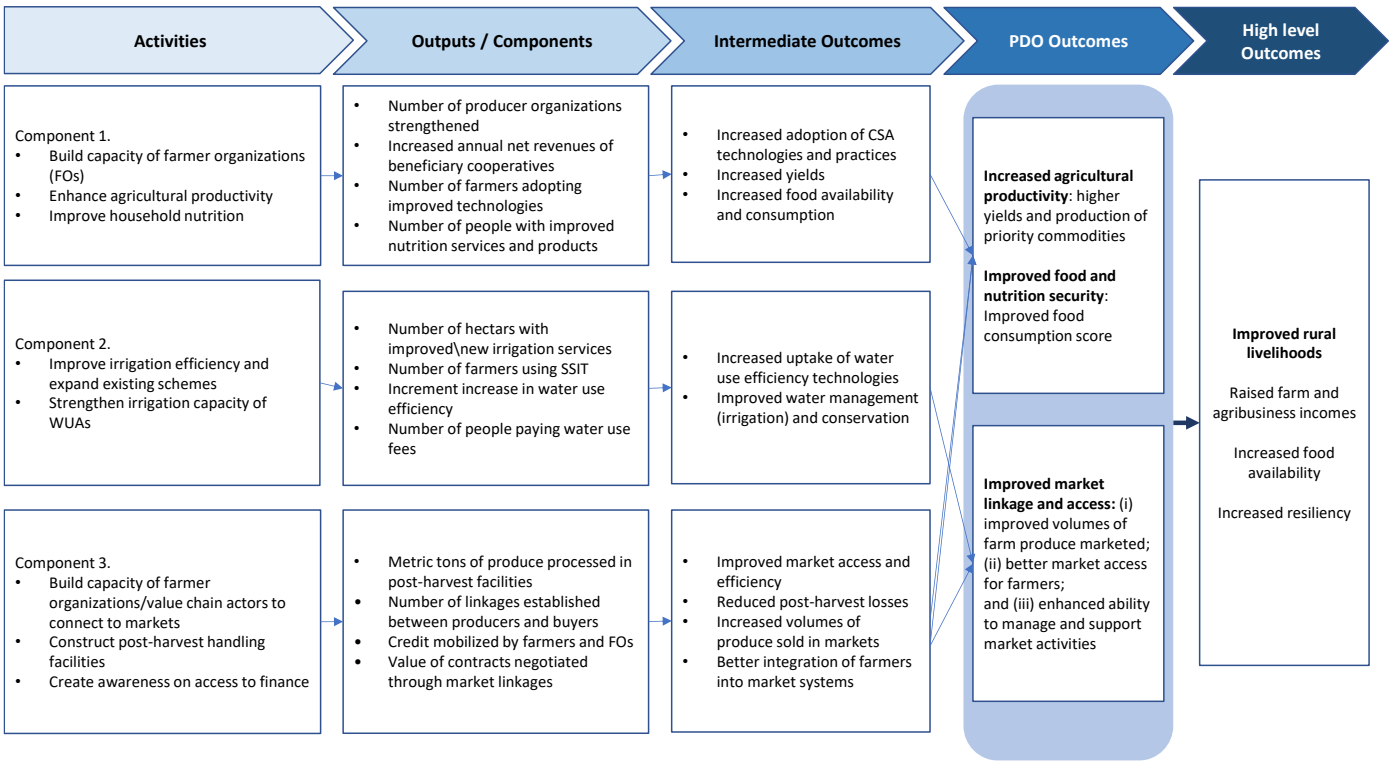
[15] unmet demand, potential for productivity gains, and value addition.

[16] nutrition improvement, opportunities for on- and off-farm employment, and income-generation potential.

[17] national priority crops and potential project impact.

[18] Muyanza, Rwamagana-34, Karongi-12, Karongi-13, Kayonza-4, Nyanza-23, Gatsibo-8, and Nyabihu. These sites are in eight districts (Rulindo, Rwamagana, Karongi, Rutsiro, Kayonza, Nyanza, Gatsibo, and Nyabihu).

Figure 1: Theory of Change



Project Development Objectives (PDOs)

6. The Project Development Objective (PDO) was "*to increase agricultural productivity, market access, and food security of the targeted beneficiaries in the project areas*".

Key Expected Outcomes and Outcome Indicators

7. **Achievement of expected project outcomes was measured by 4 outcome indicators**, namely increases in the: (i) harvested yield of targeted crops (percentage); (ii); produced commodities in targeted value chains marketed

by participating producers (percentage); (iii) Food Consumption Score (number), a composite score proposed by the World Food Program used to measure dietary diversity, food frequency, and nutritional importance of different food groups[19]; and (iv) farmers adopting improved agricultural technology (number).

Components

8. **Component 1. Institutional Strengthening, Agriculture Productivity Enhancement, and Nutrition Improvement (At Appraisal: US$7.68 million; At completion US$9.90 million)** aimed to strengthen farmer organizations for improved agricultural productivity and healthier household nutrition through three sub-components. *Subcomponent 1.1: Strengthening farmer organizations*[20] financed capacity-building[21] with emphasis on building women and youth (14-35 years old) leadership skills, and skills building for public sector extension agents. *Subcomponent 1.2: Agricultural productivity enhancements* funded interventions to increase productivity and profitability of the selected VCs (Technical Assistance [TA] for climate-smart farming as a business [FAB] approach; Farmer Field Schools (FFSs) to promote Good Agricultural Practices[22] [GAPs] with a focus on CSA\NSA practices and technologies, climate-sensitive inputs, and extension services). *Subcomponent 1.3: Improving nutrition outcomes at household level* funded input kits for kitchen and village gardens to increase the availability of affordable, safe, and diverse fruits and vegetables[23], poultry rearing for animal protein; TA for food preservation to enhance year-round access to nutrient-rich foods; nutrition education; and Behavior Change Communication (BCC) through radio programs, and healthy cooking menu/demonstrations.

9. **Component 2. Irrigation and Water Use Efficiency (At appraisal US$7.19 million; at completion US$8.63 million),** aimed to improve irrigation efficiency for higher crop productivity and resilience through two sub-components. *Sub-component 2.1: Improved efficiency and expansion of existing irrigation schemes* [24] provided matching grants and training [25] for farmers [26] to: (a) access Small-Scale Irrigation Technology (SSIT) from the Government's SSIT Development Program[27]; and (b) purchase small-scale irrigation equipment[28]. *Subcomponent 2.2: Strengthening irrigation capacity* trained targeted WUAs in management skills[29] and irrigation water management.

10. **Component 3. Market Linkages and Value Addition Investment Support (At appraisal US$7.30 million; at completion US$8.87 million),** aimed to enhance market linkages and value addition for FOs and other VC actors to connect to domestic, regional and international markets, and improve access to finance through two subcomponents. *Subcomponent 3.1: Capacity building to foster market linkages* funded training in post-harvest handling, quality enhancement, pre-processing[30] and certification[31] to reduce losses\preserve the nutritional value of produce to improve access to markets. It also funded workshops for financial institutions and intermediaries on market\business

[19] calculated based on frequency of consumption of various food groups over 7-days, each assigned a specific weight. Score is summed up to provide a household FCS which classifies households into categories of: Poor (0-21), Borderline (21-35), and Acceptable (above 35).
[20] formed under LWHP and RSSP3
[21] organizational management, business planning, entrepreneurship, job creation, irrigation infrastructure management.
[22] irrigation, organic fertilizer, certified seeds, diversification and crop rotation, integrated pest management, mechanization, soil erosion control, agro-forestry, etc.
[23] including bio-fortified foods such as iron-fortified beans and orange-fleshed sweet potatoes with Vitamin A, mushrooms.
[24] hillside irrigation constructed under the LWHP.
[25] in irrigation equipment handling, maintenance, and business plan development
[26] Focus was on youth and women groups in hillside project sites in existing irrigation schemes
[27] Established by the GoR to develop affordable and sustainable irrigation technologies.
[28] sprinklers, drip, gated-pipes, hose-furrow technologies
[29] planning, organizational management, infrastructure O&M, O&M costing and water pricing, financial planning, accounting, and bookkeeping
[30] cleaning, grading, sorting, and packaging.
[31] Quality Standard Mark (S-Mark) for processed goods, from the Rwanda Standards Board (RSB) and other quality standards

potential and use of Savings and Credit Cooperatives (SACCOs) for agent banking. *Subcomponent 3.2: Investment support to market linkages* provided matching grants for young cooperatives to finance post-harvest, marketing and processing facilities[32] and equipment[33], and capacity building for O&M activities and management of the facilities.

11. **Component 4. Project Management and Technical Assistance (At appraisal US$4.13 million: at completion US$4.89)** had 2 subcomponents. Sub-component 4.1: Project Management funded overall management and coordination; monitoring and evaluation (M&E); communication and knowledge sharing; establishment and operation of a grievance redress system (GRS); and project operating costs at the national and district levels. Sub-component 4.2: Technical Assistance implemented by the Food and Agriculture Organization [FAO], focused on: (a) extension services; (b) nutrition; and (c) implementation of the farmer-led SSIT as a complement to project interventions.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

12. **SAIP underwent two restructurings**. The first restructuring, approved on June 30, 2021, provided US$5,985,295 in Additional Financing to address COVID-19's adverse impacts on the agriculture and food system in project areas. The pandemic disrupted SAIP activities, delaying the SSIT program, halting irrigation maintenance and affecting input access. Horticulture cooperatives, especially women and youth led small agro-businesses faced major income loss. Capacity-building activities and FAO TA were suspended. Consequently, production decreased, postharvest losses increased, food prices rose (e.g., beans by 25 percent), malnutrition increased, and exports fell (e.g., horticulture exports dropped from 2,015 to 688 tons, revenue fell from US$2.1M to US$1.2M[34]).

13. Most AF funds supported scaling up ongoing activities under component 1, with the bulk directed to enhancing agricultural productivity and repairing of damaged irrigation infrastructure under component 2. Additionally, containment measures were implemented at post-harvest facilities[35] to limit virus spread. SAIP expanded to 11[36] sites and 9 districts, targeting 7,082 more households, including 4,786 from the new sites. The project closing date was extended to *August 30, 2024*. End targets for the 4 PDO indicators, and 9 of 13 intermediate indicators were raised. A new intermediate indicator was added to measure the *increase in annual net revenues made by beneficiary cooperatives.* All other key elements remained unchanged.

14. The second restructuring approved on April 19, 2023, extended the parent Trust Fund's closing date (TF-A8221) to August 30, 2024[37], aligning it with the AF Trust Fund (TF-B6154). The Results Framework (RF) was adjusted, revising the PDO level FCS target, and, changing the measurement unit[38] from "percentage" to "number", per the FAO's recommendation made during the Mid-Term Review (MTR). Also, per MTR guidance, a new intermediate indicator, "Increment of Water Use Efficiency" (Percentage), was added to measure improvements in water use efficiency under component 2. Additionally, four intermediate indicator targets achieved early due to the success of the nutrition activities and matching grant funding for businesses, were raised.

[32] drying shelters, drying grounds, collection centers, storage and cold storage facilities

[33] threshers, weighing balances, dryers, solar bubble dryers, moisture meters, hermetic bags, aflatoxin kits, relevant processing equipment

[34] AF Project Paper

[35] Post-harvest facilities were used for production aggregation, trainings, workshops, and meetings, and gathering places for farmers.

[36] New sites were: (i) Rwangingo in the Gatsibo District in the Eastern Province; (ii) Nyabirasi in the Rutsiro District in the Western Province; and (iii) Ngoma 22 in the Ngoma District in the Eastern Province; the new and ninth District.

[37] For administrative purposes only. The parent closing date was inadvertently not updated in the Operations Portal during the AF processing.

[38] to align with the World Food Programme's approach.

Revised PDO and Outcome Targets

15. **The PDO remained unchanged**, but as mentioned earlier, the final targets for four PDO indicators and nine intermediate indicators were increased, either to align with the AF scale-up or because of early achievements.

Revised PDO Indicators

16. The PDO indicators did not change.

Revised Components

17. **Components were not changed but their costs were adjusted under the AF**. Table 1 below shows the original and revised project cost breakdown of the total project funding from GAFSP.

Table 1: SAIP Original and Revised Costs (US$)

Components	Activities	Original Funding (GAFSP contribution) (US$)	Additional GAFSP Funding (US$)	Revised Budget (US$) (Original + Additional)
Component 1: Institutional Strengthening, Agricultural Productivity Enhancement and Nutrition Improvement	1.1 Strengthening farmers organizations	2,010,955	503,158	**2,514,113**
	1.2 Agricultural productivity enhancement	4,509,700	1,487,158	**5,996,858**
	1.3 Improving nutrition outcomes at household level	1,161,200	231,495	**1,392,695**
Component 2: Irrigation and Water Efficiency	2.1 Improvement of efficiency and expansion of existing irrigation schemes	6,283,100	1,390,000	**7,673,100**
	2.2 Strengthening irrigation capacity	902,400	50,000	**952,400**
Component 3: Market Linkages and Value Addition Investment Support	3.1 Capacity building to foster market linkages	2,633,600	615,923	**3,249,523**
	3.2 Investment support to market linkages	4,667,865	952,204	**5,620,069**
Component 4: Project Management and Technical Assistance	4.1 Project management	2,631,180	655,357	**3,286,537**
	4.2 Technical Assistance	1,500,000	100,000	**1,600,000**
TOTAL		**26,300,000**	**5,985,295**	**32,285,295**

Source: AF Project Paper

Other Changes

18. N/A

Rationale for Changes and Their Implication on the Original Theory of Change

19. The above changes did not affect the PDO nor the underlying Theory of Change.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

20. **The relevance of the PDO was rated "High" at appraisal and remained "High" at project closing.** The PDO aligned with the NST1; 2017-2024; NAP 2018-2030; and the PSTA. SAIP contributed to the NST priorities through its focus on CSA, NSA, and market access for smallholder farmers. It aligned with two of the PSTA4 pillars: (a) productivity and commercialization for food security, nutrition, and incomes; and (b) resilience and sustainable intensification. It also aligned with the second theme of the World Bank's Country Partnership Strategy (CPS) (FY2014–2020), *Improving the productivity and incomes of the poor through rural development and social protection*. It contributed to expected outcomes of improved agricultural productivity and sustainability, enhanced access for small farmers to inputs, financing, and markets, as well as strengthened agricultural value chains. It was also aligned with the Rwanda Economic Recovery Plan (RERP), developed in 2021 to address the impacts of COVID-19, global spikes in fertilizer prices, and effects of climate change.

21. The PDO remained consistent with the fourth objective of the World Bank's Country Partnership Framework (CPF) for Rwanda (FY21–26, Report No. 148876-RW), of increased agricultural productivity and commercialization. Its continued relevance led to preparation of the ongoing SAIP II, a continuation of SAIP I which was scaled up in the current sites and scaled out to an additional 11 districts. Based on SAIP I lessons learned, SAIP II introduced capacity building in two new areas, Integrated Nutrient Management, and Food Quality Management.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

22. **The project fully achieved its development objectives**. PDO achievement was assessed[39] based on the degree to which each of the 3 expected outcomes— "increased productivity, market access, and food security of the targeted beneficiaries in the project areas"—were met, as measured by four PDO indicators (see Table 2 and Annex 1 Results Framework). All PDO indicators and all but 1 (number of water users paying fees to WUAs[40]) of the intermediate results indicator targets were met or exceeded.

Table 2: Summary of Key Project Results (PDO Indicators and Targets)

PDO Indicator	Baseline	End Target	Actual	Percentage change relative to initial target
1. Percentage increase in harvested yield of targeted crops	0.00	17.00	21.95	+ **29.11**
2. Percentage increase of produced commodities in targeted value chains marketed by participating producers	0.00	25.00	29.90	+ **19.60**
3. Food Consumption Score (Percentage)	0.00	36.00	42.80	+ **18.89**

[39] Data was extracted from SAIP's M&E system, World Bank's Implementation Status Results Reports, Aide Memoires, progress reports; an impact evaluation report by the World Bank's Development Impact group (DIME); ICRR mission findings; the GoR's Endline Survey, and its ICRR.
[40] 85 percent of the 9,330 target users were reached, as some farmers chose crops that did not need extra irrigation during the rainy season.

4. Farmers adopting improved agricultural technology (CRI, Number)	34,664.00	45,688.00	47,040.00	**+ 2.96**
Farmers adopting improved agricultural technology - Female (CRI, Number)	14,512.00	19,189.00	26,499.00	**+ 38.09**
Farmers adopting improved agricultural technology - male (CRI, Number)	20,152.00	26,499.00	26,604.00	**+ 0.40**

Source: SAIP Results Framework

Objective 1: Increased agricultural productivity

23. **The first PDO outcome was overachieved.** The outcome was measured by PDO indicators 1 and 4: "Percentage yield increase in harvested crops" and "Farmers adopting improved agricultural technology" disaggregated by gender, with both targets surpassed. SAIP achieved a weighted average of 21.95 percent increase in agriculture productivity in the selected VCs, exceeding the target of 17 percent. On average, between 2019 and 2024, staple food productivity increased from 6.53 to 8.26 tonnes/ha; vegetable crop productivity rose from 5.5 to 11.21 tonnes/ha; and fruit crop productivity rose from 10.5 to 19.4 tonnes/ha. All VCs outperformed appraisal expectations. Endline survey data from the Difference of Differences analysis showed higher productivity gains in project areas compared to non-project areas. The achievement, led by the SAIP team and service providers, including the FAO and Rwanda Youth in Agribusiness Forum[41], among others, is attributed to multiple factors. Institutional strengthening of FOs emphasized entrepreneurship. The matching grants facility[42] enabled farmers to invest in production, postharvest handling, and processing assets as part of viable and profitable business plans. Training on GAPs[43], extension services, use of yield-boosting agro-inputs and CSA practices/technologies enhanced farmer capacity. Improved irrigation infrastructure and water management practices contributed to crop yield increases. 3,068 ha were irrigated through new or improved irrigation or drainage exceeding the 2,900-ha target. Additionally, the farming as a business approach was highly instrumental in farmers adopting a commercial mindset towards agriculture and transitioning from subsistence to higher-value crop production with consistent demand in local and international markets. SAIP helped 19 beneficiary cooperatives transition into commercial producer organizations with 6 engaged in seed production and 14 authorized as agro-dealers within the Government's subsidized scheme, supplying subsidized seeds and fertilizers primarily to their members. Increased productivity led to a rise in cooperative incomes netting an annual increase in revenues of 69.50 percent from the anticipated 60 percent.

24. **A total of 47,040 farmers adopted improved agricultural technology[44] exceeding the target of 45,688**. Among them, 20,436 were female farmers, exceeding the target of 19,189. Success was driven by FAO TA-supported FFS, exchange visits, and training of 4,682 lead farmers[45]of whom 1,995 were women, in the adoption of CSA and NSA practices and technologies, and productivity-enhancing inputs (high-yielding and disease-resistant seed varieties, organic manure, compost, and inorganic fertilizers like DAP, NPK, and urea), crop rotation, and IPM. The matching grants facility also boosted uptake of other innovative technologies, including greenhouse farming[46], mechanization,

[41] 45 young graduates (including 18 cooperative officers, 10 horticulturists, 7 water users' association technicians and 10 nutritionists)

[42] The facility had a budget of US$12,770,000 and financed 50 to 90 percent of eligible asset costs with beneficiaries contributing the rest with personal funds\credit. Grants covered 90 percent for cooperatives/groups for primary production, postharvest, and processing investments, 85 percent for individual farmers' production, 75 percent for value addition, 80 percent for off-takers primary production, 70 percent for value addition and processing equipment, 75 percent for solar irrigation investments, and 50 percent for diesel systems. When including running costs and fixed expenses, grants could drop to 50 percent. The maximum grant was US$100,000.

[43] Per the endline survey, 76 percent of targeted farmers were trained on proper planting, 68 percent on fertilizer application, 63 percent on compost making and 55 percent on Integrated Pest Management.

[44] Per the PAD, the indicator was measured by evaluating if at least one GAP transferred during TA was adopted by the farmer

[45] representing SHGs

[46] Main crops grown were tomatoes, sweet pepper, sweet melons and cucumber

SSIT, water use efficient technologies, and production of Irish potato seedlings through greenhouses (implemented by three beneficiaries). The construction of six demonstration greenhouses in different sites spurred high demand for this technology leading beneficiary farmers to construct 179 greenhouses with support from the matching grant scheme. Grants also enabled 2,451 farmers (of which 1,094 women) to invest in SSIT on 1,367 hectares (previously rain-fed) enabling year-round crop production, and water use efficient technologies in existing irrigation schemes on 1,701 hectares, improving water use efficiency from 60 to 75 percent.[47] Additionally, 36 beneficiaries invested in mechanization equipment, including those investing in provision of rental services, which expanded ploughed land from 0 to 446 hectares (was still increasing at project closing).

Objective 2: Increased market access for the targeted beneficiaries in the project areas

25. **PDO outcome 2, measured by the "percentage increase of produced commodities in targeted value chains marketed by participating producers" was overachieved.** SAIP exceeded the target, achieving a 29.9% increase in produce marketed by participating FOs, surpassing the 25 percent target. 26,987 metric tons of produce, exceeding the 23,088 target by 113.1 percent, were processed and marketed through SAIP-supported infrastructures. This achievement was due to the increased production of higher-value horticultural crops, training, and matching grants facility. 3,110 farmers from the 19 supported cooperatives were trained in business planning[48], marketing principles, postharvest handling and storage, savings, and credit, which significantly enhanced the commercialization capacity of their cooperatives and groups. The matching grants facility financed over 235 subprojects, including 46 investments in postharvest handling and storage (17 projects)[49] and value addition and processing (29 projects)[50], reducing postharvest losses and increasing produce quality. Capacity building and TA enabled beneficiaries to meet quality certification standards[51], facilitating access to premium domestic (RwandAir catering services, 5-star hotels, and restaurants), and global markets. Marketing interventions allowed cooperatives to aggregate produce and secure supply agreements with off-takers or sell directly to local markets, increasing revenue and reinvestment into agricultural inputs. Market linkages secured 53 contracts worth over US$2 million for domestic markets, while the main export crops—chili and French beans—generated approximately US$1 million as of May 2024, with sales to the Middle East, China, India, France, the UK, and other countries. Beneficiary cooperatives mobilized US$483,358 in credit for produce aggregation and agro-dealership businesses. Although significant success was achieved in penetrating high-value markets, a balance was maintained to ensure the domestic market had access to nutritious products and to promote local consumption of home-grown produce.

***Objective 3: Increased food security of targeted smallholder farmers*.**

26. **Outcome 3 measured by an "Increased Food Consumption Score" (FCS) was exceeded.** The average FCS increased from the baseline of 29.1 to 42.80, surpassing the target score of 36, indicating a positive impact on household level food and nutrition security in the targeted project areas. Achieving this outcome was made possible by the combined efforts to both increase the availability of nutritious food and raise incomes to enhance access to such food. Project interventions supported consumption of healthy and diversified foods, especially for the more vulnerable community members (pregnant and lactating women and children under 5 years old in extremely poor

[47] Out of 1,367 hectares with SSIT, 400 hectares were irrigated with solar-powered pumps (diesel pumps were used in remaining areas). Water-use efficient irrigation technologies were gravity fed in all schemes, and did not need additional pumping. Technologies adopted by most farmers were hose pipes (1,261 hectares), systems (46 hectares), gated pipes (23 hectares), and sprinklers (26 hectares).
[48] Through FAO TA, beneficiary farmers were introduced to *RuralInvest* to facilitate the development of bankable and sustainable business plans.
[49] Mainly warehouse & storage facilities for maize, beans and Irish potato, drying sheds for maize\chili, cold storage facilities for horticulture produce, produce collection/aggregation centers, transport vehicles including cold trucks.
[50] Mainly for fruit juices, vegetable and chili pack houses (sorting, cleaning and packaging), and facilities for maize flour, avocado oil, chili oil, wine, fruit juices, animal feeds, etc.
[51] Including Global GAP, HACCP, and S-Mark

households). SAIP trained 20,313 beneficiaries (50.1 percent men and 49.9 percent women) on nutrition\reduction of malnutrition, appropriate food preparation, and consumption. It collaborated with existing Community Health Workers to deliver nutrition BCC, promoting good nutrition and sanitation practices. FAO TA for capacity building together with district technicians supported farmers in managing nutritious animal and plant food production for consumption. SAIP established village-based nutrition centers in project sites, 425 model Kitchens, conducted healthy cooking demonstrations, and provided vegetable seeds (mushrooms tubers[52], bio-fortified beans[53] and sweet potatoes[54]), leading to beneficiaries creating 15,814 personal kitchen gardens. To increase animal protein consumption, SAIP supported backyard poultry farming and other small livestock. The most poor and vulnerable received a support package of four female Sasso breed chickens, a chicken cage, and 41 kilograms of feed, sufficient for up to three months of feeding needs. SAIP distributed 38,564 chickens, 9,641 chicken cages and 399,081kg of chicken feed to 9,641 households, producing an estimated 1.4 million eggs which were mostly consumed by beneficiaries. Surplus eggs were sold in local markets for additional income. Some farmers saw this as a business opportunity, investing in larger chicken houses and increasing their flock sizes. Globally, almost 242,000 people (of which 140,420 women exceeding the target of 96,600) received improved nutrition services and products, exceeding the target of 230,000[55].

Justification of Overall Efficacy Rating

27. **Overall Efficacy is rated "High."** The project overachieved its PDO outcomes and its four PDO indicators. It met all but one of its intermediate indicators, and the gender targets (see summary Table 2, Annex 1: Results Framework, and Annex 2: Key Outputs by Component).

C. EFFICIENCY

Assessment of Efficiency and Rating *(High)*

Economic and Financial Analysis

28. The Economic and Financial Analysis (EFA) at appraisal predicted strong financial and economic profitability with an economic rate of return of 17 percent. The analysis considered three benefit categories: (i) on-site private benefits within the project area from direct income increase, avoidance of yield or income loss without project, food security, risk reduction, increased employment, and securing long-term income opportunities; (ii) downstream public benefits in the form of externalities; and (iii) global public benefits in the form of carbon sequestration. The ex-post analysis, which adapted to changes in project costs and crop numbers used six farm models to capture project benefits from rainfed cereal farming, particularly maize to more commercialized crops such as climbing beans, potatoes, fruit, and vegetable production. The ex-post analysis did not factor in benefits from associated livestock production or from composting. On this basis, the economic internal rate of return (EIRR) at closing was calculated at 53 percent, and the net present value (NPV) at US$142 million, over a 20-year period. These results are attributed to the sharp increase in crop productivity, mainly in vegetables and fruit, compared to the ex-ante scenario. Farmers switched to higher value-added crops, increasing the harvested area for vegetables and fruit while reducing it for Irish potatoes.

29. **The EX-ACT tool confirmed SAIP's strong environmental impact, exceeding expectations**. Initially projected to cut 522,549 tCO2e over 20 years, SAIP is now estimated to mitigate 790,500 tCO2e over 20 years, mainly through

[52] 85,541 mushroom tubers were distributed to 8,515 targeted households, 51 mushroom growing houses\tents were constructed.
[53] 30,305 kg of Iron fortified beans were distributed to 6,536 households and cultivated on 736.125 ha.
[54] 6,715,000 sweet potato cuttings were distributed to 7,818 households and cultivated on 163 ha.
[55] 200,000 under the original project and 30,000 under the AF.

improved cropping systems as measured by the CO2 emissions reductions. Environmental benefits as a percentage of total benefits are 2.3, 11.9, and 21.3 percent for market, low and high shadow prices, respectively. The EIRR rises to 59.3 percent, 76.6 percent, and 125.1 percent, respectively, increasing the NPV from US$142 million without environmental benefits to US$154 million, US$171 million, and US$192 million.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

30. **The overall outcome is rated "Highly Satisfactory."** The project's relevance remains "high," and its efficacy and efficiency are "high." The end-line survey findings substantiate the project results and provide evidence of attribution to the project interventions.

E. OTHER OUTCOMES AND IMPACTS

Gender

31. **Promoting gender and youth inclusion was explicitly embedded in the project**. Interventions were tailored to empower women's and youth's leadership and management skills. SAIP exceeded 3 of its 4 gender targets. Of the 47,040 farmers who adopted improved agriculture technology, 20,436 were women which exceeded the target of 19,189. 140,420 women versus 96,600 received improved nutrition services and products. 1,094 female farmers versus the target of 1,008 benefitted from SSIT interventions. One gender disaggregated target was not met: 3,121 women water users paid water fees to WUAs versus the target of 3,904. SAIP also targeted youth[56]. The Rwanda Youth in Agribusiness Forum was a key service provider for the NSA activities under Component 1. 603 youth beneficiaries (478 male and 125 females) were trained in O&M of irrigation infrastructures and water management. Youth were also specifically targeted under the matching grants program to invest in start-ups and service deliveries, such as high-value greenhouse farming and mobile mechanization services.

Institutional Strengthening

32. **SAIP's extensive capacity building initiatives embedded in all four project components, strengthened institutions, aiding its success**. Component 1 focused on targeted institutional strengthening of community level institutions involved in agriculture (farmer cooperatives, SHGs), and public sector extension agents, training local extension experts (youth and women) identified by farmer groups to provide fee-based extension services where public sector extension agents were non-existent. Under Component 2, WUAs were strengthened to collect water service fees and maintain irrigation infrastructure. These efforts improved the finances of community organizations, enabling better services to their members, and input investments, and infrastructure development. Some improved product marketing for their members.

Mobilizing Private Sector Financing

33. **SAIP was designed to promote private sector engagement across the agriculture value chain** (input supply, output purchase, transportation, processing), a lesson incorporated from the LWHP and RSSP 3 which collectively acknowledged the key role of commercial\private partners in transforming the sector. A key activity in this regard was the matching grants program, under which beneficiaries co-financed on and off-farm investments up to 50 percent, including up to 50 percent in cash contributions at an estimated US$4.3 million. While access to finance for small holder

[56] However, the RF did not include any youth related targets.

farmers remains a significant challenge, at project closure, FOs had secured US$483,358 in credits and signed the 53 contracts with private sector off-takers worth over US$2 million thanks to SAIP interventions.

Poverty Reduction and Shared Prosperity

34. SAIP did not directly measure the impact on poverty. Nevertheless, its strategic focus on enhancing the livelihoods of smallholder farmers—by boosting productivity, profitability, market access, and incomes—directly aimed to reduce poverty, food insecurity and improve nutrition, particularly for vulnerable communities. Matching Grant supported businesses including in SSIT generated 487 full time jobs with 213 filled by women, and over 1557 part-time jobs with 810 held by women. The shift towards commercial farming[57], including high-value staple and horticulture crops in demand both domestically and internationally, helped increase earnings. Female farmers, who represent a significant portion of the rural poor, especially benefited from this shift. Additionally, SAIP targeted what at the time were poverty categories[58] 1 and 2, providing support to pregnant or breastfeeding women and households with children under five through its nutrition initiatives and SHGs.

Other Unintended Outcomes and Impacts

35. **The NSA activities evolved into income generating activities for many of the poorest beneficiaries**. Mushroom growers reported an excess supply of up to 100 percent compared to household consumption, which they sold allowing reinvestment into production expansion. Similarly, poultry kit recipients reported increasing egg production with more chickens for marketing purposes inspiring other community members to invest in chicken rearing. The commercialization of agricultural inputs (agro-dealership) created another important income stream. In addition, the location of agro-dealers and provision of fertilizer close to farming sites reduced the need for long-distance travel. The additional income provided a steady source of funds for payment of cooperative's staff salaries and expenses for stock rent, electricity, and taxes, among others. Finally, SAIP had important impacts on jobs: (a) the on-farm investments in protected agriculture/greenhouses and SSIT reportedly generated more fulltime jobs than previous agricultural production methods, although in some cases also led to less demand for seasonal labor; and (b) investments in new technology such as solar technology and SSIT led to a demand for new, relatively high-skilled service jobs to maintain and repair this technology.

III. KEY FACTORS AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

36. **Several factors influenced project preparation.** The GoR's commitment and ownership of the project was strong, thereby positively impacting both preparation and implementation. The project design aligned with the national strategies and sector policies centered on transforming the agriculture sector, including enhancing food and nutrition security as detailed in the NST1; 2017-2024; NAP 2018-2030; and PSTA 4. As a sequel to the successful RSSP 3 and LWHP, the SAIP design maintained the agriculture transformational approach of promoting entrepreneurship, smallholder farmers' competitiveness, and demand-driven partnerships with private-sector off-takers. It rightfully focused on consolidating and scaling up their achievements, improving household nutritional outcomes and food security,

[57] The endline survey report indicates on average, the share of commercialization among SAIP participating farmers increased from 81.3% to 87.6% between season C 2023 and season A 2024.

[58] The categories were part of the Ubudehe program, a community-based initiative aimed at identifying and supporting the poorest households. The categories range from Category 1 (poorest) to Category 4 (wealthiest).

addressing the identified gaps and areas of unmet potential in irrigation sustainability and market access for farmers and incorporated lessons learned.

B. KEY FACTORS DURING IMPLEMENTATION

37. **An existing well established institutional and implementation infrastructure, including a technically qualified and experienced SPIU team facilitated project implementation**. Overall, project implementation was completed satisfactorily, with 100 percent funds disbursed before closing. Implementation arrangements were adhered to. While the COVID-19 related mobility restrictions temporarily impacted implementation, in particular field site monitoring, close virtual interaction and coordination between the World Bank and SPIU teams helped put implementation back on track allowing timely closing of the project by the planned date.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

38. **SAIP leveraged an existing robust M&E framework and system inherited from LWHP and RSSP 3 which was integrated into MINAGRI's Management Information System**. This eliminated a redesign of M&E. The design complied with the GAFSP/World Bank Group requirements and included core indicators, along with specific indicators for food security, nutrition, gender, and civic engagement. The RF was coherent, with measurable indicators aligned with the activities, and clear responsibilities for tracking outcomes attributable to the project.

M&E Implementation

39. **Overall, the M&E framework was effectively implemented** with clear units of measurement, baselines, targets, and defined roles for data management. There was no change to the data collection and validation system which relied on several collection methods and onsite validation using sample plots. initially, aligning the decentralization of data collection at the district level with data consolidation, quality control, analysis, and reporting at the SPIU national level proved to be challenging. In general, the bi-annual progress reports were comprehensive, with an updated RF and were shared with World Bank support missions in a timely manner. As previously mentioned, changes were made to the RF (addition of new indicators and adjustments of targets under the 2 restructurings) as agreed between the World Bank and GoR.

M&E Utilization

40. **Readily available M&E data during World Bank implementation support missions, facilitated progress monitoring** to ensure the project remained on track and proactive resolution of implementation challenges. Annual monitoring reports provided data for preparation of the annual work plans and budget. M&E data was used for the end-of-project assessment of project performance and achievement of its objectives.

Justification of Overall Rating of Quality of M&E

41. **The overall M&E equality is rated "Substantial."** The M&E system as designed and implemented was sufficient for monitoring and assessing project achievements and confirming the results chain. However, the initial phase encountered moderate shortcomings stemming from challenges in triangulating data collection and consolidation.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

42. The due diligence for environmental and social safeguards, and fiduciary compliance was in line with World Bank policies and procedures.

43. **Environmental and Social Safeguards Compliance and Performance**. SAIP, classified as Environmental Category B with a "moderate" risk rating, was prepared and implemented under the Operations Policies (OPs) and Business Procedures (BPs). It triggered OP/BP 4.01 (Environmental Assessment), OP/BP 4.04 (Natural Habitats), OP/BP 4.09 (Pest Management), OP/BP 4.11 (Physical Cultural Resources), OP/BP 4.12 (Involuntary Resettlement), OP/BP 4.37 (Safety of Dams), and OP/BP 7.50 (Projects on International Waters). Appropriate mitigation instruments were prepared, approved, and disclosed[59]: (a) Environmental and Social Management Framework (ESMF); (b) Integrated Pest Management Plan (IPMP); (c) Resettlement Policy Framework (RPF) and (d) Request for a notification exception in accordance with the requirements of OP/BP 7.50[60]. The Project did not transition to the new Environmental and Social Framework but incorporated some of its elements, such as stakeholder engagement, enhanced labor conditions, and improved occupational health and safety measures. Environmental and Social Impact Assessments for SSIT beneficiaries followed ESMF guidelines, and land acquisition for construction of water points adhered to RPF protocols. A Grievance Redress Mechanism, adapted from LWHP and RSSP 3 effectively resolved 118 grievances mainly related to land issues, preventing escalation to the World Bank's GRs. Community engagement ensured inclusion of vulnerable groups. An Environmental, Social, Health, and Safety compliance audit conducted prior to closing found no significant issues and provided recommendations for the follow-on SAIP 2. An Abbreviated Resettlement Action Plan compensated 89 Project Affected People for crops and land.

44. **Overall E&S compliance was good, with performance at project closure rated "Satisfactory" in the final ISR.** Staffing and reporting challenges often raised in AMs and progress reports gradually improved over time with support from the World Bank's environmental and social specialists.

Fiduciary Compliance

45. **Financial Management (FM) was adequate and had an overall residual risk rating of "Moderate."** Overall performance was "satisfactory" throughout implementation. The project was adequately staffed with experienced finance personnel and supported by internal audit reviews. The World Bank provided financial management support when needed. FM issues raised during implementation support missions were resolved. Timely and acceptable quarterly Interim Financial Reports were submitted. Annual audits were conducted by the Office of the Auditor General to ensure compliance with applicable laws, regulations and guidelines regulating public spending, and realization of value for money in utilization of funds. At project closure, 100 percent of the grant funds had been disbursed to the GoR. There are UN advances of US$1,405,629 and US$100,000 which require follow up for documentation. The amount unspent on the UN advances amounting to US$38,331 needs to be refunded to the Bank.

46. **Procurement management and performance overall was good**, with the performance rating fluctuating between "moderately satisfactory" and "satisfactory," an indication of good procurement implementation. No key issues were flagged during project implementation, and there were no reported cases of fraud and corruption. Intermittent delays in updating STEP data and providing data on undisbursed expenditures were flagged by the World Bank and addressed by the SPIU.

[59] In country disclosure: (a) ESMF June 8, 2018; (b) IPMP May 29, 2018; and (c) RPF May 21, 2018.

[60] The Regional Vice President approved the exception to the riparian notification requirement OP7.50 on May 23, 2018.

C. BANK PERFORMANCE

Quality at Entry

47. **The quality at entry is rated "Satisfactory."** The project design was well aligned with key national agriculture strategies as previously outlined. It incorporated lessons learned from the preceding successful LWHP and RSSP 3. Technical, E&S, and fiduciary assessments were thorough with strong viability demonstrated in the EFA. Implementation arrangements were robust, leveraging the expertise of the well-established Single Project Implementation Unit (SPIU) under the Rwanda Agriculture and Animal Resources Board (RAB)[61] which had managed the RSSP 3 and LWHP. Gender considerations were integrated reflecting Rwanda's commitment to gender equality in agriculture. The Risk assessment was thorough and candid and proposed the required mitigation measures.

Quality of Supervision

48. **Overall, the quality of supervision was "Satisfactory."** Implementation support was consistent and proactive, averaging two missions per year supplemented by continuous interactions with the World Bank's Kigali office for quick real-time issue resolution. Virtual interactions during the COVID-19 mobility restrictions helped minimize delays. Aide-memoires were candid, with clear identification of key issues and time bound actionable plans. The project support team's skills mix aligned with project needs and when needed was complemented by consultants. Overall, the skills mix of the multi-discipline mission teams comprising technical, fiduciary, safeguards, operational and administrative expertise aligned with project needs and when needed was complemented by consultants or additional TA. Project adjustments were made at MTR. Additional TA was expeditiously provided when necessary.

Justification of Overall Rating of Bank Performance

49. **The World Bank performance is rated "Satisfactory"** based on the robustness of the project design and its alignment with GoR and World Bank priorities, appropriate incorporation of lessons learned, and effective implementation support.

D. RISK TO DEVELOPMENT OUTCOME

50. **The risk that the achieved development outcomes will not be maintained is rated "moderate."** The project delivered very solid results, transforming beneficiaries' lives and improving their food and nutrition security status. With high food demand, commercial food production is critical and expected to continue growing. The FAB approach has benefited farmers beyond direct SAIP participants, which will further help the ongoing agriculture transformation agenda. Trained Trainers-of-Trainers from SHGs are expected to continue providing services. Based on the positive revenues from the investments under the matching grants programs and in the SHGs, project beneficiaries are expected to continue to use their acquired skills. Additionally, beneficiary contributions into the matching grants scheme have fostered stronger ownership of agricultural activities. This sense of ownership encourages farmers to invest more diligently in their farms, enhancing both productivity and sustainability. The synergy of reinvestment and ownership creates a strong foundation for longevity. There is continued government commitment, ownership and focus on scaling up the agriculture transformation agenda as demonstrated by the ongoing follow-on SAIP II project and the Commercialization and De-risking for Agricultural Transformation Project. While the impacts of climate change, especially on rainfed agriculture remain high, implemented CSA practices and technologies are expected to help farmers continue

[61] a non-commercial public institution under MINAGRI, with administrative and financial autonomy, focused on developing agriculture and animal resources through research and extension to boost agricultural and animal productivity.

to adapt to the risks. Continued access to CSA sensitive inputs will be key. However, there are some risks including among others fluctuating prices for agricultural inputs, energy costs, supply shocks, and adverse climate events which could impact at some level the project outcomes. Furthermore, the success of established institutions and infrastructure depends on sustained financial viability. Without continuous funding, the operational sustainability, capacity building, and market linkages of WUAs, SHGs, and cooperatives, as well as the maintenance and expansion of irrigation schemes and agricultural infrastructure could face risks.

V. LESSONS AND RECOMMENDATIONS

51. **Focused mobilization of organized farmer groups**. SAIP strongly demonstrated that smallholder farmer organizations with strong leadership, capacity, strong market arrangements with agribusinesses; off-takers and processors, had better access to inputs and extension services, increased use of irrigation and greenhouse farming. This helped increase productivity levels, value addition options, and farmers revenues. Organized farmer groups were key for maintaining cohesion and building collective responsibility. These groups also facilitated more effective technology dissemination to host communities compared to demonstrations by individual farmers. The widespread adoption of group-based learning and production facilitated collective action in the uptake and enhancement of agricultural practices and irrigation technologies, and subsequent sharing of the broader benefits with surrounding communities. In addition, these groups bring collective bargaining power in negotiations with private-sector off-takers.

52. **Farming as a Business**. This approach was a key contributor to the monumental shift in thinking of smallholder producers. Capacity building initiatives and extension services accompanied by FFS activities with a focus on strategies for transforming agriculture into a profitable and sustainable business had a crucial impact. They guided farmers towards the selection of high demand staple crops thereby facilitating the transition from subsistence to market-led farming. The grants financing also required business plans showing profitability of investments. In this regard, the SSIT investments seem, to a greater extent, have been geared towards business-oriented farmers for the purpose high-value agriculture compared with the Government run SSIT program, even though the subsidies under the two programs are the same.

53. **Market linkages and access to finance.** The success of SAIP in linking smallholder farmers to markets exposed farmers to increased competition and demonstrated the need for well-structured contract farming to provide leverage. Stronger market linkages facilitated better access to inputs and private sector led extension services, and thereby contributed to increased productivity and revenues. However, overall access to financing for smallholder farmers is still challenging. While matching grants were an important start-up funding source, they alone will not transform subsistence agriculture towards market-oriented farming practices. Access to commercial loans may be a way to ensure continuation of these and similar farmers on the path of a higher level of transformation.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS FRAMEWORK

PDO Indicators by Outcomes

Not Categorized								
Indicator Name	Baseline		Closing Period (Original)		Closing Period (Current)		Actual Achieved at Completion	
	Result	Month/Year	Result	Month/Year	Result	Month/Year	Result	Month/Year
Percentage increase in harvested yield of targeted crops (Percentage)	0.00	Jul/2018			17.00	Aug/2024		
Percentage increase of produced commodities in targeted value chains marketed by participating producers (Percentage)					25.00	Aug/2024	25.60	Aug/2024
Food Consumption Score (Number)	29.00	Jul/2018						
	Comments on achieving targets		Next update will be calculated at MTR.					
Farmers adopting improved agricultural technology (Number)					45,688.00	Aug/2024	47,040	Aug/2024
	Comments on achieving targets		Technical assistance will introduce good agricultural practices adjusted to each situation. These are, among other, the use of organic fertilizer, certified seeds, diversification and shifting cultivation and will be identified during project implementation. The indicator evaluates if at least one good agricultural practice transferred during technical assistance is being adopted by the farmer. Municipal staff using their site visits will evaluate use of agricultural practices or improved agricultural technology. One year after the completion of the first systems, an independent evaluation will confirm monitoring results of the municipal staff. If needed, an additional independent evaluation will be realized during mid-term review.						
Farmers adopting improved agricultural technology - Female (Number)	14,512.00				19,189.00		20,436.00	
Farmers adopting improved agricultural technology - male (Number)					26,499.00		26,604.00	

Intermediate Indicators by Components

Not Categorized								
Indicator Name	Baseline		Closing Period (Original)		Closing Period (Current)		Actual Achieved at Completion	
	Result	Month/Year	Result	Month/Year	Result	Month/Year	Result	Month/Year
Number of producer-based organizations supported by GAFSP (GAFSP core 4) (Number)					2,397.00	Aug/2024		
Number of people receiving improved nutrition services and products (GAFSP core 11) (Number)					230,000.00	Aug/2024	241,694	Aug/2024
Number receiving improved nutrition services and products -Female (Number)	0.00	Jul/2018			96,600.00	Aug/2024		
Farmers reached with agricultural assets or services (Number)	0.00	Jul/2018			45,688.00	Aug/2024		
Farmers reached with agricultural assets or services - Female (Number)					19,189.00		20,436	
Increase in annual net revenues made by beneficiary cooperatives (Percentage)					60.00	Aug/2024	69.50	Aug/2024
Area provided with new/improved irrigation or drainage services (Hectare(Ha))	0.00	Jul/2018			2,900.00	Aug/2024	3,068	Aug/2024
	Comments on achieving targets		This indicator measures the total area of land provided with irrigation and drainage services under the project, including in (i) the area provided with new irrigation and drainage services, and (ii) the area provided with improved irrigation and drainage services, expressed in hectare (ha).					
Area provided with new irrigation or drainage services (Hectare(Ha))	0.00	Jul/2018			1,200.00	Aug/2024		
	Comments on achieving targets		Measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank.					
	0.00	Jul/2018			1,700.00	Aug/2024		

Area provided with improved irrigation or drainage services (Hectare(Ha))	Comments on achieving targets		Measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank.					
Number of farmers benefiting from the project supported small-scale irrigation interventions (Number)	0.00	Jul/2018					2,451	Aug/2024
Number of farmers beneffiting from the project supported small-scale irrigation technologies - Female (Number)	0.00	Jul/2018					1,094	Aug/2024
Number of users paying water fees to the water users associations (Number)	914.00	Jul/2018			9,330.00	Aug/2024	7,942	Aug/2024
Number of users paying water fees to the water users associations - Female (Number)	383.00	Jul/2018			3,904.00	Aug/2024		
Increment of Water Use Efficiency (Percentage)	60.00	Jul/2018			75.00	Aug/2024		
Volume of agricultural production processed by post harvest facilities established with project support - GAFSP core 9 (Metric ton)							26,987.20	Aug/2024
Number of farmers organization - buyer linkages established (Number)	0.00	Jul/2018			52.00	Aug/2024		
Value of contracts/agreements negotiated through linkages established (Amount(USD))	0.00						2,015,674	
Amount of credit mobilized by farmers and farmers organization (Amount(USD))	0.00	Jul/2018			450,000.00	Aug/2024	483,358	May/2024

Number of knowledge products produced by the project (Number)	0.00	Jul/2018			20.00	Aug/2024	38.00	Aug/2024
Percentage of beneficiaries satisfied with the services provided by the project (Percentage)	0.00	Jul/2018			100.00	Aug/2024	91.50	Aug/2024

B. KEY OUTPUTS

Increase agricultural productivity, market access and food security of targeted beneficiaries	
PDO Indicators	2. Percentage increase in harvested yield of targeted crops 3. Percentage increase of produced commodities in targeted value chains marketed by participating producers 4. Food Consumption Score 5. Farmers adopting improved agricultural technology
Key Outputs (linked to the achievement of the PDO Outcome)	1. 21.95 percent increase in harvested yield of targeted crops 2. 29.9 percent increase in produced commodities in targeted value chains marketed by participating producers 3. 42.8 percent increase in the Food Consumption Score 4. 47,040 farmers adopted improved agricultural technology (of which 20,436)
Component 4: Project Management and Technical Assistance	
Intermediate Results Indicators	20. Number of knowledge products produced by the project 21. Percentage of beneficiaries satisfied with the services provided by the project
Key Outputs (linked to the achievement of the Component)	1. 38 knowledge products (technical manuals, guidelines, and training material on the new technologies and practices) were produced by the project 2. 83.7 percent of beneficiaries were satisfied with the services provided by the project
Component 3: Market Linkages and Value Addition Investment Support	
Intermediate Results Indicators	16. Volume of agricultural production processed by post harvest facilities established with project support -GAFSP core 9 17. Number of farmers organization - buyer linkages established 19. Amount of credit mobilized by farmers and farmers organization

Key Outputs (linked to the achievement of the Component)	1. 26,987.2 tons of agricultural production were processed by post harvest facilities established with project support 2. 53 farmers organization - buyer linkages were established worth a total value of US$2,015,674. 3. US$483,358 in credits was mobilized by farmers and farmers organization
Component 2: Irrigation and water use efficiency	
Intermediate Results Indicators	8. Area provided with new/improved irrigation or drainage services 11. Number of farmers benefiting from the project supported small-scale irrigation interventions 13. Number of users paying water fees to the water users associations 15. Increment of Water Use Efficiency
Key Outputs (linked to the achievement of the Component)	1. 3,068 ha provided with new/improved irrigation or drainage services 2. 2,451 farmers benefitted from project supported small-scale irrigation interventions (of which 1,094 women) 3.7,942 water users paid water fees to the water users associations 4. increment of 75 percent water use efficiency, up from 60 percent
Component 1: Institutional Strengthening, Agriculture Productivity Enhancement and Nutrition Improvement	
Intermediate Results Indicators	2. Number of producer-based organizations supported by GAFSP (GAFSP core 4) 3. Number of people receiving improved nutrition services and products (GAFSP core 11) 5. Farmers reached with agricultural assets or services 7. Increase in annual net revenues made by beneficiary cooperatives
Key Outputs (linked to the achievement of the Component)	1. 2,397 Producer-based organizations supported by GAFSP 2. 45,688 farmers received agricultural assets or services (of which 19,189 women) 3. 230,000 people received improved nutrition services and products (of which 96,900 women)

	4. 60 percent iincrease in annual net revenues made by beneficiary cooperatives

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Esdras Byiringiro	Team Leader
Åsa Giertz	Team Leader
Jacqueline Bugunya	Financial Management Specialist
Meron Tadesse Techane	Financial Management Specialist
Sreenivas Devarakonda	Procurement Specialist
Yacob Wondimkun Endaylalu	Environmental Specialist
Janet Umugwaneza	Environmental Specialist
Chantal Umulinga K	Social Specialist
Fiona Mbabazi	Social Specialist
Chantal Umuhoza	Social Specialist
Willy Niyonteze	Procurement Team
Dimitrie Mukanyiligira Sissi	Procurement Team
Emma Isinika Modamba	Team Member
Irene Bomani	Team Member
Aicha Sanou	Team Member
Belinda Mutesi	Team Member
Hayalsew Yilma	Team Member
Bodomalala Sehenoarisoa Rabarijohn	Team Member
Alexandra Clare Sanderson	Team Member

B. STAFF TIME & COST

Stage of Project Cycle	Staff Time & Cost	
	No. of Staff Weeks	US$ (including travel and consultant costs)
Preparation		
FY18	38.143	240,424.12

FY19	6.900	36,213.70
FY20	4.625	13,181.63
FY21	9.400	139,285.05
FY22	9.500	58,585.64
FY23	5.000	13,012.00
Total	73.57	500,702.14
Supervision/ICR		
FY19	11.300	59,180.76
FY20	47.913	119,115.69
FY21	71.911	309,237.59
FY22	53.950	471,555.83
FY23	77.349	502,555.13
FY24	61.625	487,054.19
FY25	0.000	30,653.86
Total	324.05	1,979,353.05

ANNEX 3. PROJECT COST BY COMPONENT

Component	Amount at Approval (US$M)	Actual at Project Closing (US$M)
Component 1: Institutional Strengthening, Agriculture Productivity Enhancement and Nutrition Improvement	9.9	9.90

Component 2: Irrigation and water use efficiency	8.6	8.55
Component 3: Market Linkages and Value Addition Investment Support	8.9	8.89
Component 4: Project Management and Technical Assistance	4.9	4.88

ANNEX 4. EFFICIENCY ANALYSIS

Economic and Financial analysis

1. This annex presents the ex-post economic and financial analysis for the Sustainable Agricultural Intensification and Food Security Project (SAIP). The analysis here highlights the benefits associated with investing along value-chains. The Economic and Financial Analysis (EFA) also benefits from previous ex-ante project analysis of agriculture projects in Africa and follows the World Bank guidelines. This analysis will help in understanding the effectiveness and efficiency of the project, drawing important lessons for future initiatives.

2. The World Bank approach to the EFA seeks to address three questions. First, what is the project's development impact? This is an underlying question to cost-benefit analysis, which considers expected stream of project benefits and costs, and establishes an explicit causal framework linking project activities to targeted outcomes. Second, is public sector provision or financing the appropriate vehicle? It probes the rationale for public financing and/or implementation, and explicitly considers alternative modes of financing, such as cascade. Third, what is the World Bank's value added? It examines the World Bank's contribution to the project outcomes, and seeks to determine the benefit from its involvement, or whether the proposed project maximizes the development impact.

Methodology

3. When assessing the benefits of investments, a causal link between upstream and downstream activities is made along the value-chain. In this sense, the value-chain represents the ultimate conduit for directing investments within a food systems approach, from input suppliers, farmers and producer organizations to post-harvest handlers and agribusiness processors. To capture the benefits of transformational change by the project interventions, crop and farm budgets and micro-processor/enterprise models are used to aggregate data up to the project level, using an input-output model for comparison against a base scenario - without project intervention. The net incremental benefits are used to calculate the viability of the project using indicators such as the internal rate of return (IRR), benefit-cost ratio (B/C) and net present value (NPV). The timeframe used in the financial analysis is 20 years, with a discount rate of 12 percent, which reflects an average commercial lending rate. The economic analysis evaluates the project's benefits and costs to the national economy over a period of 20 years with a social discount rate of 6 percent. The economic analysis aggregates the incremental benefits of the selected crop models.

4. **Data Collection and Sources**. This Efficiency Analysis is based on a broad range of qualitative and quantitative data sources. The main sources of information were: (i) the SAIP Project Appraisal Document (PAD, September 14, 2018); and (ii) impact stories and knowledge products published by the Project. Additional information was collected during field missions and provided by the Project management team.

5. **A cash flow model is used to assess the ex-post efficiency of Project investments.** As in the PAD, annual cash flows are estimated as the difference between without-project (WOP) and with-project (WP) net benefits for direct beneficiaries. Crop models were developed for the priority value chains, with assumptions on yields, output and input prices, capital investments, operational inputs, and labor amounts. The WP models account for the adoption of Technologies, Innovations, and Management Practices, which included improved crop, improved seeds and other inputs, and access to extension services. These are compared to the WOP scenarios of traditional farming practices.

Financial analysis

6. The commodities and cross-cutting thematic areas supported include maize, potato, climbing beans, tomato, onion, tree tomato, passion fruit, chilli (bird-eye), French beans, mango, papaya and avocado. On the basis of crop models, each with a without and with-project scenario, six farm models were considered as for the ex-ante analysis: (i) model 1 for maize and climbing beans; (ii) model 2 for potato and climbing beans; (iii) model 3 for domestic vegetables; (iv)

model 4 for domestic fruits; (v) model 5 for export vegetables; (vi) model 6 for export fruits. The farm and micro-processing models intend to capture: (i) improved household income; (ii) increased asset accumulation; (iii) adoption of climate-resilient agricultural production and livestock practices; and (iv) increased market linkage for value-added produce in national and regional markets. In addition, a model was developed for the processing of maize.

7. Regarding the financial analysis, the NPVs of the net incremental benefits per hectare range from US$907 for climbing beans to US$120,488 for Watermelon. Benefit-cost ratios range from 2.08 for climbing beans to 17.81 for watermelon. The financial performance indicators show that the performed activities are commercially viable. Compared with ex ante results, all crops saw their NPVs increase, except for chilli (hot pepper), papaya and avocado. These results could be attributed to the sharp increase in crop productivity against the ex-ante scenario. For example, staple food productivity increased from 6.53 in 2019 to 8.26 tonnes/ha on average in 2024; vegetable crop productivity rose from 5.5 in 2019 to 11.21 tonnes/ha on average in 2024; fruit crop productivity rose from 10.5 in 2019 to 19.4 tonnes/ha on average in 2024. Specific increases in yield were observed for tomato tree, tomato and Irish potatoes. The results observed for chilli (hot pepper), papaya and avocado could be due to the lack of productivity data mainly in the first years of the project (for example, once sown, it takes 4 to 6 years for the avocado to start producing fruit).

TABLE 1: SUMMARY OF THE FINANCIAL ANALYSIS OF THE CROP MODELS

Crop	NPV @ 12% discount (ex-ante)	NPV @ 12% discount (ex-post)	Benefits/Costs (ex-ante)	Benefits/Costs (ex-post)
Maize	616	4,296	1.89	2.54
Climbing bean	815	907	2.06	2.08
Potato	7,688	9,283	2.96	3.08
Tomato	12,419	35,042	2.44	4.31
Onion	11,288	59,561	5.32	10.75
Watermelon	11,873	120,488	2.78	17.81
Chili BE	19,158	82,971	3.28	6.68
French bean	14,741	29,100	1.96	2.88
Sweet pepper	7,883	7,883	4.12	4.12
Chili hot pepper	10,881	6,745	2.88	2.65
Papaya	15,436	2,318	3.82	2.72
Tree tomato	11,774	118,723	3.04	7.23
Avocado	16,071	1,704	4.62	3.08
Passion fruit	21,818	25,409	3.11	3.27
Mango		25,265		6.94

Economic analysis

8. The project generates economic and nutritional benefits from investments in development pathways related to social capital, sustainable production, and business & market development. These investments generate development outcomes, including sustainable and strengthened farmers' organizations and rural institutions that are necessary for value chain development, sustainable and more resilient production systems with improved agricultural productivity, and diet diversity and quality, better functioning integrated value chains with cooperatives and unions, and enhanced value chains among farmers with improved access to national and regional markets, reduced post-harvest losses that lead to job creation and income generation. Quantification of these economic benefits is based on benefits accruing from investments along the value chain of the agricultural commodities and cross-cutting thematic area that are supported by the project, using farm and enterprise or micro-processing models.

9. The economic analysis uses economic investment and recurrent costs of US$32.2 million from year 1 to 7, and recurrent costs of US$508,000 per annum (2 percent of initial investment cost per annum) from year 6 to year 20. The resulting economic net present value (NPV) is about US$142 million, the economic internal rate of return (EIRR) is 53 percent, and the Benefit-Cost Ratio (BCR) is 5.94. These results are higher to the ex-ante NPV (23.2 million) and EIRR (17 percent). This comparison between the **expected outcomes** with **actual results** highlights that the project was financially viable and economically beneficial.

TABLE 2: SUMMARY OF ECONOMIC ANALYSIS (BASE CASE SCENARIO)

Indicators	Results, excl. Carbon mitigation
ERR	53%
ENPV (million US$, @6%, 20-year)	142.08
ENPV benefits (million US$, @6%, 20-year)	170.83
ENPV costs (million US$, @6%, 20-year)	28.754
BCR	5.94
Switching value for benefits	-83.0%
Switching value for costs	494%

Sensitivity analysis

10. The World Bank guidance recommends as good practice to undertake a sensitivity analysis of the social discount rate. The table below presents the discount rate sensitivity, for 12 percent, 6 percent (base case ex-post EFA), 5 percent (ex-ante EFA scenario), 3 percent, and 2 percent. As expected, the ENPV remains very solid under the different scenarios.

TABLE 3: SENSITIVITY ANALYSIS OF SOCILA DISCOUNT RATE

Discount Rate (Percent)	ENPV (US$, million)
12	71.02
6	142.08
5	160.42
3	206.69
2	235.52

11. Results of the economic analysis were also tested for sensitivity to variations in benefits and various lags in the realization of benefits. Individually taken, all scenarios show robust results under all hypothetical situations.

TABLE 4: SENSITIVITY ANALYSIS OF PROJECT BENEFITS

Scenario	ERR (percent)	ENPV (US$, million)
Base case @6 percent	53	142.08
2percent social discount rate	53	235.52
12percent social disc. Rate	53	71.02
costs +10 percent	46.7	138.51
costs +20 percent	41.5	136.10
costs +30 percent	37.1	133.23

benefits +10 percent	60	158.9
benefits +20 percent	67	175.9
benefits -10 percent	46	124.8
benefits -20 percent	39	107.7
benefits -30 percent	32.3	90.6
benefits delayed 1 year	31.7	125.4
benefits delayed 2 years	21.8	109.8

12. **Environmental benefits.** Using the World Bank's Guidance note on shadow price of carbon in economic analysis (2022), the social value of these environmental benefits has been also included in the overall economic results, using the low and high estimate range for the social price of carbon.

13. The carbon balance is defined as the net balance across all GHGs expressed in CO2 equivalents (CO2e) that will be emitted or sequestered due to the Project (WP), as compared to a business-as-usual scenario (WOP). The carbon balance was calculated by using EX-ACT, a tool developed by the FAO, to quantify the volume GHGs mitigated by the Project. EX-ACT is a land-based accounting system, estimating CO2e stock changes (i.e., emissions or sinks of CO2) expressed in equivalent tons of CO2 per hectare and year. A 20-year period is being considered.

14. The quantification of the GHG mitigation allowed estimating its economic value, which was included in the economic analysis. The monetary value of the GHG balance has been estimated and considered as economic benefit of the Project in the EFA. The World Bank's Guidance Note on Shadow Price of Carbon in Economic Analysis (September 2021) recommends "projects' economic analysis use a low and high estimate for carbon pricing. The social cost of carbon attempts to capture the marginal global damage (cost) of an additional unit of CO2e emitted. The recent draft Guidance Note on Shadow Price of Carbon in Economic Analysis (September 2017) recommends "projects' economic analysis use a low and high estimate of the carbon price starting at US$40 and 80, respectively, in 2020 and increasing to US$50 and 100 by 2030". Marginal abatement costs are designed to reflect the carbon price necessary to achieve various climate change targets. Carbon market prices are the market value of CO2e emission reductions or sequestration (offsets) that are registered and sold through various market structures.

15. On average, the positive impact on GHG is -39525 tCO2 eq. per annum. Following the World Bank guidelines, this analysis presents three scenarios: using the low and high range social cost of carbon and at market prices. Carbon market prices currently average US$8 per ton, resulting in a value of US$316,200 per annum.

16. This range results in an NPV of US$171 million and US$192 million and an EIRR of 76.6 percent and 192.2 percent, respectively when using the low and high carbon price.

TABLE 5: SCENARIOS FOR VALUATION OF ENVIRONMENTAL BENEFITS

Indicators	**Results excl. Carbon mitigation**	**Results incl. carbon mitigation, valued @ low carbon price estimate range**	**Results incl. carbon mitigation, valued @ high carbon price estimate range**
ERR	53%	76.6%	125.1%
ENPV (million US$, @6%, 20 years)	142.08	171.8	192.2
ENPV benefits (million US$, @6%)	170.83	201.56	221.98
ENPV costs (million US$, @6%)	28.754	28.754	28.754
BCR	5.94	7.01	7.72
Switching value benefits	-83.0%	-86.00%	-87%

Switching value costs	494%	601.0%	672%

ANNEX 5. EX-POST GREENHOUSE GAS ACCOUNTING ANALYSIS

1. **Motivation.** The GHG emissions of this project have been estimated ex-ante, in line with the corporate requirement on GHG accounting. Following the project's closing, the actual project emissions have been estimated and are reported below.

2. **GHG accounting methodology.** The World Bank adopted EX-ACT, developed by the FAO in 2010[62] to estimate the impact of agricultural investment lending on the GHG emission and carbon sequestration in the project area. EX-ACT allows the assessment of a project's net carbon balance. The carbon balance is defined as the net balance across all GHGs expressed in CO2 equivalents (CO2e) that will be emitted or sequestered due to project implementation (WP), as compared to a business-as-usual scenario (WOP). EX-ACT is a land-based accounting system, estimating CO2e stock changes (i.e., emissions or sinks of CO2) expressed in equivalent tons of CO2 per hectare and year. The tool was designed using mostly data from the Intergovernmental Panel on Climate Change (IPPCC) Guidelines for National Greenhouse Gas Inventories (NGGI-IPCC, 2006), which furnishes EX-ACT with recognized default values for emission factors and carbon values in soils and biomass (the so-called "Tier 1 level" of precision). For the present analysis, Ex-ACT version 9.4.2 was used.

3. **Inputs to the GHG calculations**. The inputs used to calculate the project's net GHG emissions were obtained from the Rwanda Agriculture Board and are based on the project results as of project closing date. The GHG calculation is based on the following: (a) incremental production from productivity increases in the targeted value chains (maize, Irish potato, climbing beans, vegetables and fruits), with a shift from traditional cultivation to improved agronomic practices, as well as from low added-value to high added value crops; (b) additional fuel consumption due to marketing and transport of the additional production; (c) increased use of fertilizer and agro-chemicals. The assumptions for the GHG calculation are summarized in the table below. The data inputs are as follows:

Activities	Without Project Scenario	With Project Scenario	Actual as of Project Closing
Productivity increases	11,580 ha under traditional cultivation thereof: Maize 5,834 ha Irish potato 3,883 ha Climbing beans 1,294 ha Vegetables and fruits 579 ha	11,580 ha under improved agronomic practices: Maize 6,131 ha Irish potato 1,942 ha Climbing beans 1,886 ha Vegetables and fruits 1,665 ha	10717 Ha + 1,367 ha =12,084 ha under improved agronomic practices, Maize: 5988 Ha; Climbing beans: 1901 Ha Irish potato: 1060.5 Ha Vegetables and fruits: 3,134.26 ha.
Irrigation (vegetable and fruit production, drip, and sprinklers).		1500 ha of irrigation, using improved irrigation techniques was considered.	1767.26 Ha.
Transportation of crops.		Additional annual production: 60000 T Additional fuel consumption: 110 m3 per annum	Additional annual production: 26,987 T (these quantities are only sales that went through postharvest facilities) Additional fuel consumption: 49.4 m^3 per annum

[62] http://www.fao.org/tc/exact/ex-act-home/en/.

Post-harvest processing and other uses along the value chain.		The energy consumption for transport was doubled to consider energy need for processing, cold rooms, and other uses (total 110 m3 of diesel).	The energy consumption for transport was not doubled to consider energy need for processing, cold rooms, and other uses because the cold rooms are hybrid and cannot be in use full time due to seasonality.
Consumption of fertilizer and agro-chemicals (insecticides, herbicides).		Additional use (kg/annum): Urea:147,500 kg DAP: 558,200 kg NPK: 399,100 kg Insecticides/pesticides: 7,959 kg	 Urea: 239,520 Kg; DAP: 631,120 Kg; NPK: 387.339 Kg and Insecticides/pesticides: 7505.5 Kg

Results show that the project has overperformed. The ex-ante calculation determined that the project would generate emission reductions of 522,549 tCO2 eq over 20 years. The post-project assessment determined that the project would mitigate 790,499 tCO2e over 20 years. Most of these emission reductions result from the improved cropping systems.

ANNEX 6. BORROWER COMMENTS

The borrower shared a few editorial comments which were reflected in the final ICR.