



1. Project Data

Project ID P144531	Project Name Climate Smart Staple Crop Production		
Country China	Practice Area(Lead) Agriculture and Food		
L/C/TF Number(s) TF-17649	Closing Date (Original) 31-Mar-2020	Total Project Cost (USD) 5,081,082.64	
Bank Approval Date 29-Aug-2014	Closing Date (Actual) 30-Sep-2020		
	IBRD/IDA (USD)	Grants (USD)	
Original Commitment	5,100,000.00	5,100,000.00	
Revised Commitment	5,081,082.64	5,081,082.64	
Actual	5,081,082.64	5,081,082.64	
Prepared by Chikako Miwa	Reviewed by Vibecke Dixon	ICR Review Coordinator Christopher David Nelson	Group IEGSD (Unit 4)

2. Project Objectives and Components

a. Objectives

The project's Project Development Objective (PDO) and its Global Environmental Objective (GEO) was to demonstrate climate smart and sustainable staple crop production in Huaiyuan County of Anhui Province and Yexian County of Henan Province (PAD, para 6). The formulation of the PDO in the Grant Agreement (Schedule 1, page 5) was identical to that in the PAD.



b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Will a split evaluation be undertaken?

No

d. Components

Component 1. Climate Smart Agriculture (CSA) Demonstration (Estimate: US\$ 23.96million with GEF funding at US\$ 3.96 million and government financing US\$ 20.00 million; Actual: US\$ 27.02 million with GEF funding at US\$ 3.96 million and government financing US\$ 23.06 million) intended to (a) **demonstrate greenhouse gas (GHG) emission reduction and efficient irrigation techniques**, including: (i) demonstrating high fertilizer use efficiency by providing advice on dose, formulation, and placement of fertilizers in soil; (ii) promoting high-efficiency sprayers and professional pest management services; and (iii) promoting irrigation practices that improve water and energy savings in rice and wheat and lower GHG emission in rice production; (b) **demonstrate carbon sequestration techniques**, covering: (i) retention of crop residues, focused on rice straw management in Huaiyuan and improved stalk shredding with large machinery in Yexian; and (ii) tree planting around project area croplands to increase soil organic carbon and integrate trees into cropping systems; (c) **implementing new production technique pilots**, including: (i) applications of new inputs, biochar produced from wheat straw and corn straw as soil amendment on a small scale in Huaiyuan and Yexian, respectively; (ii) application of new fertilizers and methane inhibitors for rice production in Huaiyuan; and (iii) improved retention of corn stalks and no-till wheat planting techniques in Yexian; (d) **technical support for CSA demonstration**, including: (i) supporting a national expert group; (ii) providing technical services and training; and (iii) establishing and operating farmer field schools; and (e) **monitoring and evaluation (M&E)**, covering: (i) CSA M&E; (ii) social impact monitoring; (iii) environmental safeguard monitoring; and (iv) management of project data and information based on a geographic information system. This component financed project subsidies to the project farmers and the competitively selected service providers for adopting the fertilizer reduction technologies and the mechanized straw returning to field and conservation tillage carbon sequestration technology.

Component 2. Policy Development and Knowledge Management (Estimate: US\$ 3.90 million with GEF funding at US\$ 0.90 million and government financing US\$ 3.00 million; Actual: US\$ 4.21 million with GEF funding at US\$ 0.9 million and government financing US\$ 3.31 million) intended to support the following. (a) **Development of National CSA Policies, Strategies and Guidelines**, covering: (i) providing policy advice on the national CSA policy and strategy; (ii) integrating CSA concepts into the food security strategy; (iii) two CSA guidelines for staple crop production; and (iv) a methodology for quantifying GHG mitigation associated with the implementing CSA technologies and practices in staple crop production in China. (b) **Provincial and National Dissemination of Project Knowledge**, covering: development of a project website, dissemination of project newsletters and promotional materials, provincial-level knowledge sharing with farmers and extension service technicians from non-project townships surrounding the project areas, and national-level knowledge dissemination through the network of the Ministry of Agriculture and Rural Affairs (MARA). (c) **Promotion of International CSA Cooperation**, covering: a support to MARA participation in related international CSA and GEF climate mitigation events.

Component 3. Project Management (Estimate: US\$ 2.24 million with GEF funding at US\$ 0.24 million and government financing US\$ 2.00 million; Actual: US\$2.26 million with GEF funding at US\$ 0.24 million and government financing US\$ 2.02 million) supported project implementing agencies to manage, supervise and monitor project implementation.



e. **Comments on Project Cost, Financing, Borrower Contribution, and Dates**

Project Cost: At appraisal, the project was estimated to cost US\$30.10 million (PAD, para 12). At project closing, the actual cost was US\$33,481,083 (ICR, page 2).

Financing: At appraisal, the project was planned to be financed by US\$5.10 million grant from the Global Environment Facility (GEF) and US\$25.00 million from the Government (PAD, para 12). At project closing, the project was financed by US\$5,081,083 grant from the GEF and US\$28.40 million from the Government (ICR, page 2).

Dates: The project was approved on August 29, 2014, and became effective on December 1, 2014. The Mid-Term Review was completed on May 28, 2018. The project was closed on September 30, 2020, which was six months after the original closing date of March 31, 2020.

Restructuring: The project had a restructuring in April 2019 to extend the project duration and to reallocate funds between disbursement categories.

3. Relevance of Objectives

Rationale

Country and Sector Context. China's agriculture sector was supporting 22% of the world's population with only 9% of the world's arable land at appraisal (PAD, para 2). To achieve food security, China developed intensive crop production systems that rely on high consumption and inefficient use of fertilizers, pesticides, and irrigation water inputs, which resulted in significant greenhouse gas (GHG) emissions. Heavy reliance on synthetic fertilizers also stressed its limited arable land. This situation was aggravated by unsustainable crop production practices which often included excessive tillage, straw burning, and low rates of organic residue return to soil, monocropping or limited crop rotation, and flood irrigation. These practices not only led to the high GHG emissions from crop production but also reduced resilience of the country's crop production systems to the expected climate change. The two project counties, Huaiyuan and Yexian, were selected from the country's main staple crop production region. Three main staple crops were raised under two major crop production systems: the rice-wheat system in Huaiyuan and the wheat-corn system in Yexian. During the project preparation, the baseline investigation in the target areas confirmed that the baseline GHG emissions were from nitrous oxide (N₂O) emissions from fertilization, methane and N₂O emissions from rice paddy, N₂O and methane releases from burning of crop residues, and carbon dioxide (CO₂) emissions from crop production related fuel combustion (PAD, page 15). According to official reports, the number of households living below the national poverty line (extreme poverty) in 2013 were 994 in Huaiyuan project villages and 1,485 in Yexian project villages (PAD, page 14).

Relevance to Government Strategies. At appraisal, the project objective was well aligned with China's national priorities as articulated in the 12th Five-Year Plan (FYP) for National Economic and Social Development (2011-2015), in specific, the 12th FYP's target to raise the efficient use co-efficient of water used in agricultural irrigation to 0.53 (PAD, page 37). The project design also directly contributed to implementing China's Nationally Determined Contribution under the Paris Agreement. China strived to



integrate climate smart development actions into its green growth strategy. In doing so, the Government developed the National Program on Climate Change (2007), the White Paper on China's Policies and Actions for Addressing Climate Change (2011), and the Work Plan for Greenhouse Gas Emissions Control during the Period of the 12th FYP for National Economic and Social Development (2011). Consistent with these frameworks, the Government's Action Program on Climate Change for Agriculture (2008) emphasized sustainable crop production systems to enhance crop yields and farmers' incomes while reducing GHG emissions, and promoting resilience to climate change induced variability in crop production systems. At project closing, the project objective was in line with the 13th FYP (2016-2020). In addition, throughout the project duration from 2014 to 2020, the project objective was aligned with the emphasis of agriculture in a series of "No. 1 Central Document," which was the first policy document jointly released every year by the Central Committee of the Communist Party of China and the State Council for the most important policy theme.

Relevance to Bank Assistance Strategies. At appraisal, the project objective was in line with the Country Partnership Strategy FY2013-2016, in specific, Strategic Theme 1: Supporting Greener Growth and Outcome 1.4: Promoting sustainable agriculture practices. At project closing, the project objective was aligned with the Country Partnership Framework FY2020-2025, in specific, Objective 2.3: Demonstrating Sustainable Agriculture Practices and Improving Food System Quality and Safety. The CPF (page 49) noted that the current WBG support recognizes the need to address food safety and agriproduct quality, environmental sustainability, and climate change in an integrated and complementary way.

Prior Sector Experience. The Bank supported China's program to pilot low GHG emission and soil carbon sequestration technology, such as precision fertilization and crop residue retention in the field. The Ministry of Agriculture and Rural Affairs (MARA, Ministry of Agriculture before the government re-organization in 2018) identified a number of factors limiting the uptake of climate smart crop production technologies: (a) limited public support to the screening and assessment of agricultural technologies; (b) inadequate demonstration on the ground; (c) limited awareness of farmers and local governments; (d) lack of policy incentives; and (e) low capacity of extension services to disseminate advisories to farmers (PAD, para 4). To address these challenges and promote continuous identification and adoption of context-specific climate smart crop production technologies, MARA requested the Bank's support to prepare and implement this project financed by the Global Environment Facility. This project was implemented in parallel to the IBRD-financed Integrated Modern Agriculture Development Project (P125496, US\$200 million, 2013-2020), which aimed to develop sustainable and climate resilient agricultural production systems in selected areas of Gansu, Hunan, Jiangxi, and Liaoning provinces; Xinjiang Uygur Autonomous region; and Chongqing municipality.

The PDO was appropriately pitched for addressing development challenges to utilize climate smart crop production technologies. The five limitation factors that were identified prior to the project were adequately addressed by project activities, as described in Section 4 below.

Rating

High

4. Achievement of Objectives (Efficacy)



OBJECTIVE 1

Objective

To demonstrate climate smart and sustainable staple crop production in Huaiyuan County of Anhui Province and Yexian County of Henan Province

Rationale

Theory of Change (TOC): The project aimed to address the following development challenges limiting the uptake of climate smart crop production technologies: (a) limited public support to the screening and assessment of agricultural technologies; (b) inadequate demonstration on the ground; (c) limited awareness of farmers and local governments; (d) lack of policy incentives; and (e) low capacity of extension services to disseminate advisories to farmers, as described in Section 3. The project objective's TOC envisioned that project activities such as promoting appropriate dose, formulation, and placement of fertilizers in soil, promoting high-efficiency sprayers and professional pest management services, promoting efficient irrigation practices in rice production, and testing application of new fertilizers and methane inhibitors for rice production would result in outputs such as adoptions of GHG emission reduction and efficient irrigation practices in crop production areas, reductions in inputs of fertilizers, pesticides, and water, increases in average net staple crop production income. In addition, the TOC envisioned that project activities such as retention of crop residues, tree planting around project area croplands, testing no-till wheat planting techniques, and piloting biochar production from wheat straw and corn straw as soil amendment would result in outputs such as adoptions of carbon sequestration practices in crop production areas. Moreover, the TOC envisioned that project activities such as supporting development of national CSA policies, strategy, and guidelines, disseminating project knowledge at provincial and national level, promoting international CSA cooperation, supporting a national expert group, and establishing farmer field schools would result in outputs such as developments of a series of policy documents and operationalizations of farmer field schools. The outputs on demonstration of GHG emission reduction and efficient irrigation techniques would result in outcomes such as reduced GHG emissions and increased average crop yields. The outputs on demonstration of carbon sequestration techniques would result in outcomes such as increased carbon sequestration. The outputs on policy development and project knowledge dissemination would result in outcomes such as scaled up mitigation actions in China's staple crop production through CSA technologies and practices. *Critical assumptions* included that there would be uptake by farmers and continued government support to achieve the outcomes. In the long-term, the outcomes were envisioned to contribute to the achievements of the sustainable agricultural development to ensure food security, the Nationally Determined Contribution target by 2030, and the carbon neutrality before 2060.

Outputs:

- 6,700 hectares (ha) of crop production areas adopted project promoted practices, surpassing the target of 4,000 ha (167% of the original target). The target was overachieved because the project area was enlarged by an increase in the actual counterpart financing, which exceeded the approved budget by 14% (ICR, para 52).
- Reduction in fertilizer inputs was 572 tons, exceeding the target of 500 tons.
- Reduction in pesticide inputs was 121 kg, exceeding the target of 100 kg.
- Reduction in water inputs was 1,450,000 m³, exceeding the target of 1,000,000 m³.
- Areas serviced by professional service providers with new CSA techniques were 3,350 ha, exceeding the target of 3,000 ha.



- 30 farmer field schools were under proper operation, meeting the target of 30 farmer field schools.
- Increase in average net staple crop production income was 14.2%, exceeding the target of 12%. The farmers' net incomes were calculated by subtracting expenses from revenues. The achievement of the target of the Intermediate Results indicator showed that the target farmers' productivity increased as envisioned.
- Clients who adopted an improved agricultural technology promoted by the project were 28,474 clients, exceeding the target of 25,000 clients. Female clients who adopted an improved agricultural technology promoted by the project were 12,050 female clients, meeting the target of 12,000 female clients.
- 5 policy documents were developed, meeting the target of 5 policy documents. Specifically, the project conducted the studies for policy advice and developed technical guidelines and methodology as follows: (a) a study on national CSA policy and strategy (including the financial subsidy policy for farmers) to examine how existing agricultural policies could be adjusted and optimized to support CSA adoption and knowledge dissemination; (b) a study to examine how to integrate CSA concept into China's food security strategy; (c) two CSA technical guidelines for the wheat-corn production system and the wheat-rice production system; (d) a baseline and monitoring methodology for quantification of GHG mitigation associated with implementing CSA technologies and practices in staple crop production. The two CSA technical guidelines and the GHG mitigation quantification methodology associated with CSA implementation were scheduled to be approved by the MARA by the end of 2021 for nationwide adoption. In the next few years, the project's contribution was expected to be observable in more CSA policies and plans (ICR, para 57). Client days of training provided (person*day) were 25,016 client days, meeting the target of 25,000 client days. On the other hand, client days of training provided to female (person*day) were 11,050 female client days, not meeting the target of 14,000 female client days.

In addition to the outputs in the Results Framework, the ICR reported on the following achieved outputs. None of them had formal targets.

- Project knowledge was disseminated at national and provincial levels. In the two project provinces, dissemination activities were organized to educate farmers and extension service technicians from non-project townships surrounding the project areas. Good practices generated by the project were disseminated nationally through the MARA network.
- An international forum that was jointly organized by MARA and the World Bank in September 2020, in order to promote international CSA cooperation.

Outcomes:

- Reduced GHG emission (CO₂ equivalent) was 29,782 metric tons, exceeding the target of 21,000 metric tons. Higher cumulative GHG emissions reductions were achieved in Anhui since methane (CH₄) emissions declined due to improved water management (financed by the government counterpart funding in the rice fields) and decreased nitrous oxide (N₂O) emissions predominantly through improved use of inputs in wheat production. In Yexian, net GHG emissions reductions were achieved by decreasing N₂O emissions through improved use of inputs in wheat production.
- Increase in carbon sequestration (CO₂ equivalent) was 99,565 metric tons, achieving more than twice of the target of 44,000 metric tons. The achievement was mainly due to the higher than expected crop residue retention combined with improved soil water content and soil structure (ICR, page 27).



- Increase in average crop yield was 8.02%, meeting the target of 8%. Crop productivity was monitored through surveys of project farm households through the change in average crop yield. The sampling approach and procedures to measure the actual achievement followed those in the baseline survey. The achievement of this PDO outcome indicator's target showed that adopting the CSA technologies supported by the project led to the increase in average crop yields.

Referring to the TOC above, the achievements of the PDO outcomes showed that reducing the GHG emissions and increasing the carbon sequestration would be achieved while increasing the crop yields when the CSA technologies were adopted to staple crop production. The project addressed the development challenges limiting the uptake of climate smart crop production technologies, that were: (a) limited public support to the screening and assessment of agricultural technologies; (b) inadequate demonstration on the ground; (c) limited awareness of farmers and local governments; (d) lack of policy incentives; and (e) low capacity of extension services to disseminate advisories to famers. In a few years after the project closing, more evidence was expected to be available regarding to what extent the studies developed under this project were actually reflected in the national policies to enhance the GHG mitigation actions. Overall, the achievement of objective is rated substantial.

Rating

Substantial

OVERALL EFFICACY

Rationale

All the PDO outcomes were achieved by achieving the Intermediate Results as intended. The overall efficacy thus is rated substantial.

Overall Efficacy Rating

Substantial

5. Efficiency

Economic Analysis: At appraisal, the Economic Internal Rate of Return (EIRR) of the project was estimated at 19% with the carbon shadow price of US\$6/ton and the economic discount rate of 12% (PAD, para 18). At project closing, the EIRR for Yexian County was estimated at a low of 31% (carbon shadow price at US\$ 40/ton) and high of 35% (carbon shadow price at US\$ 80/ton with annual growth rate at 2.25 percent) respectively, and for Huaiyuan County, a low of 44 percent and high of 45 percent (ICR, para 47). The assumptions for the EIRR calculation at project closing included: the project life of 20 years; the social discount rate at 12 percent; and no adjustment between financial and economic prices per recent Bank project analysis. The EIRRs at project closing were noticeably higher than that at appraisal due to the increase in the carbon shadow prices as per the World Bank's guidance note from US\$6/ton at appraisal to US\$40/ton for a low case scenario and US\$80/ton for



a high case scenario at project closing. When the carbon shadow price of US\$6/ton was used, the EIRR of the whole project at project closing was 18%, which was comparable to the EIRR at appraisal.

Regarding methodologies, both ex-ante and ex-post EIRRs were calculated by using cost-benefit analysis and comparing “with” and “without” situations. The incremental economic costs included: (a) investment for adopting new technologies; (b) operational costs for agricultural production; and (c) project management and capacity-building costs. The major benefits included in the analysis were: (a) improved agricultural production; (b) savings from reduced agricultural input costs, including fertilizer, agrochemicals, diesel, and irrigation water; and (c) environmental benefits from GHG emissions reduction.

Financial Analysis: At appraisal, without subsidies, the financial internal rate of returns (FIRRs) of the pest management and irrigation infrastructure activities were estimated to be above the discount rate of 12% (PAD, para 19). With the proposed project subsidies, the fertilization investments were estimated to generate FIRRs far above the discount rate. Even with the subsidies, the conservation agriculture investments were not able to generate a FIRR above the discount rate because such investments would lead to positive externality such as carbon sequestration that could not be internalized by project farmers. At project closing, without subsidies, the financial internal rate of returns (FIRRs) of the pest management and irrigation infrastructure activities were above the discount rate of 12% (ICR, para 49). With the project subsidies, the FIRRs of the fertilization and conservation agriculture activities were above the discount rate (Ibid).

Regarding methodologies, both ex-ante and ex-post FIRRs were calculated by comparing “with” and “without” situations of various project interventions. The incremental project costs and benefits were calculated based on the expected and actual changes in (a) crop yields; (b) agricultural inputs; and (c) investment costs.

In sum, the ex-post EIRR was comparable to the ex-ante EIRR and the ex-post FIRRs were above the discount rate. Overall, the efficiency is rated substantial.

Efficiency Rating

Substantial

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	19.00	100.00 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	18.00	100.00 <input type="checkbox"/> Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome



Relevance is high as the objective was in line with the government and Bank assistance strategies and the prior sector experience. Efficacy is substantial as the PDO outcomes were achieved as intended. Efficiency is substantial, considering the ex-post EIRR and FIRR. Overall, the project's outcome is rated satisfactory.

a. Outcome Rating
Satisfactory

7. Risk to Development Outcome

The section on risk to development outcome in the ICR (para 90) described the transition arrangements for regular operation of supported activities after project closing and the knowledge sharing activities to reflect the project's lessons to similar interventions. No specific description was provided by the ICR regarding whether any risk to development outcome was identified at project closing, and if so, what were each risk's category, likelihood of occurrence, and potential impact to the project's outcomes, as well as what measures were taken to mitigate each risk. Based on the descriptions in the ICR, this ICR Review categorizes and summarizes potential risks to the project's outcomes in the following.

Financial Risk: There was an uncertainty on financial viability of the project promoted practices after project closing, especially those that were not financially profitable without subsidies. To mitigate the potential risk, the central and provincial governments would continue making well-targeted subsidies for interventions that were not profitable to farmers, such as straw-returning mechanization, green manure, and pollution control to support implementation of climate smart agriculture (CSA) activities. The government subsidies also covered the uses of organic fertilizer, green fertilizer from rotation and fallow cultivation, and formula fertilizer. A special fund for agro-ecological protection and resource utilization was established in 2019. There would be a potential for reducing the subsidies in the medium term, given that some CSA technologies (e.g. conservation tillage, use of organic manure) would take some time to generate full benefits and farmers would gain more experience with using CSA technologies.

Government Ownership Risk: There was an uncertainty on government commitment to sustain and scale-up the CSA practices. To mitigate the potential risk, the project ensured that the CSA strategies and technologies were mainstreamed into policies, programs, and action plans at the national level, including the government's obligations to Nationally Appropriate Mitigation Actions in the agriculture sector.

8. Assessment of Bank Performance

a. Quality-at-Entry

The strategic relevance and approach, the M&E arrangements, and risk assessments were adequate. Technical, financial, environmental, and fiduciary aspects were well considered. The implementation management structure was designed properly with responsibilities clearly stated for the project management offices at the central, provincial, and county levels. A Project Implementation Manual was prepared by the MARA before project approval to guide project implementation. These supported the



PMO and the two county PMUs that had no prior experience with Bank operation. Bank's inputs were appropriate and reasonable, as the preparation process was efficient in terms of preparation costs and time. Overall, the quality at entry is rated satisfactory.

Quality-at-Entry Rating

Satisfactory

b. Quality of supervision

The Bank team provided adequate staff and resources for project implementation support with a focus on development impact. A project restructuring was conducted in a timely manner to extend the project to cover the full crop production season and to pilot new CSA technologies, which required adequate time for collecting and assessing the results. The Bank team also provided sufficient technical and implementation support and conducted trainings to enhance the institutional capacities in fiduciary, environmental and social safeguards management. In particular, recruiting an internationally recognized soil scientist before the MTR mission provided best advice to the PMOs and the monitoring team to ensure the soundness of M&E work for GHG emission reduction and soil carbon sequestration. Bank missions were conducted approximately bi-annually and recorded in mission Aide Memoires, Management Letters, and Implementation Status and Results Reports. During the late months of implementation under COVID-19 travel restrictions, virtual supervision missions and consultations were conducted to address the potential delay of the key project activities. The task team was composed of an adequate mix of skills and experiences of professionals. The TTL turnover (three TTLs during project implementation) did not substantially affect the project implementation due to the support from senior professional Bank staff. Overall, the quality of supervision is rated satisfactory.

Quality of Supervision Rating

Satisfactory

Overall Bank Performance Rating

Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design

The objective was clearly specified. The Theory of Change was well embedded in the design of Results Framework, and the PDO outcome indicators encompassed all relevant outcomes of the PDO statement. Most of the Intermediate Results (IR) indicators were adequate to capture the contribution of the operation's activities and outputs toward achieving PDO-level outcomes. The methodologies used for GHG emissions reduction quantification were based on internationally and nationally recognized methodologies and appropriate at appraisal. Moreover, establishments of the baselines were completed during project preparation, following the methodologies and guidance approved under the United Nations Framework Convention on Climate Change. Before appraisal, the baseline values were stratified based on the



cropping system, the farm type, and the soil type, in order to inform evaluation of the cost effectiveness of various CSA technical options and to lay a solid foundation for M&E implementation. On the other hand, the IR indicator on the number of policy documents developed was not fully specific whether the “policy documents” referred to the studies and the policy advice to the national CSA policies or the national CSA policies themselves.

b. M&E Implementation

All the indicators included in the Results Framework were provided with the baseline data where applicable. All the indicators were measured and reported, though the ambiguity in the design of the IR indicator on policy documents negatively affected measuring the project’s achievements on CSA policy development, as described in Section 4. The M&E data were collected and analyzed by an independent third-party agency. The agency responsible for M&E ensured attention to effective M&E implementation. The methodologies of the GHG quantification were revised during the project implementation. In the first two years, the GHG emissions, soil organic carbon, and forest carbon sequestration were directly measured. The monitoring team undertook stratified sampling for two years to tackle the spatial variability and obtain accurate results (2015-2017). The DeNitrification-DeComposition (DNDC) model was verified and calibrated by two years of observation data (four cropping seasons), showing a general convergence of modeling results with field observations. Thereafter, the team used a modeling approach to calculate emissions, which was cost-effective by reducing field measurement and labor requirements. Recent literature suggested the DNDC model was sensitive to rainfall, soil organic carbon and temperature which can result in overestimation of N₂O peaks during the warm wet season. Therefore, the modeling could have further benefited from a subset of direct validation analysis after the first two years.

c. M&E Utilization

The M&E data analyses were used to inform project management and develop technical standards. The critical data and analyses were provided for implementation progress evaluation, project restructuring and implementation completion and result report. The M&E data was used to provide evidence of achievement of outcomes, such as GHG emissions reduction, carbon sink, and crop yield increase. The M&E data and methodologies were envisioned to inform the subsequent interventions, as recommended by the government.

The Results Framework and the indicators were adequately designed to reflect the Theory of Change envisioned at appraisal with a minor shortcoming. The technical methodologies to measure GHG emissions and carbon sequestration for some indicators were designed in line with the sector standards at appraisal and updated to reduce data collection costs during the implementation. The collected M&E data were used to inform the project management and the governmental stakeholders. Overall, the M&E quality is rated substantial.

M&E Quality Rating

Substantial



10. Other Issues

a. Safeguards

The project was classified as Category B and triggered three safeguards: Involuntary Resettlement (OP 4.12), Environmental Assessment (OP4.01), and Pest Management (OP4.09). The project complied with all safeguards policies and safeguards performance was satisfactory, as elaborated below.

Involuntary Resettlement (OP 4.12): This safeguard policy was triggered as the project's counterpart funding financed the construction and rehabilitation of on-farm crops production infrastructure such as farm roads or irrigation canals that involved small-scaled land acquisition activities. During the project's preparation, the Ministry of Agriculture and Rural Affairs (MARA) prepared a Resettlement Policy Framework (RPF) for the entire project with: (a) detailed procedures on preparation, review and approval of potential land acquisition activities; (b) institutional and financial arrangements for carrying out such activities; and (c) the monitoring plan for supervising the implementation of such activities. The RPF was agreed between the Bank and the MARA and disclosed in 2014. The agreed RPF under this project was satisfactorily implemented by the PMOs.

Environmental Assessment (OP4.01): The project was classified as Category B – partial assessment; because, the construction and rehabilitation of small scale on-farm agricultural infrastructures under Component 1 generated some environmental impacts, such as noise, air, wastewater, and solid waste. Environmental Codes of Practice (ECOPs) were prepared for such investment in accordance with the Bank environmental safeguard requirements. ECOPs implementation was deemed generally satisfactory based on the review and monitoring and mission field visits by the PMOs and the Bank's task teams.

Pest Management (OP4.09): The project promoted Integrated Pest Management practices and supported the review and development of technical codes and standards related to applying agricultural inputs (including pesticides) in CSA practices. A Pest Management Plan (PMP) was prepared for rice, wheat, and corn production at the project sites and its implementation was generally satisfactory throughout the project. The impacts were environmentally positive as the project reduced the use of pesticides and fertilizers.

Public Consultation and Disclosure: In accordance with the policies and regulations of both the Bank and the national government, public consultations were conducted with project farmers and other stakeholders through meetings and on-site surveys and interviews during the project preparation. The opinions and concerns of the people consulted were considered in the safeguards' documents and the project design. The project information was disclosed at project villages and government websites. The ECOPs and PMP were disclosed to the public in accordance with the Bank's information disclosure policy.

b. Fiduciary Compliance

Financial Management (FM): At appraisal, the FM capacity assessment identified the following key risks: (a) the financial staff of the PMO at the Ministry of Agriculture and Rural Affairs (MARA) and two Project Management Units in counties were new to the Bank's operations; and (b) the internal control procedures designed for Component 1 might not be followed strictly by the involved entities. The risk mitigation measures included: (a) financial management training was provided to the project financial staff; (b) an FM Manual was prepared as part of the Project Implementation Manual to state clearly the responsibility of



each involved entity and standardize project implementation procedures; and (c) close monitoring and supervision from the Bank team and the PMO were conducted. Originally the Ministry of Finance managed the GEF grant and oversaw the Designated Account (DA), until the DA was moved to the MARA as a result of government institutional reform. During implementation, the changes of financial staff at both national and county levels and the complex disbursement review process made disbursement inefficient in the first two to three years during project implementation, resulting in late submission of the interim financial reports. The Bank team provided implementation support and on-the-job training to relevant financial staff at PMOs to ensure that an acceptable financial management system was in place. The required annual audit reports were submitted timely, and the external auditors issued unqualified audit opinions.

Procurement: The MARA PMO, in line with the legal covenants and the Bank’s procurement guidelines, carried out procurement activities with designated staff attended procurement training provided by the Bank team during project preparation, and additional trainings during project implementation. During implementation, the MARA PMO arranged continuous capacity-building events on procurement and contract management for staff members of the PMO and two county PMUs. The procurement plan for project implementation was agreed upon during project negotiations and was regularly updated thereafter. The Bank team closely oversaw procurement activities carried out by the client to ensure compliance with Bank procurement policies and procedures.

c. Unintended impacts (Positive or Negative)

No unintended impact was mentioned in the ICR.

d. Other

11. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Satisfactory	Satisfactory	
Bank Performance	Satisfactory	Satisfactory	
Quality of M&E	Substantial	Substantial	
Quality of ICR	---	Substantial	

12. Lessons

The following lessons in the ICR stood out as important and relevant to other projects on climate smart staple crop development, and are presented here with some editing.



1. A sound project monitoring and evaluation system with a solid baseline survey can support efficient project implementation. Under this project, the M&E system design had a clear Results Framework and adequate indicators, with a technically sound baseline survey done at project preparation on the cropping system, farm type, and soil type, laying a solid foundation for measuring, demonstrating and reporting on results, performances, and the cost-effectiveness of various CSA technical options. Further, M&E data were collected and analyzed by a professional third-party agency responsible for each province, ensuring the independence of the M&E process and data quality.

2. The CSA interventions of a public good nature can benefit from support by a government payment for ecosystem service (PES) or similar program. The compensations provided to the farmers under the project were well founded and were effective means to achieving valuable climate benefits. As demonstrated in the economic analysis (ICR, Annex 4), in terms of the cost benefit ratio, the subsidies for farmers could generate far more climate benefits. The public good delivery by farmers should be fully recognized and compensated fairly, as the beneficial externalities generated by a farmer cannot be internalized. As such, it would be desirable if compensation for CSA technologies could be covered in the PES program. Moreover, the project showed that different technical interventions generated divergent financial returns for farmers and economic returns for society as a whole. Given this, the magnitude and level of CSA compensations can be based on specific implementation results to enable efficient and effective use of public financing.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

The ICR provides a detailed overview of the project. The narrative supports the ratings and available evidence. It is candid and generally aligned to the project development objective. The report is concise, follows the guidelines, and is focused on results. The quality of evidence and analysis are mostly aligned to the messages outlined in the ICR. The ICR (Figure 1, page 7) outlines the project's theory of change that helps the reader to understand how the ratings have been reached, though the description could have been more detailed to clarify logical paths to link each activity, output, outcome, and intended impact. The ICR's lessons are clear and based on evidence outlined in the ICR. Overall, the quality of the ICR is rated substantial.

a. Quality of ICR Rating

Substantial

