



Report Number: ICRR0023133

1. Project Data

Project ID
P127775

Project Name
Guangdong Agricultural Pollution Control

Country
China

Practice Area(Lead)
Agriculture and Food

L/C/TF Number(s)
IBRD-83110

Closing Date (Original)
31-Dec-2019

Total Project Cost (USD)
82,554,537.49

Bank Approval Date
27-Dec-2013

Closing Date (Actual)
30-Jun-2021

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	100,000,000.00	0.00
Revised Commitment	77,454,537.49	0.00
Actual	77,454,537.49	0.00

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Project ID
P127815

Project Name
Guangdong Agricultural Pollution Control (P127815)

L/C/TF Number(s)
TF-15418

Closing Date (Original)

Total Project Cost (USD)
5100000.00

Bank Approval Date

Closing Date (Actual)



27-Dec-2013

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	0.00	5,100,000.00
Revised Commitment	0.00	5,100,000.00
Actual	0.00	5,100,000.00

2. Project Objectives and Components

a. Objectives

The Project Development Objective (PDO), as stated in the Loan Agreement (IBRD – 83110), and the Project Appraisal Document (PAD), was: “to reduce water pollutant releases from crop and livestock production in selected areas of Guangdong Province”. The Global Environment Objective (GEO, TF-15418) was identical to the PDO.

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

Yes

Did the Board approve the revised objectives/key associated outcome targets?

Yes

Date of Board Approval

18-Feb-2021

c. Will a split evaluation be undertaken?

Yes

d. Components

Component 1: Environmentally-Friendly Crop Production (Appraisal/Original allocation: US\$47.6 million; Actual Cost: US\$43.36 million). The component supported:

(i) Soil nutrient sampling and analysis informing the development of sound soil nutrient management plans and provision of subsidies to beneficiary farmers to promote their use of various technical measures to improve the application and use efficiencies of fertilizer;

(ii) Upgrading of pest monitoring and early-warning systems, promotion of IPM practices for key cropping systems, and provision of subsidies for professional pest management services and for the acquisition of pesticides and related equipment;



(iii) conservation agriculture (CA) pilots to demonstrate the use of no-till or limited tillage technologies and practices for typical cropping systems;

(iv) technical support to project beneficiaries, in particular smallholders, on crop production practices promoted by the project, along with subgrants to eligible Village Committees (VC) to finance a portion of the incremental operating costs to carry out project activities and beneficiary certification incentive payments;

Component 2: Livestock Waste Management (Appraisal cost: US\$140.18 million; Actual cost: US\$81.65 million). This component supported:

(i) Subgrants to beneficiary farms to partially finance the construction of Livestock Waste Management (LWM) facilities to promote the proper collection and treatment of pig manure;

(ii) Output-based subgrants to finance the incremental costs incurred by pig producers in the construction of pilot high-rise pig production facilities;

Component 3: Monitoring and Evaluation, Capacity Building, and Knowledge Management (Appraisal cost: US\$16.75 million; Actual cost: US\$20.81 million). This component supported:

(i) the monitoring and evaluation (M&E) of project activities, including monitoring compliance with the environmental and social safeguards requirements and measuring the impacts of various project activities;

(ii) building the capacities of the Department of Agriculture (DOA) and project stakeholders, including arranging study trips and trainings, carrying out technical and policy studies, and facilitating knowledge management activities to capture lessons from project implementation;

Component 4: Project Management (Appraisal cost: US\$8.62 million; Actual cost: US\$3.22 million). This component supported activities to strengthen the institutional capacity of the Project Management Office (PMO) and the Project Management Units (PMUs) to implement the project, including the provision of incremental operating costs.

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

Project Costs: The total project cost at approval was US\$ 213.4 million. Due to project restructuring, revised costs, and implementation performance, especially with respect to reduction in the scope/costs of component 2, the revised and final project costs at closing was US\$155.35 million (73% of the original project costs).

Financing: At approval, the IBRD Loan (No. 83110) was US\$100 million, supplemented by Trust Fund from GEF (TF15418) for US\$5.1 million, with Government counterpart contribution of US\$108.2 million, for a total financing of US\$213.3 million. During the 2nd restructuring, there was a reduction of component 2 activities; and a cancelling US\$19.1 million from the IBRD loan. By closing, the total financing was US\$155.3 million (IBRD: US\$77.4 million; GEF: US\$5.1 million; Government/beneficiaries:US\$72.8 million).

Borrower/Recipient Contribution: Government and beneficiary farmers contributed US\$72.8 million (\$42.25 million and US\$30.55 million, respectively), which was about 67% of the original amount at



appraisal (US\$108.2 million). This shortfall reflected the above revisions in project costs, arising from restructuring (especially reduction in component 2) and implementation progress by project closing.

Dates: The Project was approved on December 13, 2013, and became effective May 23, 2014, with a slight delay due to meeting various conditions of effectiveness. The original closing date was December 31, 2019, with the final closing date of June 30, 2021 (for an additional 18 months).

Restructurings: Significant Changes During Implementation (see ICR, paras. 18 – 21 for details).

The project had two level 2 restructurings, and approved in April, 2017 (following the mid-term review, in 2016) and February, 2021, both fully consistent with the reconstructed theory of change (see below).

During the first restructuring (approved in 2017): the PDO, PDO and intermediate indicators, project components, and technical interventions remained unchanged; project areas under component 1 (environmentally-friendly crop production) were expanded from the original 6 to 22 counties, to reflect the growing demand for these activities financed by the project; and the Province's request to reduce the number of pig farms receiving assistance for LWM, from 300 to 200 (ICR, paras. 22 and 23). The project closing date was extended to accommodate the implementation of the substantially increased project activities and geographic coverage of environmentally-friendly crop production (see ICR, para. 22 for further details on the rationale), but the number of farms where LWM investments would be supported was reduced to 200, thereby keeping total investment costs and the project's broad level of ambition stable.

Revisions during the second restructuring (approved in 2021) included: (i) cost of component 2 was reduced (from US\$140.2 million to US\$81.7 million), due to the adverse impacts and challenges arising from the outbreak of the African Swine Fever (ASF). The outbreak halved the pig population of the participating farms, and therefore, there was no prospect of installing the originally targeted number of LWM facilities on the targeted farms, for various reasons (ICR, para. 23); (ii) component 2 added bio-security training and capacity building activities; (iii) while there was no change to the PDO, the targets for the PDO's two core pollution reduction targets (COD and ammonia-nitrogen levels) were revised downwards, as follows with the aim of being more realistic, as follows:

(a) **COD Level:** The indicator for pollution is the mass of chemical oxygen demand (COD) which is the amount of dissolved oxygen needed to oxidize organic matter present in surface and underground water. The COD indicates the severity of pollution, but at restructuring this target for Objective 1 concerning the COD for water in the project area was lowered from 45,000 tons/year to 36,000 tons/year;

(b) **Ammonia-Nitrogen Level:** The target for the pollution load reduction (ammonia-nitrogen) indicator for surface water and underground water to be achieved by the project was lowered from 5,000 tons/year to 4,000 tons/year;

Split Rating: The project's level of ambition was decreased substantially with the decrease of the LWM support and the reduction in the expected outcomes for pollution reduction following the second restructuring which reflected greater realism regarding the project's eventual scope because of the unforeseen swine fever outbreak and the sharply reduced pig numbers (see above). IEG concurred with the ICR that, in light of the lower level of ambition authorized by the project's second restructuring, a split evaluation of outcomes was appropriate.



3. Relevance of Objectives

Rationale

Country and Sector Context: The PDO was highly relevant to addressing key environmental challenges identified during project design. At the time of appraisal of the project, China had made significant progress in curbing rapid growth in pollution discharges, but still faced significant challenges to improve overall environmental quality. In 2010, China had also recognized that agriculture and rural settlements had surpassed industry and urban areas as the most important sources of water pollution. The first Guangdong pollution survey (2007) reported that this province's intensive agricultural production systems had led to serious pollution problems, contributing 40, 41 and 56 percent of Guangdong's gross chemical oxygen demand (COD), total nitrogen (TN) and total phosphorus (TP) discharges, respectively. The two major sources of agricultural pollution identified in Guangdong were the overuse of fertilizer and pesticides, and the lack of treatment of livestock waste discharged from concentrated production. The large standing pig population in the Province contributed 62 percent of COD discharged from livestock population. The overuse of fertilizer and pesticides and livestock production by-products were recognized as major contributors to climate change through release of greenhouse gases. The national government, together with Guangdong Province, highlighted national and provincial targets for 2 key water pollution measures: COD and ammonia-nitrogen.

Relevance to Government Strategies: Addressing these targets, a key part of the country's and province's 12th Five-Year Plan/FYP (2011-2015) on Environmental Protection, formed the basis for the design of the project. The project also was strongly aligned with the FYPs for 2016-2020, 2021 – 2025, and with the National Agricultural Development Plan (2015 – 2030), which emphasized indicators/targets for improved surface quality, and sound management of the environment and ecosystems, including sustainable use of natural resources (ICR, para. 25). The Province's Department of Agriculture (DOA) recognized that the wide adoption of enhanced and appropriate pollution control technologies and practices faced various challenges to achieve these environmental targets, including: perverse input subsidies which encouraged excessive use of agricultural inputs in crop production; reluctance of cash-constrained farmers to invest in costly agricultural equipment and livestock waste management (LWM) facilities; limited demonstration/dissemination and technical support of enhanced agricultural practices.

Accordingly, Guangdong Province requested assistance from the World Bank and the Global Environment Facility (GEF) to prepare and implement a project which would: (i) scale-up previously demonstrated fertilizer and pesticide use reduction and LWM technologies and practices; (ii) pilot additional new and innovative technologies and practices; (iii) provide capacity building and training; and (iv) support policy discussions aimed at the further reduction of pollution releases from the agricultural sector.

Relevance to Bank Assistance Strategies: The project was strongly aligned with the Bank's Country Partnership Strategy/CPS for FY2013-2016 (especially outcome 2.3 on innovative solutions for pollution reduction), and also GEF's strategies to support environmental-friendly crop production technologies and practices, which included reducing land-based pollution such as being affected by Guangdong's crop and livestock subsectors. The CPS aimed to support greener growth by promoting sustainable agricultural practices, pollution management, and climate mitigation and adaptation and Guangdong's 12 FYP on Environmental Protection emphasized low-carbon green development and environmental protection. The project targeted reducing pollutants released from crop and livestock production to improve environmental performance. The World Bank brought international experience and provided technical guidance and



knowledge of advanced technologies to help Guangdong province to achieve the targets in its 12th FYP on Environmental Protection.

In summary, the Project's design with respect to its PDO and targets were highly relevant to the National Guangdong Province government's development strategies, the Bank's partnership strategy (including subsequent CPSs of FY17-20 and FY21-25), the Bank's Climate Change Action Plan (2021-25), and GEF strategies for promoting sustainable agricultural development, especially to reduce key sources of land-based pollution, generating global public goods and to promote greener growth (ICR, para. 26).

Rating

High

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective

To reduce water pollutant releases from crop and livestock production in selected areas of Guangdong Province.

Rationale

The PAD did not include a theory of change (ToC) because it was not required when the PAD was written. The ICR reconstructed a ToC for the project, which was consistent with its overall objective, strategy and components (ICR, Figure 1, para. 9).

Theory of Change: The ToC identifies clearly prioritized activities to help achieve Objective 1: (a) with respect to crop production: developing sound soil nutrient management plans; improving application and use efficiency of fertilizer; promoting IPM practices for key cropping systems; adopting no-till or limited tillage technologies. (b) With respect to livestock production: promoting LWM energy-environmental protection model; promoting energy and ecological use model; and piloting high-rise pig production pilots. These two broad groups of activities were postulated to help generate key intermediate outcomes of: (a) with respect to crop production: environmentally friendly production, and contribute to the PDO outcomes measured by the reduction of COD (at least indirectly, see below) and reduction of ammonia nitrogen pollution (complemented by objective 2); and (b) with respect to livestock production: improved livestock waste management, and PDO outcomes of reduction of COD and reduction of ammonia-nitrogen pollution (complemented by objective 1). Together (crop and livestock-related project activities), the emerging outcomes would thereby contribute to the longer-term outcomes of reducing land-based pollution to the coastal and estuary ecosystems of the South China Sea (as part of Guangdong Province).

With respect to reduction of COD levels, the Bank's project team subsequently informed IEG that there was a sound technical rationale for not showing separate contributions to COD reduction from crop production because: (a) COD cannot serve as an indicator for pollutants coming from crop production system because the quantitative relationship between COD and the nitrogen-ammonia leakage from crop production cannot



be reasonably established; (b) if COD is counted separately for crop production, it may constitute double counting. Also, the nutrient load reductions according to crop and livestock production compared with the targets are shown in the ICR (Annex 7, para. 24/Table 7.7).

The critical assumption for this TOC was the successful/effective demonstration and uptake by crop farmers of enhanced environmentally friendly technologies.

Outputs:

(i) Soil nutrient management support for: (a) provincial, municipal, and county extension services to develop sound soil nutrient management plans; (b) promoting the use of various technical measures to improve the application and use efficiencies of fertilizer based on soil nutrient management plans. By the end of project life 45,192 ha were brought under environmental-friendly crop production technologies and practices; (ii) Integrated pest management (IPM). Support investment in upgrading existing pest monitoring and early-warning systems, and promote IPM practices for key cropping systems. Project beneficiaries fully complied (100 percent) with the WHO Class I & II pesticide residue threshold; (iii) Conservation agriculture pilots, carried out for key crop production systems (e.g., rice-rice system, rice-rice-vegetable system, maize-maize-potato system, and maize-vegetable-maize system); (iv) Implementation support to beneficiaries. Support for agricultural extension services at the county and township levels to provide field technical support to project farmers, especially smallholders, to ensure that they can understand and properly implement project-promoted crop and livestock production practices. By the end of the project, the number of beneficiaries who adopted environmentally-friendly crop and livestock production technologies and practices were 134,420, of which 17,726 were female; (v) No. of livestock waste management facilities constructed: Original Target (OT): 300; Actual Achieved: 127; % of Target:42%;(vi) No. of high rise pig production pilots: OT: NA; Actual Achieved: 6 pilots were constructed; (vii) No. of client days of training provided (both crop and livestock farmers): OT: 36,000; Actual Achieved: 385,661; % of Target: 1069%; and (viii) No. of policy studies completed: Original Target (OT): 11; Actual Achieved: 23; Actual as % of Target: 209%.

Outcomes: (including intermediate outcomes)

(i) Mass of COD pollution load reduction (tons/year): OT: 45,000; Actual Achieved: 43,836; % of Target: 97.3%;

(ii) Nutrient-load reduction (nitrogen-ammonia) achieved under project (tons/year): OT: 5,000; Actual Achieved: 5,031; % of Target: 100%; Target:100%;

(iii) WHO Class II pesticide residue compliance rates (%): BL: 90; OT: 96; Actual Achieved:100%; Actual as % of Target: 104%;

(iv) Crop production areas adopted project promoted practices (No. of Has.): OT: 18,000; Actual Achieved: 45,192; Actual as % of Target: 251%;

(v) Clients who adopted improved agricultural technology (promoted by project): OT: 15,000; Actual Achieved: 134,420; Actual as % of Target: 896%;

(vi) Female Clients who adopted improved agricultural technology (promoted by project): OT: 3,000; Actual Achieved: 17,726; Actual as % of Target:590%;



(vii) Reduction in Total Consumption of Pesticides (MT): OT: 100; Actual Achieved: 397; Actual as % of Revised Target: 397%;

(viii) WHO Class I pesticide residue compliance rates (%): BL: 100; OT: 100; Actual Achieved: 100; Actual as % of Target: 100%;

(ix) Phosphorus load reduction (TP) achieved under project (MT): OT: 250; Actual Achieved: 739; Actual as % of Target: 255%; (

x) No. of project supported pig farms in compliance of performance requirements: OT: 300; Actual Achieved: 123; % of Target: 41%;

The various components/activities contributed to making substantial progress in achieving this original objective of reduced water pollutant releases from crop and livestock production in selected areas of Guangdong Province.

The efficacy with which the Objective 1 was achieved, with respect its associated original indicators and targets, is rated Substantial, which reflects some variability in achieving the original targets.

Rating

Substantial

OBJECTIVE 1 REVISION 1

Revised Objective

PDO remained the same (i.e.: To reduce water pollutant releases from crop and livestock production in selected areas of Guangdong Province), but some indicators/targets were revised downwards to be more realistic (i.e.,reduced targeted number of LWM facilities constructed; reduction of 2 core PDO targets).

Revised Rationale

Theory of Change: The ToC was the same as for the original objective, but with the following adjustments (reflected in the relevant outputs and outcomes): cost of component 2 was reduced substantially; the resulting decrease in the targeted number of LWM facilities constructed; addition of biosecurity training and capacity building activities; 2 core PDO targets were reduced to be more realistic.

Outputs: Similar to the original objectives, while below the outputs which were revised at the 2nd restructuring: (i) No. of Livestock Waste Mgt. Facilities Constructed: OT: 300: RT: 123: A: 123: A as % of RT: 100%; (ii) Pig Farms with Biosecurity Training: OT: NA (not included in original project): RT: 100:

Outcomes: (PDO and intermediate levels): Similar to original objective, with following adjustments:(i) Mass of COD pollution load reduction achieved (Tons/yr.): OT: 45000; RT: 36,000; A: 43836: A as % of RT: 122%; (ii) Nutrient load reduction (Nitrogen-Ammonia) achieved (Tons/yr): OT: 5000; RT: 4000: A: 5031: A as % of RT:126%; (iii) No. of project-supported pig farms in compliance of performance requirements: OT: 300; RT: 123: A: 123: A as % of RT: 100%;



The extent to which Objective 1, Revision 1 was achieved, based on the above evidence, it is rated High.

Revised Rating

High

OVERALL EFFICACY

Rationale

The efficacy of the extent to which the original objective and targets were achieved was Substantial, and High efficacy against the revised outcome targets, following the first restructuring. By project completion, all PDO-level outcomes and intermediate outcomes were met or exceeded. The two core PDO indicators reflected reductions in water pollutant releases arising from crop and livestock production. The analyses presented in the ICR is complemented by various intermediate result indicators and other information (including results of independent studies), showing good progress and justifying these ratings. COD reduction was achieved (and exceeded the revised target) through the treatment of pig manure from the project-supported LWM facilities. Expanded application of environmentally friendly crop production practices also contributed to reduced COD releases. The ammonia nitrogen reduction target was achieved from both components 1 and 2 (and exceeded the revised t). The project also achieved/exceeded other pollutant reductions (biological oxygen/BO demand and total phosphorus) as intermediate outcomes. Clients who adopted improved agricultural technology promoted by the project overachieved the targets (896 and 224 percent of the original and revised targets, respectively). The above section shows the extent to which the project met or exceeded the targets for other key intermediate and output indicators (original and for the restructuring). The ICR provides further details on the positive progress achieved by the project, with respect to the above indicators, including attribution to project interventions, including other impacts (e.g., formulation of relevant policies/plans; health and ecological benefits; and GHG emission reductions as global public goods, see ICR, Table 1, paras. 42 – 44).

Overall Efficacy Rating

Substantial

5. Efficiency

Overall, the project performance and results demonstrated an efficiency rating of Substantial, based on various evidenced-based tools applied and qualitative analyses and presented in the ICR (paras. 47 – 51, and Annex 4, also informed by various supporting studies). The project's cost-benefit analyses demonstrated improved efficiency.

Financial Analyses: The ICR carried out financial analyses for components 1 and 2, taking into account the methodology used at appraisal, and using project M&E data and crop budget analyses for participating farmers, showing positive financial returns per unit of land for component 1 (ref. conservation agriculture), and negative



returns for component 2 (without subsidies), and marginal positive returns (6-11%) with project subsidies. The ICR concluded that substantial positive externalities were generated by LWM activities through mitigating GHG emissions and reducing non-point source pollution, thereby justifying subsidies (equivalent to “eco-compensation”), while persuading pig farmers to internalize the costs of LWM facilities at the time of applying for production licenses. This financial challenge will need to be addressed as part of the project’s follow-up/sustainability actions. The ICR correctly recognized that the project investments has helped to “avoid sizable expenditures on downstream water quality improvement and healthcare costs”. (ICR, para. 50).

Economic Analyses: An ERR was not estimated at appraisal or at ICR stage. Instead, the appraisal confirmed the economic viability of the project by the benefits accruing from improved water quality. The reduction in pollutant loads entering waterways generated “tremendous local environmental benefits”...the pollutant reduction was achieved from both crop farming and livestock production through more efficient use of chemical fertilizer and improved treatment of pig manure and waste at LWM facilities.” To estimate the economic benefits of improved water quality, the ICR applied a similar approach used at appraisal (“benefits transfer method”) and concluded that “economic benefits far exceeded the project costs” (three to seven-fold). With the inclusion of Green House Gas/GHG emissions reduction, estimated project economic benefits increased by \$3.5 – 7 million per year (ICR, para. 47, and Annexes 4 and 8 for details). The ICR clarified (Annex 4, para. 6) that quantifying economic losses due to poor water quality and determining the share of the damage that can be attributed to agriculture is challenging. It is more difficult to quantify the economic losses that can be avoided due to the interventions supported by the project. Therefore, the ICR correctly concluded that generating an ex-post economic rate of return was deemed extremely difficult due to the attribution problem.

The ICR also highlighted the project’s solid implementation efficiency (ICR, paras. 46-51). Based on the sound evidence provided in the ICR (paras. 46 – 51), the project’s 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		0	0 <input type="checkbox"/> Not Applicable
ICR Estimate		0	0 <input type="checkbox"/> Not Applicable

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

6. Outcome

The Outcome Rating is based on a split evaluation of the performance of the project’s objectives and supporting activities and emerging results/impacts. The key changes involved reductions in the targets of two core outcomes, whereby most of the original or revised targets were either met or exceeded by project closing.



Based on the project’s high relevance, substantial to high ratings for efficacy (for the 2 restructurings, but only 1 restructuring shown in the split evaluation), and substantial efficiency, this ICRR concludes that the weighted average of the project’s achievements indicates an overall “Satisfactory” outcome. Table 1 provides the basis for this assessment.

The overall evidence used for the ratings of the three core elements cited above for determining the project’s overall outcome rating are as follows:

(1) High rating for relevance of PDO, based on the project’s strong alignment with (at appraisal and completion): (a) Government’s national, Provincial, sectoral policies and strategies for promoting reduced water pollutant releases from crop and livestock production, covering 22 counties in Guangdong Province; (b) Bank’s country partnership strategy/CPS, while building on the relevant lessons of previous and on-going analytical work and investments which focused on promoting enhanced environmental sustainability.

(2) Substantial and High Ratings for efficacy, based on the evidence of the project’s achievements and results toward meeting the PDO, the two core outcome targets, and progress toward meeting/exceeding the targets of other relevant intermediate outcomes and outputs, with respect to the two restructurings.

(3) Substantial Rating for Efficiency, considering the financial and economic achievements, reflected in the analyses presented in the ICR, coupled with the project’s other positive efficiency gains.

Table 1: Split Rating for Project’s Overall Outcome Rating

Description	Without Restructuring	With Restructuring
Relevance of PDO	High	High
Efficacy:		
Objective 1: from crop and livestock production	Substantial	High
Efficiency	Substantial	Substantial
Outcome Ratings	Satisfactory	Highly Satisfactory
Numerical Value of Outcome Ratings	5	6
Disbursement (US\$ million)	65.16	10.4
Share of Disbursement	86.2 %	13.8 %
Weighted value of outcome rating	4.3	0.83

Overall Outcome Rating: Satisfactory (4.3+0.83)=5.1, rounded to 5. This is equivalent to Satisfactory.

a. Outcome Rating



Satisfactory

7. Risk to Development Outcome

There is low to moderate risk to sustaining the project's outcomes and contribution to the project's expected impacts. The ICR provides sound approach and evidence regarding the project's risk-mitigating actions (ICR, paras. 85 – 87), for the following 2 main types of risks:

(a) Financial Risks and Mitigation Actions:

- Provide appropriate output and performance-based subsidies on a limited basis to smaller pig farmers for accessing LWM facilities, given that treatment of livestock waste generates local and global public goods (e.g., reduced GHG emissions and pollutants discharged into waterways generates positive externalities, therefore subsidies serving a role of “eco-compensation; ICR, 48); alternatively, Government could explore investing in centralized public manure treatment facilities for small pig farms. Currently, based on the above rationale, the Provincial Government continues (at least for short-term) to provide output-based subsidies for LWM facilities and matching grants for the environmentally-sustainable crop production.

(b) Institutional Support Risks and Mitigation Actions:

- Continue to support and use the strengthened extension system to promote among all farmers the reduction in the use of fertilizer and pesticide, and the improved adoption of technologies and practices which will increase crop productivity and reduce production costs, with the aim of phasing out the temporary subsidies (see above); Promote the dissemination and implementation of various agricultural knowledge and good practices generated by the project into “green” agricultural policies and programs to help ensure their scaling up in Guangdong Province, and subsequently, nationwide. These initiatives and outputs include:

1. Guidelines on the Development of Green and Low-Carbon Economic System by China's State Council (2021);
2. Guidelines on the Construction for High- Standard Farmland for Food Security by China's State Council (2019);
3. Technical Guidance and Management for High-Standard Farmland Construction, issued by the MARA (2021);
4. Guangdong Province's 14th FYP for Agriculture and Rural Development.

8. Assessment of Bank Performance

a. **Quality-at-Entry**

The ICR (para. 81) provides evidence on the following positive aspects of the project's design at appraisal:



- Project design was technically sound and innovative
- Project provided strong support to country, agricultural sector and environmental priorities
- The design of the Project's LWM activities was based on proven technologies and methodologies developed and piloted under the preceding LWMEAP
- The Project addressed provincial and local priorities for reducing agricultural pollution, by focusing on the various sources of pollution
- The Bank team worked closely and effectively with technical counterparts during preparation and implementation to help ensure sound design and implementation arrangements, coupled with well-focused capacity building activities, and sound risk-mitigation measures

Quality-at-Entry Rating Satisfactory

b. Quality of supervision **a. Quality of supervision**

The quality of supervision was satisfactory, based on the following evidence provided in the ICR (para. 82): (i) The World Bank team provided adequate staff and resources for project implementation support, with adjustments to resource needs made about twice a year and, in particular, in response to the two project restructurings; (ii) Clear assessments of implementation progress, key issues, and follow-up actions were documented in the Aide Memoires (AMs) and ISRs. The task team regularly reviewed the project's implementation progress, and third-party M&E reports and provided candid and thorough feedback to the client for action; (iii) In response to the restructurings due to changes in the operational environment (outbreak of ASF, which reduced demand for LWM facilities under Component 2) and to address implementation issues (increased demand for environmentally friendly crop production activities under Component 1), the World Bank team promptly supported the counterpart in adopting bio-security interventions and provided technical guidance for good on-farm crop and livestock management practices and training; (iv) The Bank team also involved the expert panel team which was established in 2021 composed of various technical experts to provide timely and much-needed technical guidance on ASF control to the contiguous non-project farms; (v) The Bank team devoted adequate time and expertise to enhancing institutional capacity in fiduciary, environmental, and social safeguard management practices.

Quality of Supervision Rating Satisfactory

Overall Bank Performance Rating Satisfactory

9. M&E Design, Implementation, & Utilization



a. M&E Design

Overall, the project's M&E design provided a sound basis to guide and track the M&E framework and associated implementation activities and results. It was based on China's performance reporting and verification system developed under the 12th FYP to track pollution reduction and monitoring activities. According to the ICR findings, the 12th FYP system had detailed M&E methodology and verification procedures for determining COD and ammonia nitrogen discharges from livestock production, but only a general description for estimating them from crop production. During implementation, these monitoring procedures for these 2 key indicators were funded by the project, and were used for Guangdong Province and in China. The ICR correctly notes that the targets for the two key targets (COD and ammonia nitrogen) should have been disaggregated by source (crop production and livestock waste management, and supported by technical parameters (ICR, para. 67, and Annex 10). Subsequently, the Bank team provided IEG evaluator with further clarifications on the rationale for not showing this disaggregation by crop and livestock production (see Section 2 above).

b. M&E Implementation

Data were collected and verified consistent with the indicators and methodologies specified in the M&E framework report and results framework. The results were documented as part of the project's management information system (MIS), which tracked various components of project implementation (e.g., procurement and contract management, accounting and finance, and various M&E reports). Independent professional teams were contracted to carry out qualitative environmental monitoring studies to better assess in greater depth the impact of the project on agricultural pollution reduction. The results of the various monitoring and evaluation reports were shared with relevant entities for their operational use (e.g., Department for Environment Protection, Southern China Agricultural University). The ICR correctly highlighted some of the main challenges with M&E implementation (e.g., ban on on-farm visits and travel restrictions due to ASF and COVID-19; some data inconsistencies between county level targets and actual achievements, which were rectified). During implementation, efforts were made by an independent entity to design methodologies and site selection for monitoring COD reductions from crop production., which were subsequently used in Guangdong Province and in China (ICR, para. 67).

c. M&E Utilization

Notwithstanding some challenges (as cited above), the M&E data were used effectively by DOA and the Project Management Offices (PMOs) at both provincial and county levels to track the overall project implementation progress and to develop new M&E methodologies and verification procedures. Good utilization of M&E results was reflected in (ICR, para. 70): M&E reports used to facilitate management decision-making processes to address key challenges and government subsidies; impacts of project interventions were analyzed to generate technical parameters/coefficients for pollution reduction from crop production; to integrating monitoring data into the broader water quality information system; and the Bank's project team use of relevant information to prepare project status reports.

M&E Quality Rating

Substantial



10. Other Issues

a. Safeguards

The project was classified as environmental category B (partial assessment), and triggered the following environmental and social safeguard policies: Environmental Assessment (OP/BP 4.01), Pest Management (OP/BP 4.09), Involuntary Resettlement Policy (OP/BP4.12), and Indigenous Peoples Policy (OP/BP4.10, following the second restructuring). An Environmental Management Plan (EMP), a Pest Management Plan (PMP), a Resettlement Policy Framework (RPF), and an Ethnic Minority Development Framework (EMDF) were prepared to guide the project implementation according to World Bank safeguard policies and Chinese domestic laws and regulations.

In accordance with the World Bank's Information disclosure policy, the EMP and PMP were disclosed in the project areas and on the websites of the local government agencies (January, 2013), and were disclosed at the World Bank Info Shop (February, 2013). The PMO had dedicated E&S specialists who provided quality and frequent supervision of sub-projects to ensure that all safeguard policies and requirements were complied with, including support through third-party monitoring teams (see ICR, paras. 73 – 76). There were no reported grievances expressed.

b. Fiduciary Compliance

(i) Financial Management (ICR, para. 80):

The project had an adequate FM system that provided reasonable assurance and accurate and timely information that the IBRD loan was being used for the intended purposes. Several good FM practices were adopted by the project (e.g., the IC card system), which significantly enhanced the quality of project monitoring and management. The project complied with the accounting and financial reporting requirements specified in the LA. However, only about half of the interim unaudited financial reports were submitted on time. No significant FM issues were noted throughout project implementation, and all issues or weaknesses raised during FM reviews or in audit reports were resolved on time. All project audit reports were submitted on time and received unqualified opinions. In addition, the procedures for submitting withdrawal applications were followed and flow of funds arrangements were appropriate.

(ii) Procurement (ICR, paras. 77 – 79): The project's overall procurement performance was satisfactory, consistent with the Bank's procurement policy and procedures. The project awarded 117 contracts, with 113 contracts successfully completed (and sound reasons for terminating the 4 contracts). The World Bank task team closely oversaw procurement and was available to assist and clarify procurement-related issues raised by the implementing agencies. Post reviews were carried out on a random basis. These oversight functions were carried out efficiently and satisfactorily.

c. Unintended impacts (Positive or Negative)

The ICR did not identify other unintended outcomes and impacts.



d. Other

The ICR provided useful summary results (supported by evidence) of “other significant impacts” and “other intended outcomes and impacts” involving:

- (i) formulation of policies and plans on promoting green agricultural development (ICR, para. 42);
- (ii) enhanced health, ecological and environmental benefits (para. 43);
- (iii) contributions to GHG emission reductions (ICR, para. 44);
- (iv) activities to improve the welfare and equality of female participants (e.g., project-supported IPM technologies and practices, capacity building, and M&E activities. The number of training activities for female beneficiaries exceeded the original target); (ICR, para. 53);
- (v) project training activities to strengthen institutional capacity (at provincial and county levels) to: implement and monitor agricultural pollution control activities, including M&E methodologies and verification procedures, particularly under Component 3; carry out relevant technical and policy studies; and to manage and share knowledge on pollution control (paras. 54 and 55);
- (vi) While the project was not designed to mobilize private sector financing, substantial investments were made by the owners of pig farms in the LWM facilities and high-rise production systems promoted under the project, including demonstration effects to help induce additional private sector financing (para. 56);
- (vii) the project contributed to poverty reduction by project activities which contributed to increasing incomes of all participating farmers (para. 57).

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 ICR presents six relevant and sound lessons, supported by project experience, which have broader application beyond this project, for China and other countries. Below are strategic aspects of the 4 more important lessons (ICR, paras. 89 – 94).

Lesson 1: An integrated approach involving both livestock and crop management is needed to effectively demonstrate a rural circular economy. The project integrated investments in LWM facilities and environmentally friendly crop production systems and also provided technical assistance and capacity building to pig farm owners and smallholder farmers. As a result, the project was able to effectively demonstrate a rural circular economy in which treated livestock manure and waste is used to replace chemical fertilizer use, thereby reducing GHG emissions and NPS pollution.



Lesson 2: Subsidies play a critical role in helping reduce risk of adopting new technologies and practices by small-scale farmers. Smallholder farmers' willingness to participate and adopt new technologies and practices such as those related to agricultural pollutant reduction depends largely on financial incentives provided in the first few years to help farmers manage their investments and associated risks. In addition, sufficient financial profitability, which enabled temporary subsidies given their public good features, was critical for the new technologies and practices to be sustained and upscaled in Guangdong Province and nationwide. It was also vital to ensure sound and explicit rationale for the subsidies (e.g., sound farmer incentives and positive externalities to improve water quality/ICR, para. 16, and Annex 4 for details), and a clear phase out plan to ensure sustainability.

Lesson 3: Digital agriculture tools facilitate targeting of support to farmers and monitoring of beneficiaries and input suppliers. Simple but innovative application of the Identification Card (IC) card system in procuring and financing agricultural inputs and services enabled the project to target the delivery of subsidies to smallholder farmers, which significantly improved the project's implementation efficiency, M&E, and the transparency of project interventions.

Lesson 4: Local academic and research institutions can provide fit-for-purpose technical solutions to farmers. By closely working with the most relevant academic and research institutions, the project was able to develop, pilot, and adopt methodologies for monitoring and measuring the reduction of pollutants entering waterways from crop production systems. In addition, relevant institutions helped sustain the effective and improved application of technologies and monitoring processes.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

Overall, the quality of the ICR is "Substantial". The ICR was well written, complied with ICR preparation guidelines, analytical (and guided by a generally sound reconstructed theory of change), candid, consistent, results-focused, and generally supported by adequate evidence to justify the ICR's assessments and proposed ratings.

However, the ICR exhibited four shortcomings, mostly presentational, and they do not affect the conclusions of the project's analyses.

First, the ICR carried out a detailed financial and economic analyses using acceptable methodologies and evidence generated through the project's M&E system (including crop budgets of farmers and 21 LWM facilities; "benefit transfer method"). While the overall results were sound, they did not include an estimated internal economic rate of return (although implied to be quite high, with economic benefits exceeding costs by three to seven-fold", para. 47). Subsequently, the TTL further clarified the rationale for not estimating an ERR (see above, Section 5, including the footnote).



Second, some of the intermediate outcome indicators were outputs (ICR, Annex 1, p. 33, e.g., number of livestock water management facilities constructed, client days of training provided, policy studies completed).

Third, with respect to the project's two core outcome indicators, the results framework showed the reductions (of COD pollution and nitrogen-ammonia) from both crop and livestock. It might have been useful to state explicitly in the ICR text the rationale for not showing this disaggregation (as also explained above in Section 5, due to attribution issues).

Fourth, the split evaluation focused on using only the 2 PDO outcome indicators as the basis for assessing overall efficacy. While these indicators were vital, the ICR could have also recognized the project's progress with respect to achieving some strategic intermediate outputs and outcomes, which together, contributed to the project's PDO and overall efficacy rating. These other indicators are shown above in Section 4..

a. Quality of ICR Rating
Substantial