Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No: ICR00005259

IMPLEMENTATION COMPLETION AND RESULTS REPORT

ON A

LOAN (IBRD-8321-CN)

IN THE AMOUNT OF US$200 MILLION

TO THE

People's Republic of China

FOR THE

Integrated Modern Agriculture Development Project
November 30, 2021

Agriculture and Food Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective Dec. 31, 2020)

Currency Unit =	RMB/Y RMB
Y 6.52 =	US$1
US$0.15 =	1 Y RMB 1

FISCAL YEAR
January 1-December 31

Regional Vice President:	Manuela V. Ferro
Country Director:	Martin Raiser
Regional Director:	Benoit Bosquet
Practice Manager:	Dina Umali-Deininger
Task Team Leader:	Ladisy Komba Chengula
ICR Main Contributor:	Xueming Liu (Author), Armine Juergenliemk (Co-Author)

ABBREVIATIONS AND ACRONYMS

CBE	Center of Budget Evaluation
CPF	Country Partnership Framework
CPMO	County Project Management Office
CPS	Country Partnership Strategy
DA	Designated Account
EMDP	Ethnic Minority Development Plan
ERR	economic rate of return
ET	evapotranspiration
FA	farmers' association
FC	farmers' cooperative
FRR	financial rate of return
FYP	Five-Year Plan
GHG	greenhouse gas (main GHG emissions from the agriculture and land use sector include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)).
IBRD	International Bank for Reconstruction and Development
ICRR	Implementation Completion and Results Report
IMAD	Integrated Modern Agriculture Development Project
M&E	monitoring and evaluation
MARA	Ministry of Agriculture and Rural Affairs
MIS	management information system
MOF	Ministry of Finance
NDC	Nationally Determined Contribution
NPMO	National Project Management Office
O&M	operation and maintenance
PAD	Project Appraisal Document
PDO	project development objective
PMO	Project Management Office
PPMO	Provincial Project Management Office
SOCAD	State Office for Comprehensive Agriculture Development
TOC	theory of change
TTL	task team leader
WUA	Water User Association

CONTENTS

DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P125496	Integrated Modern Agriculture Development Project
Country	**Financing Instrument**
China	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
People's Republic of China	Center of Budget Evaluation

Project Development Objective (PDO)

Original PDO

The project development objective is to develop sustainable and climate resilient agricultural production systems in selected areasof Gansu, Hunan, Jiangxi, and Liaoning provinces; Xinjiang Uygur Autonomous region; and Chonqging municipality.

This will be achieved by investing in (i) irrigated agriculture infrastructure improvement, (ii) enhanced climate smart agricultural practices, and (iii) institutional strengthening and capacity building.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
IBRD-83210	200,000,000	200,000,000	200,000,000
Total	**200,000,000**	**200,000,000**	**200,000,000**
Non-World Bank Financing			
Borrower/Recipient	0	0	0
Local Govts. (Prov., District, City) of Borrowing Country	93,240,000	93,240,000	93,240,000
Sub-borrower(s)	19,900,000	19,900,000	19,900,000
Total	**113,140,000**	**113,140,000**	**113,140,000**
Total Project Cost	**313,140,000**	**313,140,000**	**313,140,000**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
27-Dec-2013	21-May-2014	12-Apr-2017	31-Dec-2019	31-Dec-2020

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
05-Dec-2017	104.33	Change in Results Framework Change in Components and Cost Reallocation between Disbursement Categories
21-May-2019	152.67	Change in Implementing Agency Change in Disbursements Arrangements
06-Nov-2019	172.67	Change in Loan Closing Date(s)

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Substantial

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	07-Apr-2014	Satisfactory	Satisfactory	0
02	18-Oct-2014	Satisfactory	Satisfactory	.25
03	08-Jan-2015	Satisfactory	Satisfactory	3.25
04	22-Sep-2015	Satisfactory	Moderately Satisfactory	19.36
05	23-Mar-2016	Satisfactory	Moderately Satisfactory	32.82
06	19-Aug-2016	Satisfactory	Moderately Satisfactory	56.82
07	21-Dec-2016	Satisfactory	Satisfactory	73.82
08	22-Jun-2017	Satisfactory	Satisfactory	89.83
09	12-Nov-2017	Satisfactory	Satisfactory	104.33
10	30-May-2018	Satisfactory	Satisfactory	136.53
11	12-Dec-2018	Satisfactory	Satisfactory	152.67
12	13-Jun-2019	Satisfactory	Satisfactory	152.67
13	30-Nov-2019	Moderately Satisfactory	Moderately Satisfactory	172.67
14	25-Jun-2020	Moderately Satisfactory	Moderately Satisfactory	184.17
15	01-Jan-2021	Satisfactory	Satisfactory	199.50

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Agriculture, Fishing and Forestry	**96**
Irrigation and Drainage	78
Other Agriculture, Fishing and Forestry	18

Public Administration	**4**
Other Public Administration	4

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Finance	**5**
Finance for Development	5
Agriculture Finance	5
Urban and Rural Development	**48**
Rural Development	48
Rural Markets	5
Rural Infrastructure and service delivery	39
Land Administration and Management	4
Environment and Natural Resource Management	**134**
Climate change	132
Mitigation	45
Adaptation	87
Renewable Natural Resources Asset Management	2
Biodiversity	1
Landscape Management	1

ADM STAFF

Role	At Approval	At ICR
Regional Vice President:	Axel van Trotsenburg	Manuela V. Ferro
Country Director:	Klaus Rohland	Martin Raiser
Director:	John A. Roome	Benoit Bosquet
Practice Manager:	Mark R. Lundell	Dina Umali-Deininger
Task Team Leader(s):	Rabih H. Karaky	Ladisy Komba Chengula, Jianwen Liu

ICR Contributing Author:	Armine Juergenliemk

I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. **China's rapid agricultural productivity growth had been widely attributed to the rural and economic reforms carried out since 1979, resulting in rapid decreases in poverty and improved food security.** Effective institutional reforms, especially the rural household contract responsibility system[1] for farmland, coupled with market liberalization and swift technological adoption, promoted a significant expansion in agricultural productivity. In the three decades leading up to 2013, China's agricultural output grew at a rate of 4.6 percent per annum, more than four times its population growth rate. Grain crops were the most important in both area harvested and output value: grains occupied 50 percent of the total cultivated area and 40 percent of the total value of agricultural output. Grain production increased from 325 million metric tons to 547 million metric tons over the previous three decades as of 2013. The total land allocated to grain, however, declined from 117 million hectares to 109 million hectares, indicating that the heightened production was driven by productivity gains.

2. **Several factors played a key role in generating this output growth: investment in irrigation, land-saving technological changes such as improved seed varieties and fertilizers, and market reforms.** The total irrigated area increased from about 45 million hectares in 1978 to nearly 60 million hectares in 2009, covering more than half the total cultivated area. Irrigation expansion also enabled a significant jump in the production of cotton, oilseeds, fruits and vegetables, and forage crops. As the economy flourished and incomes rose, demand intensified for additional quantity, better quality, greater variety, higher value, and enhanced safety of food. Meeting this escalating demand for a more diversified and grain-intensive diet was a priority for Chinese policymakers.

3. Despite past success, the Chinese agricultural sector faced renewed development challenges. These included the following:

a. Vulnerability to climate change. The effects of a changing and variable climate were already visible in China and were expected to accelerate in the future. Over the preceding 50 years, the average annual surface temperature had risen by 1.2 ^{o}C, with faster increases in the north and northeastern provinces. Regional variations in precipitation had become more pronounced, with average precipitation levels dropping in the north, northeast, and northwest parts of the country, while climbing in the south and southeast. Although the overall average precipitation was expected to grow, concern was mounting over both overall rainfall and its changed timing, which limits crop development and production.

b. **Overexploitation of water resources and low water productivity.** Overall, China ranked in the bottom 25 percent of countries in water availability per capita. The share of total water use by agriculture was 64 percent. Overexploitation of water resources—including withdrawals from rivers and overdraft of groundwater resources, causing a drop in water tables—was a common problem, particularly in the dry northern regions of the country. The average water productivity for grains was 0.7–0.8 kg per m^3, which was much lower than the 2.0–2.5 kg per m^3 recorded in industrialized countries. Improved irrigation system efficiencies and improved water productivity have been key to better managing water resources in agriculture.

[1] The household responsibility system (household contract responsibility system with remuneration linked to output) is a crucial state policy the Chinese government adopted in 1978. Literally, "responsibility" means that an individual household, or a group of households, assumes the task of production and payment to the government.

c. **Overuse of chemical inputs.** China had one of the highest rates of fertilizer and pesticide use in the world. The intensive use of chemical inputs has led to (i) degraded soil fertility, (ii) polluted water systems, (iii) high greenhouse gas (GHG) emissions, (iv) lowered profits for farmers, and (v) increased concerns about food safety. These practices led to decreased resilience to climate change in the country's crop production systems. Field evidence suggested that fertilizer use in some areas could be cut by 30–60 percent with little or no loss of crop yield.

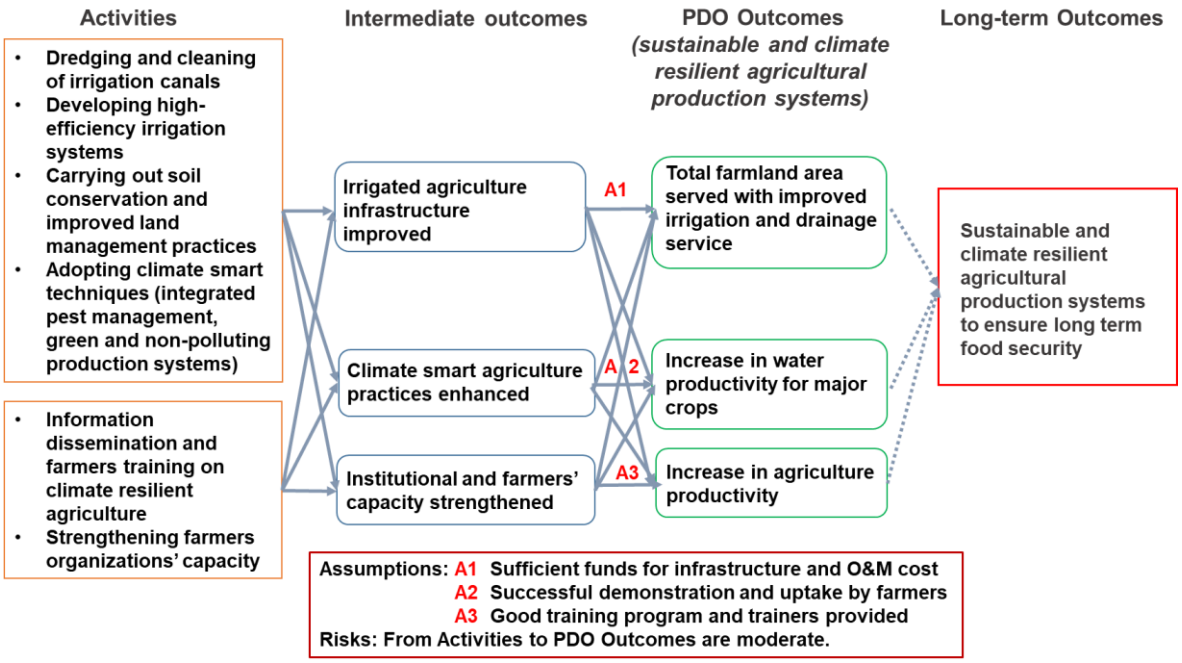
d. **Weak farmer organizations.** Given the small and fragmented nature of Chinese farms, farmers' cooperatives (FCs) had an important role to play in facilitating access to markets for small producers and integrating them into higher-value commodity chains. FCs were also a major conduit of knowledge and services to their members. Water User Associations (WUAs) were filling an organizational and institutional gap in irrigation management systems and were providing significant benefits such as improving their operation and maintenance, contributing to water savings, diminishing water allocation-induced conflicts, and ensuring better fee collection rates for service provision. Despite early progress driven by collaboration between the government and donors, WUA coverage was limited in China, and many existing WUAs continued to face financial, legal, and institutional challenges that threatened their sustainability.

4. **The Integrated Modern Agriculture Development (IMAD) Project was an integral part of China's efforts to address food security and climate resilience in the agricultural sector and directly contributed to the World Bank's Country Partnership Strategy for China for 2013–2016 (Report No. 67566).** Maintaining an acceptable level of food self-sufficiency, raising farmers' income, and constructing the "New Socialist Countryside" were top priorities in the government's development agenda, as articulated in the 12th Five-Year Plan for National Economic and Social Development (FYP 2011–2015). The 12th FYP outlined China's commitment to decrease GHG emissions and "actively cope with" and "increase adaptability to" climate change. It described China's plans to accelerate research, development, and the application of low-carbon technologies in several sectors, including agriculture. It also called for improving the levels of adaptation to climate change in certain key sectors "such as agriculture, forestry, and water resources," and for enhancing the monitoring, reporting, and prevention of extreme climatic events. This project directly addressed a key strategic theme of the World Bank's Country Partnership Strategy for China (2013–2016) by supporting greener growth through sustainable agricultural practices that improve water and farm productivity, produce good-quality and safe products, and expand China's ability to adapt to climate change in agriculture.

Theory of Change (Results Chain)

5. The theory of change (TOC) was constructed retroactively because the project appraisal document (PAD) did not include a TOC (Figure 1). It illustrates the results chain, starting with the activities and outputs, proceeding through intermediate outcomes, and finally arriving at the outcomes of the project development objectives (PDOs).

Figure 1. Theory of Change.



Project development objectives (PDOs)

6. The PDO is 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.

Key expected outcomes and outcome indicators

7. Achievement of the PDO was measured by several key indicators, including the following:

(i) Farmland area served with improved irrigation and drainage services (ha).
(ii) Increase in water productivity for major crops in project areas by province (kg per m^3).
(iii) Increase in agricultural productivity of indicator crops in project areas by province (kg per ha).
(iv) Number of farmers who are members of organizations such as WUAs, farmers' associations (FAs), and farmers' cooperatives (FCs).

Components

8. The project aimed to finance investments in 33 counties or districts in Gansu, Hunan, Jiangxi, and Liaoning provinces; Xinjiang Uygur Autonomous Region; and Chongqing Municipality. Interventions were tailored to the local conditions and determined in consultation with line bureau staff, technical institutions, farmer groups, local private-sector representatives, and local governments. Project areas were selected based on specified criteria, including but not limited to clustered arable land with adequate water resources, infrastructure and technology gaps, vulnerability to climate shocks, potential for agricultural modernization with demonstrative impacts, and access to markets. The project comprised the following four components.

9. **Component 1: Irrigated Agriculture Infrastructure Improvement (estimated cost: US$202.68 million, IBRD: US$155.33 million, actual cost: US$204.38 million, IBRD: US$155.66).** This component financed investments to improve farmland infrastructure and the reliability and efficiency of irrigation and drainage systems. It also aimed to stimulate irrigated agriculture and water productivity through better water use efficiency and adoption of water-saving techniques. Activities financed under this component included the following:

a. Improving irrigation and drainage infrastructure, such as dredging and cleaning irrigation canals and drainage channels and enhancing canal lining, canal structures, pumping stations, irrigation wells, and small water storage systems;

b. Developing high-efficiency irrigation systems, including low-pressure pipeline water delivery systems and sprinkler, micro, and drip irrigation systems;

c. Water monitoring, measurement, and management, including construction and installation of water measurement structures and facilities for upgraded irrigation and drainage systems, monitoring of the annual amount of groundwater pumped for irrigation within the project area in the three northern provinces (Xinjiang, Gansu, and Liaoning), preparation and implementation of groundwater management plans for six counties in the northern provinces (Dunhuang, Lingtai, Gaotai, Fukang, Lingyuan, and Zhangwu), and piloting crop evapotranspiration (ET) monitoring in three selected counties (Denghuang, Fukang, and Lingyuan); and

d. Rehabilitation of farm access roads and on-farm rural power transmission lines.

10. **Component 2: Enhanced Climate-Smart Agricultural Practices (estimated cost: US$66.04 million, IBRD: US$23.69 million, actual cost: US$65.82 million, IBRD US$24.89 million).** This component aimed to build on improved irrigation infrastructure and water delivery activities under Component 1 to enhance the productivity of irrigated agriculture, increase farmers' income, and decrease their vulnerability to adverse climatic events. Activities financed under this component included the following:

a. Carrying out or promoting soil conservation and better land management practices, including the following:

   (i) Land leveling, improved tillage practices, and the use of crop residues;
   (ii) Improved soil fertility management through soil testing, precise or formula fertilizer application, organic fertilizer application, and soil fertility monitoring; and
   (iii) Developing multi-purpose agroecological activities, such as shelterbelts, greenbelts, and windbreaks, and environmental monitoring.

b. Promotion of climate adaptation-oriented agronomic techniques, including the following:

   (i) Integrated pest management;
   (ii) Green and non-polluting production systems;
   (iii) Farm-based demonstrations and extension of improved varieties and technologies as well as of greenhouses or plastic houses; and
   (iv) Applied research on technical or policy-related measures to adapt to climate change in agriculture.

11. **Component 3: Institutional Strengthening and Capacity Building (estimated cost: US$28.63 million, IBRD: US$19.59 million, actual cost: US$20.75 million, IBRD US$17.98 million).** This component supported improving the capacity of farmers, farmer organizations, and institutions at various levels to conduct and promote sustainable and climate-resilient agriculture. Activities under this component included the following:

a. Developing and transferring technical knowledge through training and study tours;

b. Awareness building, education, and communication on climate-smart agriculture for a wide range of stakeholders;
c. Establishing and strengthening of WUAs for better operation and maintenance of on-farm irrigation infrastructure and improved water management for climate-change resilience;
d. Promotion and support of FCs and FAs to enhance collective action for service delivery, access to markets, and farmer-based adaptation to climate change;
e. Provision of technical assistance through mobile expert teams[2] and of relevant equipment to farmers, farmer groups, and project institutions for them to learn and adopt climate-resilient agriculture, such as integrated and better water resource management as well as mitigation and adaptation to climate change in its agricultural, environmental, social, and economic aspects; and
f. Project management capacity building for Project Management Office (PMO) staff at the central, provincial, and county levels, including the provision of office equipment, training materials, and vehicles.

12. **Component 4: Project Management Support (estimated cost: US$15.29 million, IBRD: US$0.89 million, actual cost: US$14.76 million, IBRD US$0.97 million).** This component supported relevant agencies at each level to manage, implement, supervise, and monitor project activities and progress. Activities financed under this component included the following:

a. Project surveys, design, and construction supervision; and
b. Project management, including a management information system (MIS), establishing an effective monitoring and evaluation (M&E) system to assess physical and financial outcomes and impact indicators, and the recruitment of any related consultancies.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

13. There were three Level 2 restructurings in December 2017 (loan disbursement at US$104.33 million), May 2019 (loan disbursement at US$152.67 million), and November 2019 (loan disbursement at US$172.67 million).

Revised PDOs and outcome targets

14. There was no change to the PDO and outcome targets.

Revised PDO indicators

15. In the December 2017 restructuring, two PDO indicators were revised:

a. “Total farmland area served with improved irrigation and drainage services” was downgraded to an intermediate outcome indicator;
b. “Share of high-standard farmland in selected areas where at least two new sustainable or climate-resilient practices or technologies promoted by the project have been adopted” was added as a new PDO indicator.

[2] A group of experts providing advisory services, technical assistance, and review of design plans for the project implementation. Their expertise covered water conservation, engineering, agronomy, horticulture, agro-forestry, climate change, research and extension, meteorology, and environmental sciences.

Revised components

16. The project components were not revised but had price and physical contingencies (US$32.18 million) mostly relocated to Component 1.

Other changes

17. Some reallocations of resources occurred across expenditure categories such as works, goods, and consultants' services.

18. Under the May 2019 restructuring, the Responsible Agency for project implementation was changed at the central level from the State Office of Comprehensive Agriculture Development (SOCAD) under the Ministry of Finance (MOF) to the Center of Budget Evaluation (CBE), also under the MOF.

19. The Project Loan Agreement and the Disbursement Letter were amended to reflect the new Responsible Agency for project implementation at the central level: the CBE under the MOF. In addition, the project Designated Account (DA) was closed in December 2018 because of these changes. A new DA was opened and managed by the CBE after the amendments.

20. The project loan closing date was extended from December 31, 2019, to December 31, 2021.

Rationale for changes and their implication for the original theory of change

21. The project was able to achieve cost savings for two reasons: first, the competitive bidding process resulted in lower than expected contracts for many investments, especially in civil works; second, the YRMB depreciated vis-à-vis the U.S. dollar since the project became effective.

22. During the preparation stage, part of the IBRD loan was reserved for physical contingencies and price contingencies—a total of US$32.18 million. Because of savings in both procurement and the exchange rate, sufficient resources were available to finance all project activities and thus there was no need for the contingencies.

23. Because of the reorganization of the Chinese government that began in early 2018, the functions of the Responsible Agency for the project, the SOCAD under the MOF, were transferred to the MARA. The government decided that the responsibility for implementing the IMAD Project remained with the MOF, but under another MOF institution, namely, the Center of Budget Evaluation.

24. The project results framework was revised to strengthen the indicators and the program logic. For example, the PDO-level outcome indicator on "Total farmland area served with improved irrigation and drainage services" was moved to the intermediate level because it is a contributor to other PDO-level indicators such as increased water and crop productivity. A new PDO-level indicator was added to reflect the number of farmers adopting a set of climate-resilient and sustainable agriculture approaches.

25. The project loan closing date was extended to enable the completion of project activities.

26. The project restructurings did not lead to material changes to the TOC (Figure 1).

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of relevance of PDOs and rating

27. **The PDO remains highly relevant and fully aligned with the World Bank's Country Partnership Framework for 2020–2025 (CPF, Report No. 117875-CN) and with the new phase of the World Bank's China engagement at closing.** The China-World Bank Group (WBG) partnership has entered a new era following 40 years of close collaboration. The CPF focuses on closing any remaining institutional gaps and supporting interventions that generate significant global public goods. This is consistent with China's new development strategy of promoting green growth to achieve ecological civilization. The IMAD Project contributed directly to Engagement Area 2 (EA2) of the CPF—Promoting Greener Growth. Under EA2, the Bank aims to support government efforts to (i) decrease air, soil, water, and marine plastics pollution; (ii) demonstrate sustainable agricultural practices and improve the quality and safety of agro-food products; and (iii) strengthen sustainable natural resource management.

28. **At project completion, the PDO was also well aligned with China's current national priorities for rural and agricultural development, which focus on agricultural sustainability and decreasing agriculture's climate footprint.** In February 2021, the Committee of the Communist Party of China and the State Council issued the *Opinions on Comprehensively Promoting Rural Revitalization and Accelerating Agricultural and Rural Modernization,* which is the Central Document No. 1 of 2021, highlighting four priority areas: (i) promoting green agriculture development, (ii) developing modern agricultural and rural industries, (iii) expanding the provision of rural infrastructure and public services, and (iv) strengthening the governance of rural areas. In its Nationally Determined Contribution (NDC),[3] China also committed to proactively adapting to climate change by enhancing mechanisms and capacity to effectively defend against climate change risks in key areas such as agriculture, forestry, and water resources.

29. **The relevance of the PDO is rated as high** given that the project's objectives are aligned with the current World Bank CPF and Government of China development priorities as described above.

B. ACHIEVEMENT OF PDOs (EFFICACY)

30. The PDO is 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 achieved through improving irrigation and drainage services, adopting climate-smart agricultural practices, and strengthening institutional capacity building of farmers' organizations such as WUAs, FAs, and FCs.

31. Agricultural resilience to the impacts of climate change is measured by productivity increases resulting from adopting new crops and technologies that increase resilience to climate change. The sustainability of project-promoted interventions depends on the cost-effectiveness of the technical measures adopted in improving the climate resilience of crop production systems both now and in the future. After the field demonstrations of improved land and water management practices, it is expected that farmers would continue to implement sustainable practices with proven financial profitability. More importantly, the project's sustainability depends on whether it can increase (or at least maintain) productivity as measured by crop yield in a way and at a rate that supports and enhances the resilience of ecosystems and the benefits.

[3] Source: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China percent20First/China's percent20First percent20NDC percent20Submission.pdf

32. Sustainability and climate resilience complement one another for viable agricultural production systems. For evaluation purposes and according to the design of the PDO indicators, developing climate-resilient agricultural production is measured by the outcome indicator "Share of high-standard farmland in selected areas where at least two new sustainable or climate-resilient practices or technologies promoted by the project have been adopted." [4] Sustainability is measured by two outcome indicators: "Increase in water productivity for major crops by province" and "Increase in land productivity by province." Case studies on the adoption and impact of climate-resilient sustainable agricultural practices are presented in Annex 7.

Assessment of achievement of each objective/outcome

Climate-Resilient Agricultural Production Systems Developed: Rated Substantial

33. This outcome was measured by one indicator: "Share of high-standard farmland in selected areas where at least two new sustainable or climate-resilient practices or technologies promoted by the project have been adopted." The baseline was 0; the actual result was 73.27 percent, exceeding the original target (70) by 3 percent.

34. Climate-resilient technical interventions introduced in the project include the following:

a. Soil conservation and improved land management practices including but not limited to (i) land leveling, improved tillage practices, and the use of crop residues; (ii) improved soil fertility management through soil testing, precise or formula fertilizer application, organic fertilizer application, and soil fertility monitoring; and (iii) developing multi-purpose agroecological activities such as shelterbelts, greenbelts, and windbreaks, and environmental monitoring.

b. The promotion of climate adaptation-oriented agronomic techniques, including the following: (i) integrated pest management, (ii) green and non-polluting production systems, (iii) farm-based demonstrations and extension of improved varieties and technologies as well as of greenhouses or plastic houses, and (iv) applied research on technical or policy-related measures to adapt to climate change in agriculture.

35. Based on project interventions, four intermediate results indicators were used to support the measurement of climate resilience**.** The indicators fully achieved or substantially exceeded the original targets: (a) "Increase in area of leveled land and improved soil physical conditions" exceeded the original target by 38 percent (the actual result was 53,443 ha); (b) "Increase in area adopting balanced fertilization" exceeded the original target by 40 percent (the actual result was 87,346 ha); (c) "Increase in area under integrated pest management or green or non-polluting production" exceeded the original target by 36 percent (the actual result was 98,186 ha); and (d) "Increase in area under shelter and agroforest plantation" exceeded the original target by 4 percent (the actual result was 2,522 ha) (Annex 1).

Sustainable Agricultural Production Systems Developed: Rated Substantial

36. This outcome was measured by increased water and land productivity, which either fully achieved or exceeded their final target values by province, as described below.

37. **For major crops, water productivity increased in each project area.** The water productivity of maize increased by 22 percent in Liaoning Province (the actual result was 1.91 kg per m^3), whereas in Gansu Province it increased by nearly 20 percent (the actual result was 1.58 kg per m^3). The water productivity of wheat increased by 27 percent (the actual result was 1.59 kg per m^3) in the Xinjiang Uygur Autonomous Region. The water productivity of rice in Jiangxi Province

[4] This indicator was added after the first restructuring to better capture the number of farmers adopting a set of climate-resilient and sustainable agriculture approaches. See paragraph 18.

increased by 17 percent (the actual result was 1.33 kg per m^3), whereas in Hunan Province it increased by 15 percent (the actual result was 1.36 kg per m^3) and in Chongqing Municipality the observed increase was 23 percent (the actual result was 1.29 kg per m^3).

38. Increased land productivity was also observed. The land productivity of maize in Liaoning Province increased by 16 percent (the actual result was 9,608 kg per ha), whereas in Gansu Province the increase was 11 percent (the actual result was 9,854 kg per ha). For wheat, land productivity increased by 15 percent in the Xinjiang Uygur Autonomous Region (the actual result was 6,085 kg per ha). For rice, land productivity increased by 12 percent in Jiangxi Province (the actual result was 6,560 kg per ha), by 44 percent in Hunan Province (the actual result was 8,475 kg per ha), and by 24 percent in Chongqing Municipality (the actual result was 8,329 kg per ha).

39. The following intermediate results indicators related to water management supported the measurement of sustainability: (a) the "Overall irrigation water use efficiency by province" target was achieved in all provinces; (b) "Area provided with new or improved irrigation or drainage services" increased from 2,633 hectares to 102,497 hectares and "Volume of groundwater extracted in selected provinces" reached the targets. These were achieved through the following measures:

(i) Irrigation and drainage infrastructure was improved by dredging and cleaning canals and drainage channels and enhancing canal lining and structures, pumping stations, irrigation wells, and small water storage systems. Almost all the activities have been completed at 100 percent of the revised target.

(ii) High-efficiency irrigation systems were developed, including low-pressure pipeline water delivery systems, sprinklers, and micro and drip irrigation systems. These activities were completed at a rate of 79 percent to 102 percent. For example, water-saving irrigation in Chiling contributed to improved efficiency and time savings and decreased the cost of irrigation (as described in Annex 7).

(iii) Water monitoring, measurement, and management were enhanced. This took place through the construction and installation of water measurement structures and facilities for improved irrigation and drainage systems. The annual amount of pumped irrigation groundwater within the three northern province project areas was monitored. Groundwater management plans were prepared and implemented for six counties in the northern provinces. Crop evapotranspiration pilots were monitored in three selected counties. The completion rate reached the targets in the pilot areas. Furthermore, in Gansu Province, it was possible to significantly diminish groundwater extraction rates (the baseline was 2,818.00 m^3, the original target 2,636 m^3, and the actual result 1,053 m^3). The groundwater management plan and water monitoring measurements restricted overextraction and an environmental rebound effect when efficiency gains led to increased use.

40. The intermediate indicator "Farm roads constructed and rehabilitated" target exceeded the original target by 26 percent. The road construction supports sustainability by providing access to markets for both agricultural outputs and inputs (e.g., improved seed, fertilizer), which contributes to increased competitiveness. It was also demonstrated that rural road investments can decrease poverty significantly through higher agricultural production, higher wages, lower input and transportation costs, and higher output prices.[5] Furthermore, studies demonstrate that road expansion encourages farmers to participate in local off-farm work rather than migrate.[6]

41. Other relevant indicators include "Number of farmers who are members of farmer organizations disaggregated

[5] Khandker, S. R.; Bakht, Z.; & Koolwal, G. B. 2006. *The Poverty Impact of Rural Roads: Evidence from Bangladesh.* Policy Research Working Paper No. 3875. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/8333 License: CC BY 3.0 IGO.

[6] Qiao, F.; Rozelle, S.; Huang, J.; Zhang, L.; & Luo, R. 2014. Road Expansion and Off-Farm Work in Rural China. *The China Quarterly* 218: 428–51. doi:10.1017/S0305741014000629

by WUAs, FAs, and FCs" and "Number of farmer organizations disaggregated by WUAs, FAs, and FCs, supported and delivering services to members," which surpassed 100 percent completion. FAs and FCs addressed the small-scale farm fragmentation challenge and facilitated aggregation and value chain development. The project, by demonstrating aggregation of small- and medium-scale farmers into groups, helps achieve economies of scale along value chains. Aggregation points bring together small farmers, off-takers, processors, transporters, and traders and facilitate access to other services, including finance, market information, etc. Aggregation also helps producers to meet the standards and requirements of modern markets and address other barriers to access, supports farmers in improving their productivity through increased access to services and markets, and enhances their competitiveness by decreasing the transaction costs of companies choosing to work with them. For example, Shenghui vegetable planting professional cooperative supported the whole value chain development. It provided members with full-process services such as vegetable production, transportation, cleaning, packaging, refrigeration, and sales. It has also boosted brand creation (13 vegetable varieties obtained green food certification) and marketing, potentially generating additional jobs (Annex 7). WUAs ensured the sustainability of improved water management. It has been well recognized that WUAs can also (i) increase productivity and per capita income by 40 percent, (ii) decrease or eliminate water conflicts, and (iii) facilitate better water fee collection rates.[7] In Chiling, WUAs enhanced the team, cooperation, and collective consciousness of large grain farmers (Annex 7).

42. The project had substantial impacts on capacity building and institutional strengthening (Section III.E). Specifically, farmer-centered activities (e.g., farmer organization development, technical assistance, training and extension services) contributed to the sustainability of the interventions. All capacity-building activities were completed and the end targets of capacity building for farmers and farmer groups were achieved. "Farmers trained" by the project were 18,523 persons, of which 7,894 female farmers and 1,363 ethnic minority people were trained, 88 percent and 129 percent higher than the original targets, respectively. The provision of technical assistance through mobile expert teams further supported information dissemination.

Additional project outcomes

43. The implementation of climate-resilient and sustainable technologies and practices produced additional climate change mitigation and environmental benefits.[8] The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) describes how improved water management in rice production can decrease GHG emissions.[9] In the case of this project, soil organic matter in the Hunan project area increased from 2.4 to 12.5 percent, an average increase of 7.8 percent, and whole nitrogen increased from 2.2 to 9.5 percent, an average increase of 6.5 percent.[10] Similarly, the field measurements undertaken during the implementation of the Climate-Smart Staple Crop Production (P144531) project demonstrated that improved water management decreases methane emissions, whereas improved soil management promotes carbon sequestration. Using integrated pest management decreased soil and water pollution, conserved pollinator biodiversity, and decreased adverse human health impacts from handling pesticides and unintentionally consuming food with pesticide residues, as the literature review demonstrates interconnectedness between negative health impacts and pesticides.[11] Efficient irrigation technologies in combination with water monitoring,

[7] World Bank. 2011. China: Water Pricing and Water User Associations Sustainability. Washington, DC World Bank. https://openknowledge.worldbank.org/handle/10986/18374 License: CC BY 3.0 IGO.
[8] See Climate-Smart Agriculture Sourcebook. http://www.fao.org/3/i7994e/i7994e.pdf
[9] Smith, P.; Martino, D.; Cai, Z.; Gwary, D.; Janzen, H.; Kumar, P.; McCarl, B.; Ogle, S.; O'Mara, F.; Rice, C.; Scholes, B.; & Sirotenko, O. 2007. Agriculture. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Metz, B.; Davidson, O.R.; Bosch, P.R.; Dave, R.; & Meyer, L.A. (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
[10] Client Implementation Completion Report. July 2021.
[11] Nicolopoulou-Stamati, P.; Maipas, S.; Kotampasi, C.; Stamatis, P.; & Hens, L. 2016. Chemical Pesticides and Human Health: The Urgent Need for a New Concept in Agriculture. *Frontiers in Public Health* 4: 148. doi:10.3389/fpubh.2016.00148

measurement, and management decreased water use (Paragraphs 36 and 40). Furthermore, integrated irrigation and fertilizer use contributed toward improved labor productivity. Additionally, a decrease in GHG emissions was achieved through sustainable soil management and decreased fertilizer use. The project increased area adopting balanced fertilization by 87,346 hectares. Retaining crop residues promoted carbon sequestration and eliminated the negative effects of crop residue burning that generates smog, which then causes health hazards, biodiversity loss, and diminished soil fertility.

Justification of overall efficacy rating

44. The overall project efficacy is rated as ***Substantial*** based on the above assessment.

C. EFFICIENCY

Assessment of efficiency and rating

45. **Financial and economic analysis:** Following the approach adopted at appraisal, a cost-benefit analysis was conducted to re-assess the project's ex post economic viability at completion. In the analysis, 100 percent of the actual project costs have been included, covering both physical infrastructure and institutional strengthening activities. Physical infrastructure investments have improved the delivery, conveyance, and water use efficiency of irrigation and drainage systems in the project areas and therefore increased crop yield, diversification, and cropping intensity. Enhanced climate-smart agricultural practices such as balanced fertilization, improved tillage practices, organic fertilizer use, extension for new seeds, and biological pest control have decreased the use of chemical fertilizer and pesticide and contributed to productivity increases. To carry out the economic and financial analysis, models were built that represented the major crops in the project area for each county and aggregated upward. Quantifiable benefits include (i) increased yield between the "with" and "without" scenarios; (ii) increased cropping intensity for the southern provinces of Jiangxi, Hunan, and Chongqing Municipality; and (iii) crop diversification. The economic rate of return (ERR) for the project was therefore estimated at 20 percent. For individual provinces, the ERR varies from 17 percent to 25 percent. The financial rate of return (FRR) is calculated at 18 percent and varies from 15 percent to 22 percent among the project provinces. The ERRs at the project level and FRRs by province at project completion are comparable with those estimated at appraisal.

46. The analyses did not include significant benefits that were not readily quantifiable, such as (i) environmental and health benefits from reductions in non-point source pollution due to decreased fertilizer and pesticide use, and from diminished underground water extraction; and (ii) the incremental benefits from better resource use and improved service delivery due to institutional strengthening. The ERRs at project closure as such were conservative estimations for the true economic values of the project.

47. **Fiscal impact analysis.** The central government is responsible for repaying the loan and the World Bank loan proceeds were allocated to the project provinces as grants. The provincial and county governments have adequately provided counterpart funds. The local governments will feel no additional fiscal impacts after project completion because the water infrastructure operation and maintenance (O&M) costs will be borne by the WUAs. With the abolition of agricultural taxation, the project will not make a direct contribution to fiscal revenues.

48. **Implementation efficiency.** The procurement and financial management performance were generally satisfactory (Section IV.B). Project restructuring with a 12-month closing date extension was justified (Section I.B). Although project implementation progress was delayed at a late stage because of the COVID-19 epidemic outbreak (Section III.B), all project activities, including those added at project restructuring, were completed before project closure. The actual project cost (US$315.82 million) was close to the PAD estimation (US$313.14 million) and the project management cost incurred was US$14.76 million, slightly lower than the PAD estimation. The World Bank loan proceeds were fully disbursed at project

closure.

49. The project efficiency is rated as Substantial based on the above assessment.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

50. The overall outcome of the project is rated ***Satisfactory*** based on its high relevance, substantial efficacy, and substantial efficiency.

E. OTHER OUTCOMES AND IMPACTS

Gender

51. Gender equality was promoted through wide and equal participation of, and consultation with, local people in the project areas throughout project implementation. Special attention was given to the participation of vulnerable people, both men and women, with a good degree of gender sensitivity. Equal participation and gender responsiveness were reflected in project activities such as training, WUAs, FCs, FAs, and other capacity-building activities. The number of training activities for female beneficiaries achieved was 164 percent of the revised target and 188 percent of the original target.

Institutional strengthening

52. Component 3 was exclusively devoted to enhancing the capacity of farmers, farmer organizations, and institutions at various levels to conduct and promote sustainable and climate-resilient agriculture. Through field visits and consultations with farmers, the Bank's ICRR team met with several FCs in each province and found that the idea of sustainable and resilient agricultural production systems, which entails financial incentives in terms of heightened land and water productivity, has been internalized and put into field operation by farmers.

53. Good practices were introduced through demonstrations and training. Specifically, project interventions included the following:

a. Developing and transferring technical knowledge through training and study tours for farmers and project staff;

b. Awareness building, education, and communication on climate-smart agriculture for a wide range of stakeholders, including farmers, government officials, and project staff;

c. Establishing and strengthening WUAs for better operation and maintenance of on-farm irrigation infrastructure and improved water management for climate-change resilience;

d. The promotion and support of FCs and FAs to enhance collective action for service delivery, access to markets, and farmer-based adaptation to climate change;

e. The provision of technical assistance through mobile expert teams and relevant equipment to farmers, farmer groups, and project institutions. This aimed to facilitate a comprehensive and multidisciplinary understanding of what climate-resilient agriculture means and how integrated and better water resource management supports mitigation and climate adaptation goals in its agricultural, environmental, social, and economic aspects; and

f. Project management capacity building for PMO staff at the central, provincial, and county levels, including the provision of office equipment, training materials, and vehicles.

54. A case study of FCs was prepared by the National Project Management Office (NPMO) (Annex 7).

Mobilizing private-sector financing

55. Although the IMAD Project was not designed to mobilize private-sector financing, the resulting improved infrastructure in irrigation and farm roads has facilitated private investment in agribusiness operations, including the processing, storage, and marketing of commodities produced under the project in all six provinces. For example, FCs in Heishan County, Liaoning Province, have entered into a contractual agreement with an agribusiness company for agricultural input supply, marketing, and joint investment for processing. Agri-tourism focusing on specialty products has also been promoted by the project, particularly in Chongqing's Longping Township, where the farmers' "Harvesting Festival" has been celebrated for the past three years.

Poverty reduction and shared prosperity

56. It is reasonably believed that the IMAD Project contributed to poverty reduction and shared prosperity by enhancing crop yield and decreasing the cost of production inputs. Crop yield and smallholder farmers' income in the project areas have risen significantly with the project's investments and interventions. For example, in Hunan, the total value of crop production grew from a baseline of CNY 396 million before project implementation to CNY 506 million in 2019, up by 28 percent, with an annual growth rate of 5.6 percent.

Other unintended outcomes and impacts

57. **None**

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

58. The project design was innovative and visionary for green agriculture development in China, which was then at the incipient stage. This was the first effort by the World Bank to implement climate-smart agriculture on a wide scale in China, covering six provinces from south to north across the country in various agro-climatic zones. It also directly contributed to the implementation of China's Nationally Determined Contributions (NDCs),[12] for which the agricultural sector plays a key role in decreasing GHG emissions.

59. The project design adopted a holistic and integrated approach combining infrastructure investment and capacity building. The project components complemented each other and contributed to achieving the PDOs**.** Although "sustainable" and "climate resilient" are not directly measurable, the PAD and the selected indicators provided context in terms of what was meant, particularly incorporating the financial incentives to farmers through land and water productivity enhancement to increase their income. The causal relationships between project interventions and the intermediate and PDO indicators were generally justified with operational logic. In terms of agronomic conditions for the whole country, the selection of project provinces was appropriate.

[12] Source: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China percent20First/China's percent20First percent20NDC percent20Submission.pdf

60. The potential risks from the project's wide geographic coverage and the multiplicity of institutions involved were clearly identified. There were, however, some minor project design issues related to some inappropriate classification of outcome and intermediate outcome indicators (Section IV.A). The implementation management structure was well designed, following similar arrangements under previous World Bank projects implemented by the SOCAD, with responsibilities clearly defined for the project management offices at the central, provincial, and county levels (Section III.B).

61. Project M&E was designed through the joint efforts of the SOCAD and line bureaus with sound monitoring methodologies and realistic measures for data collection. The workflow for M&E data collection and consolidation was well established (Section IV.A).

B. KEY FACTORS DURING IMPLEMENTATION

62. **The government reorganization at the national and sub-national levels created uncertainty and delays in project implementation**. Project implementation had progressed well, and the project was on track to close by December 31, 2019, as scheduled. However, with the government-wide institutional reform and reorganization that began in early 2018, the project became delayed. The Responsible Agency functions for the project provided by SOCAD under the MOF were transferred to the MARA. The government decided that the responsibility for implementation of the IMAD Project should remain with the MOF, but under another MOF institution, specifically the CBE.As a result, the project DA was closed in December 2018 and a new DA managed by the CBE was approved in May 2019, but it became operational only in December 2019, thus delaying loan disbursements and project implementation. However, the national PMO at the CBE and Provincial Project Management Offices (PPMOs) made great efforts to catch up in implementing project activities despite lost time due to the government reorganization and the COVID-19 pandemic. As a result, the bank loan was fully disbursed by the restructured project closing date.

63. **Effective implementation arrangements led by a competent NPMO were instrumental to successful project implementation.** The key feature of the institutional arrangements for the IMAD Project was that it was built upon an existing hierarchy of project management and channels of interaction, which also applied to previous Bank projects implemented by SOCAD.[13] Both SOCAD and the CBE under the MOF as the lead implementing agency demonstrated a high level of managerial capacity and commitment to implementing this project, which geographically covered six provinces and 33 counties. They were able to (i) engage multiple stakeholders such as line bureaus, research institutes, and farmer groups in project implementation and supervision, and (ii) stress quality assurance pertaining to both construction and institutional development with a particular focus on farmer organizations.

64. **Mutual learning experiences in project implementation among the PPMOs facilitated scaling up both technical good practices and enhanced project management.** Noticeable variations in implementation progress and performance among the six provinces offered good opportunities for them to learn from each other, particularly through joint supervision missions (Section IV.C). The Xinjiang Uygur Autonomous Region, administratively at the same level as a province, exceled in implementation from start to finish and completed all the project activities in 2017, thus sparing itself from the negative impacts of the COVID-19 pandemic and the government reorganization at the provincial and local levels.

65. **The good implementation and use of the monitoring and evaluation system contributed to efficient project implementation.** The application of the MIS by all the provinces ensured data consistency and the engagement of third-party monitoring agencies enhanced the independence of the M&E system (Section IV.A).

[13] SOCAD implemented Bank-financed projects (e.g., IAIL 2, IAIL 3) and the GEF-Mainstreaming Climate Change Adaptation in the Irrigated Agriculture Project.

66. **Participation and ownership of farmer organizations facilitated the adoption of new practices of climate-smart agriculture and ensured sustainability.** On-farm demonstration (a process with tangible social and economic benefits to farmers) involved promoting CSA technology adoption and upscaling (Annex 7).

67. **The World Bank provided adequate project supervision and implementation support and addressed the changing operation environment in a timely fashion.** The Bank task team, composed of senior staff and consultants with rich experience relevant to China, worked proactively with their counterparts to restructure the project three times to ensure the achievement of the PDO with full use of World Bank loan proceeds (Section IV.C).

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

A. QUALITY OF MONITORING AND EVALUATION

M&E design

68. The M&E design was generally reasonable and practical, reflecting the TOC with adequate indicators. The PDO indicators, water productivity, and agricultural productivity were adequate to measure the sustainability and climate resilience of the production system, supported by a few intermediate outcome indicators such as “Reduction in the volume of groundwater extracted,” “Increase in area adopting balanced fertilization,” and “Increase in area under integrated pest management or green or non-polluting production.” Furthermore, training of farmers and developing FCs, key to achieving the PDO, was measured and evaluated by clear-cut intermediate outcome indicators. However, there was some confusion about classification between outcome and intermediate outcome indicators. For example, some indicators—such as “Total farmland area served with improved irrigation and drainage services” and “Number of farmers who are members of farmer organizations”—could only be intermediate outcome indicators as they did not measure the outcome of project interventions. This confusion was subsequently addressed during the first project restructuring.

M&E implementation

69. Based on the M&E design, every province commissioned an external agency or institute to create and undertake an impact evaluation assessment of project interventions by conducting representative surveys at three stages of project implementation: a baseline at the onset of the project, a follow-up prior to the mid-term, and a final round at project completion.

70. The M&E data were collected and analyzed in a methodologically sound manner, with support from the MIS, government bureaus, and monitoring agencies. County Project Management Offices (CPMOs) prepared regular M&E reports, which were submitted to the PPMOs for compiling and verification. These reports were then forwarded to the NPMO for review, consolidation, and reporting. Similarly, physical and financial progress was tracked through the MIS, which was adopted by all the project counties. In addition, local Water Resources and Agricultural Bureaus were engaged to inspect the implementation progress and work quality as required by government regulations.

71. External monitoring agencies were recruited as a third party to undertake the project M&E, including social and environmental safeguards (Section IV.B), which provided credibility and facilitated on-site monitoring during the COVID-19 outbreak.

72. The use of the MIS helped enhance the consistency of data recording and reporting in different CPMOs. However, some inconsistencies cropped up for a few intermediate results indicators among the World Bank

restructuring paper, the client's MIS records, and the 2018 and 2019 World Bank Implementation Status and Results Reports. These were eventually verified and rectified during the World Bank ICRR preparation.

M&E use

73. Information collected from the M&E reports was used to assess the implementation progress of activities and the likelihood of the project achieving its development objective. M&E data therefore contributed substantially to the project restructurings and ICRR preparation. The data were also used to identify implementation bottlenecks that would necessitate additional efforts and resources, as shown in the reallocations of World Bank loan proceeds. Information gathered in the M&E process also helped identify best practices that would be upscaled in the province and countrywide.

Justification of overall rating of quality of M&E

74. The overall quality of M&E was rated as *Substantial* based on the above assessment.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

Environmental and social safeguards compliance

75. This was a Category B partial assessment project. It has generated positive environmental benefits and supported sustainable and climate-resilient agricultural production systems in the project areas. The principal negative environmental impacts were construction-related, associated with the rehabilitation and improvement of existing on-farm irrigation and drainage infrastructure. Applicable environmental and social safeguard policies for the project included Environmental Assessment (OP4.01), Pest Management (OP4.09), Safety of Dams (OP/BP 4.37), Indigenous Peoples (OP/BP 4.10), and Involuntary Resettlement (OP/BP 4.12). External monitoring agencies were recruited for the six provinces as a third party to undertake the M&E of social and environmental safeguards. The project complied with all policies, and safeguards performance was generally satisfactory, as elaborated below.

76. **Environmental Assessment (OP4.01).** The environmental impacts of the IMAD Project were positive overall. It generated real water saving in project areas each year by improving irrigation and drainage infrastructure, and through developing high-efficiency irrigation systems. It brought multiple environmental benefits, such as soil conservation, reuse of crop residues, and decreases in the use of pesticide and fertilizer through balanced fertilizer application and integrated pest management. Negative impacts were related mainly to small-scale construction activities, which were involved in the rehabilitation and improvement of irrigated agriculture infrastructure. These impacts, such as noise, wastewater, waste, and disturbances to local communities, were temporary, limited, and local in nature.

77. **Pest Management (OP4.09).** The project included integrated pest management and production systems that met green and non-polluting certification standards. The improved irrigation facilities and diversification of crop systems decreased pesticide use, thus mitigating environmental and health risks. The pest management plan incorporated existing good practices from the project provinces and adopted several activities such as improvement of pest forecasting, use of bait lamps, crop rotation, pest-resistant varieties, and balanced fertilization.

78. **Dam Safety (OP4.37).** The IMAD Project did not finance dam construction, but the irrigation systems it financed drew water directly from reservoirs formed by 43 existing dams and one dam under construction, and they could not function if the dams failed. Based on the requirements of OP4.37, all the relevant provinces recruited independent dam specialists to (i) inspect and evaluate the safety status of the existing dams, their appurtenances, and their performance

history; (ii) review and evaluate the owner's O&M procedures; and (iii) provide written reports of findings and recommendations for any remedial work or safety-related measures necessary to upgrade the existing dams to an acceptable safety standard.

79. **Ethnic Minorities (OP4.10).** The project activities in the Xinjiang Uygur Autonomous Region and Liaoning Province covered some areas populated with ethnic minorities, such as Yanqi, Bohu, Qitai, and Fukang counties in Xinjiang and Lingyuan and Zhangwu counties in Liaoning. The ethnic minorities were mostly Uygur, Kazak, and Mongol, who fell within the definition of Indigenous Peoples in OP4.10. A Social Assessment (SA) was carried out during project preparation to facilitate free, prior, and informed consultations among the ethnic minority communities. An Ethnic Minority Development Plan (EMDP) was prepared based on consultations with ethnic minority groups in project areas and disclosed locally and on the World Bank website. Third-party teams were commissioned by the client to monitor implementation of the EMDP, and biannual monitoring reports were submitted largely on time. Although COVID-19-related restrictions did not allow visiting all project locations with presence of ethnic minorities in 2020–2021, based on the experience of other World Bank-financed projects in Xinjiang Uygur Autonomous Region, a series of ICRR missions[14] took place in the region in June/July 2021 with the objective of, among others, reviewing and verifying the results of the implementation of the EMDP, including gathering additional qualitative feedback from ethnic minorities.

80. A series of ICRR missions took place in June/July 2021 to gather feedback from ethnic minorities. Interviews with local farmers (including Uygur farmers) that took place through organized focus group meetings and encounters during field visits suggested that local ethnic minority groups were quite satisfied with the new irrigation technology that decreased their workload and increased yield. With technology facilitating labor-intensive tasks, the interviewed farmers informed the mission that they had more leisure time to enjoy life. Ethnic minority groups received technical training from the cooperatives and WUAs they joined. Most of these training activities covered the best types of crops to plant for a given season and irrigation technology that was introduced by the project. Some training even included materials translated into the Uygur language and all training was delivered by technical staff fluent in local languages, as described by the project completion report prepared by the client. The project implementation activities such as rehabilitation of irrigation canals, hardening of field access roads, leveling of farmland, upgrading of agricultural production facilities, and strengthening of farmers' organizations (such as WUAs, FAs, and FCs) were relevant to the minorities' needs. Although not quantifiable through the project's results framework or other mechanisms (such as beneficiary surveys), the project can be considered to have generated positive impacts on their livelihoods, such as the provision of modern agricultural technologies and facilities for income generation and local community development initiatives.

81. **Involuntary Resettlement (OP/BP 4.12).** Project activities on infrastructure improvement mainly rehabilitated existing facilities on their original land base. All the facilities supported by the project belong to village communities and no land ownership or related property rights changed hands. However, if irrigation infrastructure facilities extended beyond village boundaries or any land was taken beyond what was foreseen at appraisal, a resettlement policy framework was prepared by each of the six project provinces, as per World Bank policy OP/BP4.12, to guide project activities under those circumstances.

82. **Safeguard Documentation Disclosure:** The safeguard documents were prepared through consultation with key stakeholders. These documents complied with World Bank safeguard policies and were disclosed through announcements published on the local website. The pest management plans for all provinces and the EMP were locally disclosed on September 5 and September 6, 2012, respectively. They were subsequently disclosed by the Bank Infoshop on October 17, 2012.

[14] On April 25-30, 2021, the Bank ICRR team visited Liaoning Province and Chongqing Municipality while the Hunan Province project team joined the mission in Chongqing. From June 7 to 11, 2021, the Bank ICRR team visited Gansu and Jiangxi provinces. Finally, on July 26-29, 2021, the Bank ICRR team visited the Xinjiang Uygur Autonomous Region.

Fiduciary compliance

Financial management

83. A sound financial management system had been maintained during project implementation to ensure that the funds were used for the intended purposes. A MIS functioned as an efficient tool to monitor and manage project implementation. Although the IMAD Project encountered institutional changes that had some negative impacts on project disbursement (Section III.B), the NPMO capably put project implementation back on track quickly. The annual financial reports were audited, and "unqualified" opinions were issued. The required interim financial reports were submitted in a timely manner. Overall, the financial management performance of the project was satisfactory.

Procurement

84. The NPMO led and coordinated procurement activities for the whole project and provided guidance to PPMOs on all aspects of procurement. PPMOs coordinated the procurement activities within their respective provinces, advised the CPMOs on procurement and contract management, reviewed procurement documents prepared by the CPMOs, and supervised and monitored the procurement activities the CPMOs carried out. A capacity assessment of the different PMOs was conducted by reviewing the project organizational structure and functions, the past experiences of implementing agencies, staff skills, the quality and adequacy of supporting and control systems, and legal and regulatory aspects during project preparation. Each PMO had at least one designated procurement staff member. The World Bank team also provided procurement-related implementation support and hands-on training to relevant procurement staff to ensure compliance with Bank procurement policies and procedures. The overall procurement management performance throughout implementation was satisfactory.

C. BANK PERFORMANCE

Quality at entry

85. The World Bank's performance at entry was satisfactory. The project design was innovative and visionary, representing the first effort by the Bank to implement climate-smart agriculture on a large scale in China (Section II.A). The World Bank team worked closely with the client during the preparation process to ensure that the following criteria were achieved:

a. The project's high relevance to China's national development strategies (Section II.A);
b. A well-structured project design integrating technical interventions with capacity building for farmers and FCs (Section III.A);
c. Effective M&E design and arrangements (Section IV.A);
d. An adequate risk management plan that identified the weaknesses in implementation capacity and put mitigation measures in place; and
e. Thorough coverage and specification of environmental, social, and fiduciary aspects in the project design (Section IV.B) and in the Project Implementation Manual prepared by the client.

Quality of supervision

86. The World Bank's performance during supervision was satisfactory. The Bank provided adequate staff and resources for project implementation support. Project restructurings were conducted in response to a changing operational environment and addressed implementation issues such as loan proceeds savings, government reorganization, and refinement and changes of outcome and intermediate outcome indicators (Section I.B). During the

last year of implementation under COVID-19 travel restrictions, virtual supervision missions and consultations were organized in a timely manner to address potential delays in key project activities. The Bank team also provided sufficient technical and implementation support for the development of FCs, with one local cooperative specialist as a core team member throughout the project implementation. In addition, the Bank team devoted adequate time and expertise to enhancing institutional capacity in fiduciary, environmental, and social safeguard management (Section IV.B).

87. Implementation support missions were fielded regularly, including virtually during the COVID-19 outbreak. These missions were candid and timely in reporting progress, highlighting issues, and proposing practical follow-up actions in the form of mission Aide Memoires, Management Letters, and Implementation Status and Results Reports. The task team, composed of experienced professionals in irrigation infrastructure, climate-smart agriculture, and institutional capacity building, worked effectively with their counterparts to come up with appropriate and practical recommendations, which were well received by farmers. The understanding and trust developed between the Bank team and the client were recognized in the government ICRR.

88. The physical expanses of the six provinces made it impossible for each mission to cover them all; however, the Bank team creatively organized field visits to three provinces at once and invited the other three provinces to brief and join the mission as "observers," thus promoting exchange and mutual learning among all six provinces. Although there were three task team leaders (TTLs) during the seven-year project implementation, the transition was well managed, and no negative impacts were felt. All three TTLs were senior professional Bank staff with rich experience working in China.

Justification of overall rating of Bank performance

89. The overall World Bank performance was rated as *Satisfactory*, which was confirmed by its counterpart in its ICRR.

D. RISK TO DEVELOPMENT OUTCOME

90. The PDO was to develop sustainable and climate-resilient agricultural production systems in the project areas, which was satisfactorily achieved (Section II.B). The risk to development outcome assessment particularly benefited from the experience of the regular operation for the past four years of the Xinjiang Uygur Autonomous Region, which completed all its project activities in 2017. The risk analysis covers stakeholders' ownership and commitment as well as other technical, financial, economic, political, and environmental aspects.

a. Farmers' ownership of project assets. The assets of irrigation infrastructure facilities have been transferred to WUAs for regular O&M, which is financed by WUA inputs in cash and/or in kind. This well-established practice has worked effectively in similar domestic irrigation projects and proved viable during Xinjiang's four-year regular operational experience.

b. Financial profitability of crop production with enhanced land and water productivities. Such productivity and profitability have provided incentives and momentum to maintain and upscale the good practices generated by the project.

c. Conducive policy environment. As part of its obligations to Nationally Appropriate Mitigation Actions in the agricultural sector, the government has mainstreamed the agricultural knowledge and good practices generated

under Component 2[15] into policies and development programs.[16] This process ensures that the project's demonstrated good practices have been scaled up nationwide.

d. Lessons learned. Because it is one of the first climate-smart agriculture investment projects between the World Bank and China, the IMAD Project's lessons and experiences have been transferred to other Bank-financed projects in China, including the Henan Green Agriculture Fund Project approved in March 2020, the Hubei Smart and Sustainable Agriculture Project approved in May 2020, the China Food Safety Project approved in March 2021, and the Green Agriculture and Rural Revitalization PforR currently under preparation. These projects all aim to promote integrated, environmentally sustainable, climate-smart agriculture and agri-food quality and safety in targeted value chains and landscapes in China.

V. LESSONS AND RECOMMENDATIONS

91. The project has fully achieved its PDO. It has successfully actualized sustainable and climate-resilient agricultural production systems in Gansu, Hunan, Jiangxi, and Liaoning provinces, in Chongqing Municipality, and in the Xinjiang Uygur Autonomous Region. With persistent pressure from environmental challenges and increasing threats from climate change, enhancing agricultural resilience to climate change by improving infrastructure and mainstreaming climate-smart agricultural best practices has become an important vehicle to enhance food security and increase farmers' income. This project generated the following lessons and recommendations, which are generally applicable to similar operations of climate-smart crop development in China and other countries:

92. An integrated approach combining infrastructure investment and technical and institutional development is essential to a sustainable and climate-resilient agricultural system, which needs to simultaneously address the interlinked challenges of ensuring food security under climate change while providing financial incentives for farmers (Section III.A).

93. Well-designed project institutional arrangements were instrumental to successful project implementation. The NPMO played a critical role in coordinating this geographically vast and diverse project with multiple institutions involved (Section III.B).

94. Farmers' ownership and participation through WUAs, FCs, and FAs can serve as an effective vehicle for adopting and upscaling new climate-resilient agricultural practices and ensuring project sustainability (Section III.B, Section III.D, and Annex 7).

95. A well-designed M&E system adopted by all the project provinces and implemented by third-party external monitoring entities contributed to successful project implementation and independent evaluation (Section III.B and Section IV.A).

96. Mainstreaming the good practices of climate-resilient and sustainable agricultural systems into government programs and policies is key to upscaling project interventions and sustainability (Section IV.D).

[15] These included (i) land leveling, improved tillage practices, use of crop residues; (ii) improved soil fertility management through soil testing, precise or formula fertilizer application, organic fertilizer application, soil fertility monitoring; (iii) development of multi-purpose agroecological activities such as shelterbelts, greenbelts, and windbreaks, and environmental monitoring; and (iv) promotion of climate adaptation-oriented agronomic techniques, such as integrated pest management, green and non-polluting production systems, and farm-based demonstrations and extension of improved varieties and technologies.

[16] The Guidelines on the Development of Green and Low-Carbon Economic Systems by China's State Council, issued in April 2021; the Guidelines on the Construction for High-Standard Farmland for Food Security by China's State Council, issued in 2019; and the Technical Guidance and Management for High-Standard Farmland Construction, issued by the MARA in March 2021.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: PDO indicators

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Share of high-standard farmland in selected areas where at least two new sustainable or climate resilient practices/technologies promoted by the project have been adopted	Percentage	0.00 27-Dec-2013	0.00 31-Dec-2018	70.00 31-Dec-2020	73.27 31-Dec-2020

Comments (achievements against targets):
This is a newly added indicator during the restructure of December 2017. The target achieved 105%.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in water productivity for maize in LN province	Number	1.56 27-Dec-2013	1.90 31-Dec-2018	1.90 31-Dec-2020	1.91 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 101% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in water productivity for maize in GS province	Number	1.32 27-Dec-2013	1.56 31-Dec-2018	1.56 31-Dec-2020	1.58 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 101% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in water productivity	Number	1.25	1.56	1.56	1.59

for wheat in XJ province		27-Dec-2013	31-Dec-2018	31-Dec-2020	31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 102 % achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in water productivity for rice in JX province	Number	1.14 27-Dec-2013	1.33 31-Dec-2018	1.33 31-Dec-2020	1.33 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 100% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in water productivity for rice in HN province	Number	1.18 27-Dec-2013	1.30 31-Dec-2018	1.30 31-Dec-2020	1.36 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 105% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in water productivity for rice in CHQ province	Number	1.05 27-Dec-2013	1.27 31-Dec-2018	1.27 31-Dec-2020	1.29 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 102% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in land productivity for maize crop for LN province	Number	8,300.00 27-Dec-2013	9591.00 31-Dec-2018	9,591.00 31-Dec-2020	9,608.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 100% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

Increase in land productivity for maize crop in GS province	Number	7,500.00 27-Dec-2013	8325.00 31-Dec-2018	8,325.00 31-Dec-2020	9,854.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 118% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in land productivity for wheat crop in XJ province	Number	5,300.00 27-Dec-2013	5899.00 31-Dec-2018	5,899.00 31-Dec-2020	6,085.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 103% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in land productivity for rice crop in JX province	Number	5,850.00 27-Dec-2013	6558.00 31-Dec-2018	6,558.00 31-Dec-2020	6,560.00 31-Dec-2020

Comments (achievements against targets):

There is no change in the original target. The original target is 100% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in land productivity for rice crop in HN province	Number	5,900.00 27-Dec-2013	6505.00 31-Dec-2018	6,505.00 31-Dec-2020	8,475.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 130% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in land productivity for rice crop for CHQ province	Number	6,700.00 27-Dec-2013	7530.00 31-Dec-2018	7,530.00 31-Dec-2020	8,329.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 111% achieved.

A.2 Intermediate Results Indicators

Component: Sub-component 1 Irrigated Agriculture Infrastructure Improvement

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-component 1: Overall irrigation water use efficiency -- LN province	Percentage	56.00 27-Dec-2013	70.00 31-Dec-2018	70.00 31-Dec-2020	70.12 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 100% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 1: Overall irrigation water use efficiency -- GS province	Percentage	46.00 27-Dec-2013	58.00 31-Dec-2018	58.00 31-Dec-2020	61.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 105% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at

				Target	Completion
Sub-comp 1 Indicator 1: Overall irrigation water use efficiency -- XJ province	Percentage	53.00 27-Dec-2013	64.00 31-Dec-2018	64.00 31-Dec-2020	65.63 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 103% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 1: Overall irrigation water use efficiency -- JX province	Percentage	52.00 27-Dec-2013	66.00 31-Dec-2018	66.00 31-Dec-2020	67.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 102% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp1 Indicator 1: Overall irrigation water use efficiency -- HN province	Percentage	52.00 27-Dec-2013	65.00 31-Dec-2018	65.00 31-Dec-2020	66.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 102% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 1: Overall irrigation water use efficiency -- CHQ Municipality	Percentage	45.00 27-Dec-2013	56.00 31-Dec-2018	56.00 31-Dec-2020	57.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 102% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 2: Area provided with new/improved irrigation or drainage services	Hectare(Ha)	2,633.37 27-Dec-2013	0.00 31-Dec-2018	98,031.00 31-Dec-2020	102,497.00 31-Dec-2020

Comments (achievements against targets):

This is a newly added indicator during restructure in 2017. The new indicator is 105% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 3 : Volume of groundwater extracted -- LN province	Cubic Meter(m3)	6,188.00 27-Dec-2013	5380.00 31-Dec-2018	5,380.00 31-Dec-2020	5,321.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. It is 99% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 3: Volume of groundwater extracted -- GS province	Cubic Meter(m3)	2,818.00 27-Dec-2013	2636.00 31-Dec-2018	2,636.00 31-Dec-2020	1,053.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 40% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 3: Volume of groundwater extracted -- XJ province	Cubic Meter(m3)	4,282.00 27-Dec-2013	4178.00 31-Dec-2018	4,178.00 31-Dec-2020	4,045.00 31-Dec-2020

Comments (achievements against targets):
There is no change in the original target. The original target is 97% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 1 Indicator 4: Farm roads constructed and rehabilitated	Kilometers	0.00 27-Dec-2013	2262.00 31-Dec-2018	2,594.00 31-Dec-2020	2,855.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017.

Component: Sub-component 2 Enhanced Climate-Smart Agricultural Practices

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at

				Target	Completion
Sub-comp 2 Indicator 1: Increase in area of leveled land and improved soil physical conditions (tillage practices)	Hectare(Ha)	0.00 27-Dec-2013	38537.00 31-Dec-2018	38,777.00 31-Dec-2020	53,443.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 154% of the revised target, and 138% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 2 Indicator 2: Increase in area adopting balance fertilizations (include crop residues returned and organic fertilizers)	Hectare(Ha)	0.00 27-Dec-2013	62340.00 31-Dec-2018	65,369.00 31-Dec-2020	87,346.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 134% of the revised target, and 140% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

Sub-comp 2 Indicator 3: Increase in area under IPM/Green/non polluted production	Hectare(Ha)	0.00 27-Dec-2013	72000.00 31-Dec-2018	67,253.00 31-Dec-2020	98,186.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 146% of the revised target, and 136% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 2 Indicator 4: Increase in area under shelter and agroforest plantation	Hectare(Ha)	0.00 27-Dec-2013	2420.00 31-Dec-2018	2,218.00 31-Dec-2020	2,522.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 114% of the revised target, and 104% of the original one.

Component: Sub-component 3 Institutional Strengthening and Capacity Building

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

Sub-comp 3 Indicator 1: Improved irrigated area devolved to WUA for Village Committee for O&M	Hectare(Ha)	0.00 27-Dec-2013	36000.00 31-Dec-2018	56,187.00 31-Dec-2020	59,682.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 106% of the revised target, and 166% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-component 3 Indicator 2: number of WUA, FA, and FC	Number	2.00 27-Dec-2013	379.00 31-Dec-2018	365.00 31-Dec-2020	390.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 107% of the revised target, and 103% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 2 - Number of WUAs supported and delivering services to	Number	0.00 27-Dec-2013	183.00 31-Dec-2018	145.00 31-Dec-2020	156.00 31-Dec-2020

members					

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 108% of the revised target, and 85% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 2 - Number of FAs supported and delivering services to members	Number	1.00 27-Dec-2013	47.00 31-Dec-2018	25.00 31-Dec-2020	26.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 104% of the revised target, and 55% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 2 - Number of FCs supported and delivering services to members	Number	1.00 27-Dec-2013	149.00 31-Dec-2018	195.00 31-Dec-2020	208.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 107% of the revised target, and 140% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 3: Number of farmers who are members of farmer organizations (FAs/FCs/WUAs)	Number	29,000.00 27-Dec-2013	0.00 31-Dec-2018	52,772.00 31-Dec-2020	57,210.00 31-Dec-2020
In which: Female members	Number	7,601.00 27-Dec-2013	0.00 31-Dec-2018	16,018.00 31-Dec-2020	17,838.00 31-Dec-2020

Comments (achievements against targets):
This is a newly added indicator during restructure in 2017. The new indicator was 108% achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 4: Farmers training	Number	0.00 27-Dec-2013	12000.00 31-Dec-2018	12,879.00 31-Dec-2020	18,523.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 154% of the revised target, and 154% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 4 - Female training	Number	0.00 27-Dec-2013	4200.00 31-Dec-2018	4,819.00 31-Dec-2020	7,894.00 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The actual achieved target is 164% of the revised target, and 188% of the original one.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Sub-comp 3 Indicator 4 - Ethnic minorities training	Number	0.00 27-Dec-2013	595.00 31-Dec-2018	643.00 31-Dec-2020	1,363.20 31-Dec-2020

Comments (achievements against targets):
The original target was revised during the restructure in 2017. The achieved target is 212% of the revised target, and 229% of the original one.

B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1: To develop climate-resilient agricultural production systems in selected areas of Gansu, Hunan, Jiangxi, and Liaoning provinces; Xinjiang Uygur Autonomous Region; and Chonqging Municipality.	
Outcome indicators	1. Share of high-standard farmland in selected areas where at least two new sustainable or climate-resilient practices/technologies promoted by the project have been adopted (percentage).
Intermediate results indicators	1. Increase in area of leveled land and improved soil physical conditions (tillage practices) (ha). 2. Increase in area adopting balanced fertilization (include crop residues returned and organic fertilizer) (ha). 3. Increase in area under IPM/green/non-polluting production (ha). 4. Increase in area under shelter and agroforestry plantation (ha).
Key outputs by component (linked to the achievement of Objective/Outcome 1)	• Component 2: Enhanced Climate-Smart Agricultural Practices. • Carrying out, or promotion, of soil conservation and improved land management practices including but not limited to (i) land leveling, improved tillage practices, use of crop residues; (ii) improved soil fertility management (soil testing, precise/formula fertilizer application, organic fertilizer application, soil fertility monitoring); and (iii) development of multi-purpose agroecological activities (e.g., shelterbelts, greenbelts, and windbreaks) and environmental monitoring. The completion rate of different activities is from 87 percent to 206 percent. • Promoting climate adaptation-oriented agronomic techniques, including (i) integrated pest management; (ii) green and non-polluting production systems; (iii) farm-based demonstrations and extension of improved varieties and technologies, and greenhouses and plastic houses; and (iv) applied research on technical or policy-related measures for adaptation to climate change in agriculture. The completion rate of different activities is much more than 100 percent.

Objective/Outcome 2: To develop sustainable agricultural production systems in selected areas of Gansu, Hunan, Jiangxi, and Liaoning provinces; Xinjiang Uygur Autonomous Region; and Chonqging Municipality.	
Outcome indicators	1. Increase in water productivity for major crops by province (kg per m^3). 2. Increase in land productivity by province (kg per ha).
Intermediate results indicators	1. Overall irrigation water use efficiency by province (percentage). 2. Area provided with new/improved irrigation or drainage services (ha). 3. Volume of groundwater extracted in selected provinces (m^3). 4. Farm roads constructed and rehabilitated (km).
Key outputs by component (linked to the achievement of Objective/Outcome 2)	**Component 1: Irrigated Agriculture Infrastructure Improvement** • improvement of irrigation and drainage infrastructure (dredging and cleaning of irrigation canals and drainage channels, and canal lining; improving canal structures, pumping stations, irrigation wells, and small water storage systems). Almost all the activities have been completed at 100 percent of the revised target. • Development of high-efficiency irrigation systems, including low-pressure pipeline water delivery systems and sprinkler, micro, and drip irrigation systems. The completion rate is 79 percent to 102 percent. • Water monitoring, measurement, and management, including constructing and installing water measurement structures and facilities for the improved irrigation and drainage systems, monitoring of the annual amount of groundwater pumped for irrigation within the project area in the three northern provinces, preparing and implementing groundwater management plans for six counties in the northern provinces, and piloting crop evapotranspiration monitoring in three selected counties. The completion rate is 101 percent. • Rehabilitating farm access roads and on-farm rural power transmission lines. The completion rate is more than 100 percent, with the highest at 113 percent.

	Component 3: Institutional Strengthening and Capacity Building • Development and transfer of technical knowledge through training and study tours. • Awareness building, education, and communication on climate-smart agriculture for the wider range of stakeholders. • Establishing and strengthening of Water User Associations for better operation and maintenance of on-farm irrigation infrastructure and improved water management for climate-change resilience. • Promotion and support to FCs and FAs to enhance collective action for service delivery, access to markets, and farmer-based adaptation to climate change. • Provision of technical assistance to farmers, farmer groups, and project institutions for climate-resilient agriculture. • Project management capacity building for PMO staff at central, provincial, and county levels, including provision of office equipment, training materials, and vehicles.

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Rabih H. Karaky	Task Team Leader
Zheng Liu	Procurement Specialist
Yi Dong	Financial Management Specialist
Minhnguyet Le Khorami	Team Member
Zongcheng Lin	Social Specialist
Lourdes L. Anducta	Team Member
Ximing Zhang	Social Specialist
Feng Ji	Social Specialist
Meixiang Zhou	Social Specialist
Supervision/ICR	
Ladisy Komba Chengula	Task Team Leaders
Zheng Liu	Procurement Specialist
Yi Dong	Financial Management Specialist
Yan Zhang	Procurement Team
Li Ouyang	Team Member
Xuan Peng	Team Member
Yunqing Tian	Team Member
Aimin Hao	Social Specialist
Armine Juergenliemk	Team Member
Bin Xu	Environmental Specialist
Extended team	

Xueming Liu	ICR Author
Guangyong Li	Team Member
Jun Zhao	Team Member
Youlu Bai	Team Member

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY11	6.823	35,354.24
FY12	23.375	118,714.80
FY13	31.007	132,975.49
FY14	6.750	49,002.07
Total	**67.96**	**336,046.60**
Supervision/ICR		
FY14	10.663	52,328.16
FY15	16.620	101,374.37
FY16	10.838	79,645.39
FY17	6.528	50,885.02
FY18	20.550	144,931.30
FY19	13.577	99,619.75
FY20	15.079	111,432.44
Total	**93.86**	**640,216.43**

ANNEX 3. PROJECT COST BY COMPONENT

Annex Table 3.1. Project Cost by Component

Component	Amount at approval (PAD estimation) (US$ mil.)	Actual at project closing (US$ mil.)	Actual as a proportion of PAD estimation (%)
	Total (IBRD loan + counterpart)	Total (IBRD loan + counterpart)	Total (IBRD loan + counterpart)
A. Irrigated Agriculture Infrastructure Improvement	202.68	204.38	101
B. Enhanced Climate-Smart Agricultural Practices	66.04	65.82	100
C. Institutional Strengthening and Capacity Building	28.63	20.75	72
D. Project Management Support	15.29	14.76	97
Total Project Cost	**312.64**	**305.71**	**98**
E. Front-end Fee	0.50	0.50	100
F. Interest Fee during Construction	0	9.61	--
Total Financing	**313.14**	**315.82**	**101**

Annex Table 3.2 Project Cost by Financer at Appraisal (US$ M)

Component	Project cost	IBRD	Counterpart funding
A. Irrigated Agriculture Infrastructure Improvement	202.68	155.33	47.35
B. Enhanced Climate-Smart Agricultural Practices	66.04	23.69	42.35
C. Institutional Strengthening and Capacity Building	28.63	19.59	9.04
D. Project Management Support	15.29	0.89	14.40
Total Project Cost	**312.64**	**199.50**	**113.14**
E. Front-end Fee	0.50	0.50	
Total Financing	**313.14**	**200.00**	**113.14**

Annex Table 3.3: Project Cost by Financer at ICR (US$ M)

Component	Project cost	IBRD	Counterpart funding
A. Irrigated Agriculture Infrastructure Improvement	204.38	155.66	48.72
B. Enhanced Climate-Smart Agricultural Practices	65.82	24.89	40.93
C. Institutional Strengthening and Capacity Building	20.75	17.98	2.77
D. Project Management Support	14.76	0.97	13.79
Total Project Cost	**305.71**	**199.50**	**106.21**
E. Front-end Fee	0.50	0.50	
F. Interest Fee during Construction	9.61		9.61
Total Financing	**315.82**	**200.00**	**115.82**

ANNEX 4. EFFICIENCY ANALYSIS

1. **Introduction:** This annex reanalyzes the financial and economic rates of return (FRRs and ERRs), calculated at appraisal, using updated prices, actual project costs, and the latest projections of future benefits. Although the methodology used basically follows that at appraisal, the accuracy of the estimation has been improved by using actual data and better projections of benefits vis-à-vis those at appraisal. In the analysis, actual project costs were derived from PMO records while future projections were based on the performance of current operations.

2. Supporting climate change resilience of agricultural production systems through infrastructure improvement, sustainable agricultural practices, and strengthening the capacity of the institutions involved to operate, maintain, and manage their assets has enhanced agriculture and water productivity in the project areas.

3. Physical infrastructure investments improved the delivery, conveyance, and water use efficiency of irrigation and drainage systems in the project areas and thus improved crop yield, diversification, and cropping intensity. Enhanced climate-smart agricultural practices such as balanced fertilization, improved tillage practices, crop residue retention, organic fertilizer use, improved seed varieties, and biological pest control measures, coupled with institutional strengthening activities, have decreased the use of chemical fertilizer and pesticide and contributed to productivity increases.

4. To carry out the economic and financial analysis, crop models were built representing the major crops in the project areas for each of the project counties and aggregated by province. Quantifiable benefits include (a) an increase in yield between the “with” and “without” scenarios; (b) an increase in cropping intensity for the southern provinces of Jiangxi, Hunan, and Chongqing; (c) a partial shift in area away from wheat and maize in favor of higher value crops (fruits and vegetables) in the northern provinces of Xinjiang, Gansu, and Liaoning; and (d) a decrease in agricultural inputs due to the adoption of enhanced climate-smart agricultural practices such as land leveling, improved tillage practices, use of crop residues and mulching, soil testing, and precise/formula fertilizer application.

5. **Crop budget models**. Typical crops are selected in each project province to draw up crop budgets. The detailed information on the crop budgets in each province appears in Annex Table 4.1.

Annex Table 4.1. Crop budget model.

Project province	Crop budget model
Xinjiang	Wheat, maize
Gansu	Wheat, maize, potato
Hunan	Paddy, rapeseeds,
Jiangxi	Paddy, rapeseeds, vegetables
Chongqing	Maize, paddy, sweet potato
Liaoning	Wheat, paddy, peanut

6. **Yield increases.** Annex Table 4.2 shows the yield increase of the main agricultural products in each project province. For most of these products, there will be a 10 to 20 percent yield increase in the “with project” scenario vis-à-vis the “without project” scenario.

Annex Table 4.2. Yield increase in "with project" scenario.

	Without project (kg/ha)	With project (kg/ha)	Incremental yield (kg/ha)	Incremental increase (%)
Xinjiang				
Wheat	5,303	5,899	596	11
Maize	9,986	11,513	1,526	15
Gansu				
Wheat	5,063	5,338	275	5
Maize	8,088	8,470	383	5
Potato	34,750	39,300	4,550	13
Hunan				
Paddy	5,946	6,477	531	9
Rapeseeds	1,733	1,894	161	9
Jiangxi				
Paddy	5,856	6,558	702	12
Rapeseeds	1,068	1,296	228	21
Chongqing				
Maize	5,726	6,140	414	7
Paddy	6,777	7,526	749	11
Sweet potato	22,746	24,705	1,958	9
Liaoning				
Corn	8,328	9,890	1,563	19
Paddy	9,150	10,200	1,050	11

Data source: Average annual yields based on the Client ICR team field-sampling surveys.

7. **Decrease in fertilizer use.** The decrease in chemical fertilizer and pesticide use has contributed to direct deceases in the cost of production inputs (Annex Table 4.3).

Annex Table 4.3. Decrease in chemical fertilizer and pesticide use in each crop model.

	Input			
	N	P	K	Pesticide
Xinjiang				
Wheat	−4	−22	−15	−34
Maize	−18	−23	−15	−50
Gansu				
Wheat	−5	−14	−19	−18
Maize	−7	−9	−17	−27
Hunan				
Paddy	−23	−10	−2	−21
Jiangxi				
Paddy	−29	−50	−23	−23
Chongqing				
Wheat	−24	−20	–	
Maize	−27	-23	−20	−40
Vegetable	−3	−3		
Liaoning				
Maize	−12	−16	−33	−13
Paddy	−10	−10	−10	−20
Vegetable	−13	−11	−12	−5

Data source: Data collected by client ICR team field-sampling surveys.

8. In contrast to financial analysis, the transfer payment items such as taxes and subsidies were adjusted in economic analysis, but no adjustments were made between financial and economic prices of agricultural commodities as few market distortions existed after four decades of market-oriented economic reform.

9. Based on the above, the economic rate of return (ERR) was estimated at 20 percent for the project. For individual provinces, the ERR varied from 17 percent to 25 percent. The financial rate of return (FRR) was calculated at 18 percent and varied from 15 percent to 22 percent among the project provinces. The ERRs at the project level and FRRs by province at project completion were comparable with those estimated at appraisal.

10. It should be noted that the analyses did not include the significant but not readily quantifiable benefits such as (i) environmental/health benefits from decreased non-point source pollution due to the decline in fertilizer and pesticide use and diminished underground water extraction, and (ii) the incremental benefits from better resource use and improved service delivery due to institutional strengthening. The ERRs at project closure as such were quite conservative estimations for the true economic values of the project.

11. **Fiscal impact analysis.** The central government is responsible for the loan repayment and the Bank loan proceeds were allocated to the project provinces as grants. The provincial and county governments have adequately provided counterpart funds. The local governments will feel no additional fiscal impact after the project completion as

the WUAs will bear the water infrastructure O&M costs. With the abolishment of agricultural taxations, the project will not have a direct contribution to fiscal revenues.

12. **Implementation efficiency.** The procurement and financial management performance were generally satisfactory (see Section IV.B). Project restructuring with a 12-month closing date extension was clearly justified (see Section I.B). Although project implementation progress was delayed at a late stage because of the COVID-19 epidemic outbreak (see Section III.B), all project activities (including those added at project restructuring) were completed before the project closure. The actual project cost (US$315.82 million) was close to the PAD estimation (USS313.14 million) and the project management cost incurred was US$14.76 million, slightly lower than the PAD estimation. The Bank loan proceeds were fully disbursed at the project closure.

ANNEX 5. BORROWER, CO-FINANCIER, AND OTHER PARTNER/STAKEHOLDER COMMENTS

Overall Feedback on the Implementation Completion and Results Report on WB-Financed Integrated Modern Agriculture Development Project

World Bank project management team,

We have received the Implementation Completion and Results Report on the Integrated Modern Agriculture Development Project with World Bank loans (hereinafter referred to as the "Completion Report") prepared by the World Bank. The Completion Report comprehensively and accurately expounds on and summarizes the implementation of this project as well as gives it high praise.

We agree with the following feedback on the Completion Report: (1) all key performance indicators have been achieved or exceeded, indicating and verifying that the development goals of the project have been fully achieved; (2) the project's efficiency has been proved by economic and financial analysis; and (3) the project is highly related to government policies and investment priorities. All ratings objectively reflect the achievements of the project.

We also agree with the summary of experiences and lessons in the Completion Report.

However, we have revised some indicators in the original text of the report for your reference.

Last but not least, we would like to thank the World Bank's Completion Report team for their strenuous efforts. Moreover, we have gained enlightenment and experience from our cooperation with the World Bank's Completion Report team.

We look forward to more cooperation with the World Bank in the future.

The Center of Budget Evaluation of the Ministry of Finance

October 25, 2021

ANNEX 6. SUPPORTING DOCUMENTS

- Project Appraisal Document
- Implementation Status and Results Reports (ISRs)
- Aide Memoires
- Restructuring Paper
- World Bank Group (2012) Country Partnership Strategy (CPS) for China, 2013–2016
- World Bank Group (2019). China Country Partnership Framework (CPF), 2020–2025
- Government Implementation Completion Report

ANNEX 7: Case Studies on Village-Level Technology Adoption and Farmers' Cooperatives

项目典型案例

案例一：世行贷款项目助推奇台县老奇台镇牛王宫村现代农业可持续发展（地表水灌区，大田粮食作物滴灌灌溉）

Case 1: The World Bank loan project promotes the sustainable development of modern agriculture in Niuwanggong Village, Laoqitai Town, Qitai County (surface-water irrigation area, field grain crop drip irrigation)

世行项目项目区新疆自治区奇台县为严重的水资源紧缺地区，年降雨量不足200mm，但年蒸发量达1800mm，因此，发展农业节水灌溉非常必要，对保证农业可持续发展具有重要意义。在本项目实施之前，当地以传统的渠道输水和地面大水漫灌的灌溉方式为主，灌溉水利用率低，需要农民人工田间疏水和整理秧苗，劳动力投入较大，种植成本高。

Qitai County, Xinjiang Autonomous Region, the area of the World Bank project, is a water-scarce area. Its annual rainfall is less than 200 mm, but annual evaporation is 1,800 mm. Therefore, it is necessary to develop water-saving irrigation, which is of great significance to ensure the sustainable development of agriculture. Before implementing the project, the traditional irrigation methods of canal water delivery and surface flood irrigation were mainly used locally, with a low use rate of irrigation water, thus requiring farmers to drain water and arrange seedlings in the field manually, which resulted in a large labor input and high planting cost.

本项目先后在在奇台县牛王宫村实施了世行贷款可持续发展农业项目，累计投资6380.17万元，治理农田面积29333亩，根据当地气候条件，在进行土地平整、条田道路规范和防护林栽植、新品种新技术推广运用等措施的基础上，以发展PVC管道输水、滴灌设备和水肥一体化的高效节水灌溉措施为主，并用于小麦、玉米、打瓜等大田作物种植，取得了非常显著的经济、社会和生态效益，为促进区域性农业可持续发展起到了很好的示范作用。主要体现在以下几个方面：一是土地基本不需要平整，种地实现了“三无”（无渠、无沟、无埂），有力促进农业向机械化、产业化、现代化方向发展。二是实现了灌溉过程中劳动力配置的减少，滴灌通过局部湿润灌溉，易溶性肥料、植物生长调节剂、内吸杀虫剂可随水滴入，减少了中耕、施肥、喷药、锄草等的作业次数和劳动力投入，以及劳动强度，也适宜妇女劳力管理，节省了大量的人力、物力。三是实现了农业产量、水资源利用率的双提高，采用滴灌和水肥一体化技术，可以防止大水漫灌所造成的土壤次生盐碱化问题，促进耕地耕地质量等级提升，同时灌溉周期可根据农作物生长需求，按时按量进行灌溉，有利于作物生长。并且可以减少无效蒸腾蒸发量，减小用水定额，提高水分生产率。小麦产量由原来的300—350kg/亩提高到600kg/亩以上，亩均灌溉用水量由原来的600m3/亩减少为300m3/亩。农民增加净收入400元/亩左右。这对于新疆这一极度干旱和水资源紧缺地区，如何更加有效的开发利用有限的水资源，加强水资源与水环境综合管理，保证水资源的额可持续利用和农业的可持续发展，加快少数民族地区经济社会可持续健康发展，具有重要的战略意义和现实作用。

The project has successfully used the World Bank loan for sustainable agricultural development in Niuwanggong Village, Qitai County, with a cumulative investment of 63.8017 million yuan and a governance farmland area of 29,333 mu. According to the local climatic conditions, based on land leveling, specification of strip roads, planting of shelter forests, and promotion and application of new varieties and technologies, the project developed PVC pipeline water transmission. Drip irrigation equipment and high-efficiency water-saving irrigation measures integrating water and fertilizer were mainly used for the planting of wheat, maize, melon, and other field crops, and this has achieved significant economic, social, and ecological benefits, and played a

good demonstration role in promoting the sustainable development of regional agriculture. This is mainly reflected in the following aspects: first, the land basically does not need to be leveled. Farming has realized the "three noes" (no canal, no ditch, and no ridge), which effectively promotes the development of agriculture in the direction of mechanization, industrialization, and modernization. Second, the labor allocation in the irrigation process is diminished. Drip irrigation can drip soluble fertilizers, plant growth regulators, and internal insecticides with water through local wet irrigation, which decreases operation times, labor input, and labor intensity of middle tillage, fertilization, spraying, and weeding. This is also suitable for women's labor management and it saves a lot of labor and material resources. Third, the double improvement of agricultural output and water resource use rate has been realized. The use of drip irrigation and water fertilizer integration technology can prevent the problem of secondary soil salinization caused by flood irrigation and promote the improvement of the grade of cultivated land quality. At the same time, the irrigation cycle can be carried out on time and in quantity according to the growth needs of crops, which is conducive to crop growth. This can also decrease ineffective transpiration and evaporation, diminish water use, and improve water productivity. Wheat yield increased from 300–350 kg per mu to more than 600 kg per mu and the average irrigation water consumption per mu decreased from 600 m^3 to 300 m^3. The net income of farmers increased by about 400 yuan per mu. This has important strategic significance and a practical role in how to develop and use limited water resources, strengthen the comprehensive management of water resources and water environment, ensure the sustainable use of water resources and the sustainable development of agriculture, and accelerate the sustainable and healthy development of the economy and society in ethnic minority areas more effectively.

通过本项目的实施，在社会、经济和推广示范方面产生的具体效益如下：

Through project implementation, the specific benefits in social, economic, and promotion demonstration are as follows:

从世行项目实施前大水漫灌粗放式管理，一个劳动力只能管理50亩耕地，到项目实施后加压滴灌、水肥一体化技术的运用、新技术新品种的推广精细化管理，现一个劳动力可以管理300亩耕地，从根本上改变了农业生产方式。

From the extensive management of flood irrigation before the implementation of the World Bank project, one labor force could manage only 50 mu of cultivated land. With the fine management of pressurized drip irrigation, the application of water fertilizer integration technology, and the promotion of new technologies and new varieties after project implementation, one labor force can now manage 300 mu of cultivated land, which has fundamentally changed the mode of agricultural production.

项目实施前大水漫灌灌溉

项目实施后的滴灌工程

项目实施后，项目区内田、林、路、桥涵、输水管道、配水管网等农田水利基础设施生产条件得到了改善，增强了适应气候变化和抵御自然灾害的能力；通过土地平整、秸秆还田、平衡施肥、新品种示范推广等适应及减缓气候变化的农业措施，提高了土壤肥力、良种覆盖率，增加了土地综合生产能力；通过农民机构能力建设及农民技术培训，提高了农业劳动者整体素质和科学种田以及生产经营参与式管理水平，增强了规模化、标准化生产能力，为实现连片种植和优势产业的规模化经营、产业化发展奠定了基础，同时对带动周边区域，加强农业基础设施建设、改善农业生产条件、提高农业综合生产能力、促进农业增效、农民增收，具有深远而重要的意义。

After project implementation, the production conditions of farmland and water conservancy infrastructure such as fields, forests, roads, bridges and culverts, water transmission pipelines, and water distribution networks in the project area have been improved, and the ability to adapt to climate change and resist natural disasters has been enhanced. Through agricultural measures to adapt to and mitigate climate change, such as land leveling, straw returning to the field, balanced fertilization, and demonstration and promotion of new varieties, soil fertility and the coverage of improved varieties have been improved, and comprehensive land production capacity has been increased. Through capacity building of farmers' institutions and farmers' technical training, the overall quality of agricultural workers and the level of scientific farming and participatory management of production and operation have been improved and large-scale and standardized production capacity has been enhanced, which has laid a foundation for the large-scale operation and industrialized development of continuous planting and advantageous industries. At the same time, this has encouraged the surrounding areas and strengthened the construction of agricultural infrastructure. Improving agricultural production conditions, improving comprehensive agricultural production capacity, promoting agricultural efficiency, and increasing farmers' income are of far-reaching and important significance.

项目实施前机电设备及管理房
Electromechanical equipment and management room before project implementation

项目实施后机电设备及管理房
Electromechanical equipment and management room after project implementation

项目实施前机耕道路及防护林
Tractor roads and shelterbelts before project implementation

项目实施后的机耕道路及防护林
Tractor roads and shelterbelts after project implementation

世行项目的实施有效带动测土配方、高效节水、水肥一体化新品种引进等技术的推广运用，辐射带动带动了全村8万亩耕地高效节水设施修建、土地平整、规范田间道路和防护林栽植、新品种新技术推广运用。世行项目所带来的不仅仅是巨大的经济效益,更多的是广泛而深远的社会效益，实现了农民增产增收。

The implementation of the World Bank project has effectively promoted the popularization and application of technologies such as soil testing formula, efficient water saving, the introduction of new varieties integrating water and fertilizer, and the construction of efficient water-saving facilities for 80,000 mu of cultivated land in the village, along with land leveling, standardized field roads and shelter forest planting, and the popularization

and application of new varieties and new technologies. The World Bank project has brought not only huge economic benefits but also broad and far-reaching social benefits upon realizing an increase in farmers' production and income.

机械化的运用。传统农业半人工化、半机械化,以及农民“面朝黄土背朝天”的景象,如今已发生根本性变化,我村粮食生产已从半人工化、半机械化，转到全程机械化的历史新阶段。我村农作物耕种收割机械化水平超过98%、比6年前提高了近40%，机械费用亩成本降低6元，精准播种技术的运用使种子播种量亩节约5公斤，亩成本降低17.5元。

Application of mechanization. Traditional agriculture is semi-artificial and semi-mechanized and farmers' scene of "facing the loess and facing the sky" has changed fundamentally. The grain production in our village has changed from semi-artificial and semi-mechanized to a new historical stage of whole-process mechanization. The mechanization level of crop farming and harvesting in our village exceeds 98 percent, which is nearly 40 percent higher than six years ago. The cost of machinery per mu has declined by 6 yuan. The application of precision sowing technology saves 5 kg of seed per mu and 17.5 yuan per mu.

土地平整
Land leveling

秸秆还田
Straw returning

灌溉方式的改变。传统农业生产灌溉方式以大水漫灌为主，现代农业生产灌溉方式以田间高效节水滴灌灌溉为主。相比之下，现代农业亩节约用水量300立方米（原每亩用水量600立方米），亩成本降低33.78元。

Changes in irrigation methods. The traditional agricultural irrigation mode is flood irrigation, and the modern agricultural irrigation mode is field high-efficiency and water-saving drip irrigation. In contrast, modern agriculture saves 300 cubic meters of water per mu (originally 600 cubic meters per mu) and the cost per mu decreases by 33.78 yuan.

施肥方式的改变。传统农业生产施肥方式以人工为主，现代农业生产施肥方式以借助加压滴灌冲施为主。相比之下现代农业亩节约使用化肥8-10公斤/亩，亩成本降低21元。

Changes in fertilization methods. The traditional agricultural fertilization method is mainly manual, and the modern agricultural fertilization method is mainly flushing with the help of pressurized drip irrigation. In contrast, modern agriculture saves 8 to 10 kg per mu of chemical fertilizer and cost per mu decreases by 21 yuan.

农作物的增产增收。世行项目实施后，农田水利基础设施和高效节水滴灌工程的建设，彻底改变了传统农业大田粮食作物大水漫灌的灌溉方式，对周边区域的农田建设起到了示范带动作用。相比传统农业提高亩产能力 20%-30%，以冬小麦为例，可增产 200 公斤/亩，增加收入 540 元（2.7 元/公斤）。以玉米为例，可增产 280-300 公斤/亩，增加收入 250 元（1.6 元/公斤）。以打瓜为例，可增产 50 斤/亩，增加收入 250 元（12 元/公斤）。以葫芦为例，可增产 50 斤/亩，增加收入 250 元（14 元/公斤）。

Increased production and income of crops. After the implementation of the World Bank project, the construction of farmland water conservancy infrastructure and high-efficiency water-saving drip irrigation has completely changed the traditional flood irrigation mode of grain crops in agricultural fields and played a demonstration and encouraging role in farmland construction in the surrounding areas. Compared with traditional agriculture, this can increase yield per mu by 20 to 30 percent. Taking winter wheat as an example, this can increase yield by 200 kg per mu and increase income by 540 yuan (2.7 yuan per kg). Taking maize as an example, this can increase production by 280 to 300 kg per mu and increase income by 250 yuan (1.6 yuan per kg). With melon as an example, this can increase production by 50 kg per mu and increase income by 250 yuan (12 yuan per kg). With gourd as an example, this can increase production by 50 kg per mu and increase income by 250 yuan (14 yuan per kg).

劳动力的减少。世行项目实施后，相比传统农业人工费用大幅度下降，小麦传统农业用工 6 个人日/100 亩，实施世行项目后，用工 3 个人日/100 亩，减少劳动力费用开支 450 元；玉米生产传统农业用工 8 个人日/100 亩，实施世行项目后用工 4 个人日/100 亩，减少劳动力费用开支 600 元；

Decrease in the labor force. After the implementation of the World Bank project, labor cost had decreased significantly compared with that of traditional agriculture. Traditional agriculture for wheat employs 6 person-days per 100 mu. After project implementation, the labor cost declined by 450 yuan. The traditional agricultural labor force for maize production was 8 person-days per 100 mu and the labor force was 4 person-days per 100 mu after project implementation, thus decreasing the labor cost by 600 yuan.

世行项目实施前，本村土地流转租金价格为 300-400 元/亩，项目实施后，现土地流转租金价格为 800-1000 元。综上所述，世行项目的实施比传统农业每亩可增加经济收入 400.78 元左右。

Before the implementation of the World Bank project, the rent price of land circulation in the village was 300 to 400 yuan per mu. After project implementation, the rent price of land was 800 to 1,000 yuan. In conclusion, the implementation of the World Bank project could increase economic income by 400.78 yuan per mu compared with traditional agriculture.

同时，参照世行项目的综合治理模式，本村还通过国内其他项目资金支持（包括高标准农田建设和高效节水灌溉项目），对本村其他5万多亩耕地也进行了综合治理和节水改造，发展滴灌和水肥一体化，现全村共8万亩耕地全面实现了高效节水灌溉，因此，世行贷款可持续发展农业项目发挥了很好的示范引导作用。

At the same time, referring to the comprehensive treatment mode of the World Bank project, the village has also carried out a comprehensive treatment and water-saving transformation of another 50,000 mu of cultivated land in the village through financial support from other domestic projects (including high-standard farmland construction and efficient water-saving irrigation projects) and developed drip irrigation and water fertilizer integration. At present, a total of 80,000 mu of cultivated land in the village has fully realized efficient water-saving irrigation. Therefore, the World Bank loan was used for a good demonstration and guidance role.

案例二：江西省进贤县南台乡赤岭世行项目区PE管道高效节水灌溉

Case 2: PE pipe efficient water-saving irrigation in Chiling World Bank project area, Nantai Township, Jinxian County, Jiangxi Province

进贤县南台乡赤岭项目区,位于进贤县南台乡赤岭村，,受益人口2400余人,节水灌溉面积258公顷(3870亩)。

The Chiling project area in Nantai Township, Jinxian County, is in Chiling Village, Nantai Township, Jinxian County, with a beneficiary population of more than 2,400 and a water-saving irrigation area of 258 hectares (3,870 mu).

项目区所涉及的8个村小组,地处军山湖南岸,属丘陵滨湖地带。在项目区实施前，耕作条件差、交通不便,虽然濒临滨湖区,但原有电灌站因多年失修.

The eight village groups involved in the project area are located on the south bank of Junshan Lake and belong to the hilly lakeside area. Before project implementation, the farming conditions were poor, and transportation was inconvenient. Although it was close to the lakeside area, the original electric irrigation station was in disrepair for many years.

项目实施前
Before project implementation

项目区PE管道高效节水灌溉系统安装
Installation of PE pipe efficient water-saving irrigation system in the project area

按照专家的建议，设计单位在项目区设计了PE管道高效节水灌溉系统。实施后，目前效益很好，主要体现在：一是灌溉时间短，原来远距离田块需要3-5天才能到田灌水，现在打开田块出水阀一秒钟就可以到水；二是增加了有效灌溉面积80公顷（1200亩），原来无法灌溉的田块，现在水源有了保障，预计年均可增收120万元；三是减少了灌溉渠道衬砌23300米，少用了1600余方的混凝土。避免了土壤难以修复的污染和破坏。少占用了耕地30余亩；四是节约了灌水成本，全年亩均可减少20元用水成本，项目区年节约用水成本约5万元；五是成立了农民用水户协会，增强了种粮大户的团队、协作、集体意识，激发了他们种田的积极性和信心。

According to the suggestions of experts, the design unit designed a PE pipe efficient water-saving irrigation system in the project area. After the implementation, the current benefits are good, which is mainly reflected in the following. First, the irrigation time is short. It used to take 3 to 5 days to irrigate the far-away fields. Now, you open the field outlet valve, and you can obtain the water in one second. Second, the effective irrigation area of 80 hectares (1,200 mu) has been increased. The original fields that could not be irrigated are now protected by water sources and it is expected that annual income can increase by 1.2 million yuan. Third, irrigation canal lining has decreased by 23,300 m along with concrete savings of more than 1,600 m^3. This avoids pollution and damage of soil that is difficult to repair. The occupation of cultivated land has decreased by more than 30 mu. Fourth, irrigation cost is saved. The annual water cost per mu can be diminished by 20 yuan and the annual water cost in the project area is about 50,000 yuan. Fifth, an association of farmer water users has been established, which has enhanced the team, cooperation, and collective consciousness of large grain farmers, and stimulated their enthusiasm and confidence in farming.

项目区实施PE管道高效节水灌溉后
After the implementation of PE pipeline efficient water-saving irrigation in the project area

大面积使用高效节水灌溉技术,在我县第一次成功实施，并发挥良好效益。得到了县委县政府高度重视和充分肯定，得到了项目区干部群众的一致赞誉.解决了项目区乡村组织和群众长期想解决而又没有解决的问题，办成项目区乡村组织和群众想办而没有办成的大事。

The large-scale use of high-efficiency water-saving irrigation technology has been successfully implemented for the first time in our county and brought good benefits into play. It has been highly valued and fully affirmed by the county CP committee and the county government, and has been unanimously praised by the cadres and the masses in the project area. It has solved the problems that the rural organizations and masses in the project area wanted to solve but had not solved for a long time, and has become a major event that the rural organizations and masses in the project area wanted to have but had not had.

Case 3: A typical case of World Bank loan project supporting the development of farmers' professional cooperatives in Tongnan District, Chongqing

（一） 支持重庆市潼南区大地升辉蔬菜种植专业合作社案例

Supporting the case of Dadi Shenghui vegetable planting professional cooperative in Tongnan District, Chongqing.

1、种植专业合作社基本情况。重庆市潼南区大地升辉蔬菜种植专业合作社是一家专门从事蔬菜种植、加工（清洗、包装、冷藏）、销售的农民专业合作经济组织，合作社成立于2013年，位于中国西部绿色菜都——重庆市潼南区的桂林万亩蔬菜基地核心区双坝村，理事长为刘世平。

1. Basic information on planting professional cooperatives. The Chongqing Tongnan District Dadi Shenghui vegetable planting professional cooperative is a farmers' professional cooperative economic organization specializing in vegetable planting, processing (cleaning, packaging, refrigeration), and sales. The cooperative was established in 2013. It is in Shuangba Village, the core area of the Guilin 10,000 mu vegetable base in Tongnan District, Chongqing, which is the green vegetable capital in Western China. Its chairman is Liu Shiping.

2、世行项目支持建设的内容。世行项目投资40余万元，帮助农业专业合作社建成水池1座、排水管道0.4公里，购买拖拉机1台、办公设备4台套，聘请科研单位示范推广萝卜和甘蓝新品种、培训蔬菜种植技术和病虫害绿色防控技术等。

2. Contents of World Bank project support. The World Bank invested more than 400,000 yuan to help agricultural cooperatives build a water tank and 0.4-km drainage pipeline, buy one tractor and four sets of office equipment, hire scientific research institutions to demonstrate and promote new varieties of radish and cabbage, and provide training on vegetable planting technology and green pest control technology.

3、世行项目实施取得的成效。世行项目的实施，助推了农业专业合作社发展壮大，促进了蔬菜产业发展和农民增收致富。

3. The results of World Bank project implementation. The project implementation has promoted the development and growth of agricultural professional cooperatives, along with the development of the vegetable industry and farmers' income.

一是助推了农业专业合作社全程服务和发展壮大。项目基础设施建设和机械设备配置，为农业专业合作社实行供种、供肥、技术、培训、收购、销售“六统一”奠定了基础，为社员提供蔬菜生产、运输、清洗、包装、冷藏、销售等全程的服务，使合作社得到快速发展。目前，农业专业合作社发展社员163户，在桂林、崇龛、太安等地有蔬菜基地面积共1200余亩，常年种植白萝卜、黄瓜、辣椒、甘蓝等蔬菜品种13个，同时带动周边农户400余户种植蔬菜1000余亩，农业专业合作社年蔬菜产量达5万余吨，其中萝卜达3万吨。

First, the project has promoted the whole-process service and development of agricultural professional cooperatives. The infrastructure construction and mechanical equipment allocation of the project have laid the foundation for the implementation of the "six unification" of seed supply, fertilizer supply, technology, training, and acquisition and sales of agricultural professional cooperatives, and provided members with whole-process services such as vegetable production, transportation, cleaning, packaging, refrigeration, and sales to allow the cooperatives to develop rapidly. At present, there are 163 members in the development of agricultural professional cooperatives. There are vegetable bases in Guilin, Chongniche, Tai'an, and other places, covering an area of more than 1,200 mu. Thirteen vegetable varieties such as white radish, cucumber, pepper, and cabbage are planted throughout the year. At the same time, more than 400 surrounding farmers are motivated to plant more than 1,000 mu of vegetables. The annual vegetable output of agricultural professional cooperatives surpasses 50,000 tons, including 30,000 tons of radish.

大地升辉合作社及其萝卜种植基地
Dadi Shenghui cooperative and its radish planting base

二是助推了农业专业合作社品牌创建和市场销售。结合世行项目实施，农业专业合作社积极推广萝卜和甘蓝新品种、蔬菜种植和病虫害绿色防控技术，搞好尾菜处理和地膜回收，大力实施标准化蔬菜生产和绿色品牌创建，13个蔬菜品种获得绿色食品认证和绿色食品A级证书，白萝卜获得国家“生态原产地保护产品”标识使用权。同时，通过蔬菜直接配送、“农超对接”、“网络+基地”电商等方式，农业专业合作社蔬菜产品畅销全国各省、市，并出口俄罗斯等其它国家。

Second, this has boosted the brand creation and marketing of agricultural professional cooperatives. Combined with the implementation of the World Bank-supported project, agricultural professional cooperatives actively promoted new radish and cabbage varieties, vegetable planting, and green pest control technology; did a good job in tail vegetable treatment and plastic film recycling; vigorously implemented standardized vegetable production and green brand creation; and 13 vegetable varieties obtained green food certification and a green food class A certificate. White radish obtained the right to use the national logo of "ecological origin protection product." At the same time, through direct vegetable distribution, "agricultural supermarket docking," and "network + base" e-commerce, the vegetable products of professional cooperatives sell well in all provinces and cities of China and are exported to Russia and other countries.

合作社获得的认证及奖项
Certification and awards received by cooperatives

三是带动了全区蔬菜产业发展和农民增收。农业专业合作社的蔬菜种植、加工、销售发展模式，不仅示范带动了桂林蔬菜基地的发展，而且引领了潼南蔬菜产业发展，形成了中国西部绿色菜都强力的支撑，蔬菜种植亩平纯收益在2000元以上，农民实现了蔬菜种植增收。同时，农业专业合作社年支付务工工资140余万元，其中蔬菜种植、管理常年基地用工20余人，工资80—100元/天；采收、运输、清洗、包装、进冻库、出冻库、上车等季节性用工60—80人，工资200—400元/天，正常夫妻二人年打工收入在10—12万元，带动周边农民群众就近务工增收。

Third, this has driven the development of the vegetable industry and increased farmers’ income in the region. The development model of vegetable planting, processing, and sales of agricultural professional cooperatives not only demonstrated and promoted the development of the Guilin vegetable base, but also led the development of the Tongnan vegetable industry, thus forming strong support for green vegetables in Western China. The average net income per mu of vegetable planting is more than 2,000 yuan and farmers have increased their income from vegetable planting. At the same time, the professional agricultural cooperatives pay more

than 1.4 million yuan for migrant workers every year, including more than 20 employees for vegetable planting and the management base, with a salary of 80 to 100 yuan per day. There are 60 to 80 seasonal workers for harvesting, transportation, cleaning, packaging, entering and leaving the frozen warehouse, getting on the bus, etc., with a salary of 200 to 400 yuan per day. The annual working income of a normal husband and wife is 100,000 to 120,000 yuan, thus stimulating the surrounding farmers to work nearby to increase their income.