



Report Number: ICRR0022453

1. Project Data

Project ID

P121414

Project Name

CN-Sichuan Wudu Irrigated Agric Dev

Country

China

Practice Area(Lead)

Water

L/C/TF Number(s)

IBRD-81220

Closing Date (Original)

31-Dec-2017

Total Project Cost (USD)

100,000,000.00

Bank Approval Date

28-Feb-2012

Closing Date (Actual)

31-Oct-2019

IBRD/IDA (USD)
Grants (USD)

Original Commitment

100,000,000.00

0.00

Revised Commitment

100,000,000.00

0.00

Actual

100,000,000.00

0.00

Prepared by

Hassan Wally

Reviewed by

April B. Connelly

ICR Review Coordinator

Ramachandra Jammi

Group

IEGSD (Unit 4)

2. Project Objectives and Components

a. Objectives

The Project Development Objectives (PDOs) of the Sichuan Wudu Irrigated Agriculture Development Project as articulated in the Project Appraisal Document (PAD, paragraph 10) were identical to those stated in the Loan Agreement (LA, page 5) and aimed to:

"(a) increase the coverage of irrigation services in the Project Area in order to increase agricultural production; (b) provide water supply, in bulk, to small rural communities and industries in the project area; and (c) introduce a community-based participatory approach in the management of water



facilities and infrastructure and increase of production capacity of higher-value agro-products in the Project Area to ensure the sustainable development of agriculture."

In December 2017, the PDO was revised as follows:

"(a) increase the command area for irrigation in the project area; (b) increase bulk water supply capacity for small rural communities and industries in the project area; (c) introduce community based participatory approach in the management of water facilities and infrastructure in the demonstration areas."

According to the PAD (page 3, footnote#1) "The project area refers to the irrigated area of 70,200 hectares covered by the Wudu Second-phase Irrigation Scheme, including 60,250 hectares under Xizi Main Canal, and 9,950 hectares directly under Wudu Reservoir."

The key beneficiaries of the project were about 1.35 million poor farmers (397,000 households) who were expected to receive reliable irrigation water supplies and change from mainly dry farming to irrigated agriculture and boost their agriculture production. Other key beneficiaries were about 1.7 million poor people in rural and small urban communities, in addition to the industries in Mianyang City and other cities who would be provided by water supply, in bulk, from the irrigation infrastructure for drinking and industrial purposes (PAD, paragraph 11).

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

Yes

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

No

c. Will a split evaluation be undertaken?

No

d. Components

The PDOs were supported by three components as follows:

1. Construction of Main Irrigation Systems (appraisal cost: US\$691.03 million, of which Bank Financing was US\$97.41 million, actual cost: US\$662.94 million). This component aimed to finance the construction and operation of the second phase of the Wudu Scheme to irrigate about 70,200 hectares of land as well as to supply water to urban and rural areas, and water to industries in the project area. This included two systems: (1) Construction of branch canals from the right and left segments of the Wudu Reservoir to irrigate areas directly under said Reservoir. (2) Construction of a new main irrigation system consisting of: (a) Construction of Xizi Main Canal with a total length of about 108 km to divert water from the Wudu Reservoir to irrigate areas under said Canal in the Project Area and consisting of numerous structures including tunnels, aqueducts, siphons, gates and other structures; (b) Construction of a reservoir at Jinfeng with intake from the Xizi Canal with a total storage capacity of 98 million cubic meters consisting of tunnels, aqueducts, siphons, gates and other structures



including an asphalt concrete core sock-fill dam with a height of 88m and a chest length of 454.87m, an irrigation intake and a tunnel to supply and regulate the supply of water to the irrigation system to be constructed; and (c) Construction of Jinlong sub-main canal and 16 branch canals consisting of numerous structures including tunnels, aqueducts, siphons, gates and other structures to divert water to irrigate areas covered under the Xizi Main Canal to be constructed.

2. Development of Community Demand Drive (CDD) based WUAs and construction of on-farm Works in Demonstration Areas (appraisal cost: US\$4.49 million, of which Bank Financing was US\$0.90 million, actual cost: US\$3.36 million). This component would support carrying out of on-farm development works under CDD approach in selected demonstration areas in the counties of Jiangyou, Zitong and Yanting of Mianyang City covering about 766 hectares within the irrigated area covered by the second phase of the Wudu Water Diversion and Irrigation Scheme and consisting of: (1) Construction of on-farm works including 1 lateral canal and 3 sub-lateral canals with a total length of about 48 km; (2) Establishment and development of Water Users' Associations (WUAs) and enhancement of producer co-operatives based on community demand driven approach around a lateral canal area or sub-lateral areas in each demonstration area to organize and implement the construction, operation and maintenance of on-farm works; and (3) Provision of an integrated package of agricultural inputs and supporting services in each demonstration area to small holder agricultural producers and farmer groups to maximize the benefit of irrigated water delivered to the field and help increase farmer's production and income.

3. Institutional Capacity Building and Project Management Support (appraisal cost: US\$1.44 million with Bank financing 100%, actual cost: US\$1.46 million). This component would provide technical assistance for the institutional strengthening of the project counties and Sichuan to implement the project including: (1) Capacity building through, inter alia, study tours and training; (2) Consulting services and office equipment; and (3) Acquisition of vehicles to provide necessary technical support for implementing the activities under the Components 1 and 2 of the Project.

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

Project Cost. The total project cost was estimated to be US\$700.77 million, which included: US\$3.56 interest during construction and US\$0.25 million front end fees. Actual cost according to the ICR Data Sheet (page 2) was US\$672.17 million or about 96% of the appraisal estimate. The difference was due to a lower contribution of counterpart funding by the borrower (see below for more details).

Financing. The Project was financed through an IBRD Specific Investment Loan (SIL) in the amount of US\$100.00 million. The Bank Loan was on standard IBRD terms for a US Dollar denominated, variable spread loan (VSL) based on six-month LIBOR, plus an additional variable spread. Commitment-linked repayment in 25 year period, including a 6 year grace period, level repayment of principal. The full amount of the Bank loan was disbursed ICR, page 2).

Borrower Contribution. The borrower and the beneficiaries were expected to contribute US\$599.64 million and US\$1.13 million, respectively. The actual amount according to the ICR (page 2) was US\$572.17 million



or 95% of the estimated amount. The ICR did not provide a disaggregation of the counterpart funding amount and did not explain why the counterpart funding was less than expected.

Dates. The project was approved on February 28, 2012 and became effective four months later on July 11, 2012. The Mid-term Review (MTR) was conducted on April 11, 2016, four months later than the scheduled date on December 31, 2015. The project closed on October 31, 2019, which was twenty two months later than the expected closing date on December 31, 2017. According to the ICR (paragraph 23) "the closing date was extended to address the project implementation delay in the completion of the main systems construction and the demonstration of participatory on-farm works management." The project was restructured once (Level 2) on December 28, 2017, when the amount disbursed was US\$71.69 million, in order to revise the Project Development Objectives, change the Results Framework, change components and costs, extend the Loan Closing Date, and change the implementation schedule. These changes, specifically the revision of the PDO, were relevant and reflected the project scope in terms of the physical structure, which was defined as "construction of main irrigation system" in both the PAD and Loan Agreement (ICR, paragraph 20).

3. Relevance of Objectives

Rationale

Context at Appraisal. Mianyang City had relatively abundant water resources with over 1,100 mm of annual rainfall and the water-rich Fujiang river flowing through the City. However, the project area was very short of water for irrigated agriculture, mainly because of the relatively uneven temporal and spatial distribution of water resources. Four key development issues were identified in water resources development and utilization in the project areas: (a) main irrigation infrastructure systems and on-farm works (lateral, sub-lateral and farm ditches) needed to be constructed or rehabilitated urgently to help agricultural production recover from the big earthquake; (b) water shortages and frequent droughts impeded agricultural development; (c) water use efficiency and productivity were very low (water use in irrigated agriculture accounts for 66% of the total water use, and the actual consumptive use of water accounted for only 20% of the total available water resources in the City); and (d) sustainability of constructed water infrastructure was not ensured.

Previous Sector Experience. The design followed Chinese national technical standards and benefited from the lessons learned from the Wudu First-phase Irrigation Scheme built in 2002. It also took into account the 2008 earthquake which hit some of the project areas and the design of the scheme structures in those areas was adjusted to resist an earthquake of magnitude of 7.0 on Richter scale.

Relevance to Government Strategies. At appraisal, objectives were in line with the Government's strategy and its 12th Five-year plan (2011-2015) in such water shortage areas to increase agricultural production and farmer incomes with integrated measures. At completion, objectives also remained in line with the Government's priorities for water resources development as outlined in China's 13th FYP for 2016-2020. These priorities included: emphasizing the construction and rehabilitation of water engineering works, particularly in irrigated agriculture, and integrating the increase in water use efficiency with increasing farmers' income and agricultural production. Objectives were also in line with China's recently



launched National Rural Revitalization Program and the 14th FYP (for the period 2021-2025) as the project focused on delivering water to communities for domestic and industrial use in the project areas. Finally, according to the ICR (paragraph 27), "the second phase of the Wudu Scheme remains the top priority in water sector development for Sichuan Province in its new program for large scheme rehabilitation and development."

Relevance to Bank Assistance Strategies. At appraisal, objectives were in line with Bank's 2006-2010 Country Partnership Strategy (CPS) for China. Specifically, the project would support Pillar 2 of the CPS to reduce poverty, inequality and social exclusion, through promoting balanced urbanization, sustaining rural livelihoods, and expanding access to basic social and infrastructure services, particularly in the rural areas. Objectives would also support Pillar 3 to manage resource scarcity through conserving water resources. At completion, objectives were also in line with Bank's Country Partnership Strategy for China (CPS, FY11-FY15). Specifically, objectives would contribute to Strategic Theme 1: Supporting Greener Growth, through promoting Sustainable Agriculture Practices by in particular helping to deliver water to expand agricultural production and also to improve water productivity through support to agricultural extension technologies, modern irrigation technologies, WUAs and water markets in the demonstration areas. Objectives would also contribute to Strategic Theme 2: Promoting More Inclusive Development through enhancing Opportunities in Rural areas and small towns. The project would enhance secondary town development by helping local governments design integrated rural-urban development plans, financing small town infrastructure, including water supply and sanitation. The project would entail investment in water supply facilities to provide water supply in bulk to small rural communities and industries in the project area. Finally, objectives continued to be in line with the Bank's Country Partnership Framework for China (CPF, FY20-FY25) which emphasized support for addressing natural resource (including water) scarcity, increasing farm productivity, promoting efficiency and productivity in water use and its quality, and overall water governance. While the current CPF continued to reflect a strong engagement with China, activities will be increasingly selective as lending declines, with a focus on China's remaining institutional gaps and the country's contribution to global public goods (ICR, page 12, footnote#11). This implies that the relevance of objectives to the current CPF declined.

The original statement of objectives was clear, outcome oriented and focused yet ambitious. While the original objectives were overambitious, it was connected to higher level objectives of contributing to the sustainable development of agriculture in the region. However, the "original PDO and indicators were not aligned with the project scope (ICR, paragraph 28)". This questions the relevance of the original objectives, which were later revised in 2017. While the revised objectives were realistic and reflected the real scope of the project within its implementation time-frame, they could have been pitched at a more intermediate level to reflect outcome level results not just outputs. Also, the revised objectives lacked a connection to higher level objectives, namely, to improve livelihoods of poor farmers in the project area; and to enables farmers to decide on ways to increase their incomes-through showcasing CDD approaches, with assistance as necessary from local government.

Overall, Relevance of Objectives is rated Substantial. This rating reflects an over ambitious original objectives that were beyond the scope of the project, and realistic revised objectives. The revised objectives reflected the Government and Bank priorities, but lacked a connection to higher level objectives.



Finally, the most recent Bank CPF (FY20-FY25) for China pointed out a decrease in lending and a shift in the Government's priorities, which implied that the relevance to the current CPF declined.

Rating

Substantial

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective

To increase the command area for irrigation in the project area.

Rationale

Theory of Change (ToC). To increase the command area for irrigation in the project area, the project financed the upstream infrastructure (main, sub-main and branch canals) which can provide water to the command area. This included: the construction of Xizi Main Canal with a total length of 108 km, the construction of 24.24 km of the Jinlong sub-main Canal, and the construction of 16 branch canals with a total combined length of 325 km. Improving the upstream irrigation infrastructure was expected to result in more irrigation water availability which in turn would result in an increase in the command area. Anticipated longer-term outcome was the enhancement of irrigation services in the project area which would lead to increased and higher-value agricultural production. The upstream irrigation infrastructure that the Bank is financing will be complemented by on-farm infrastructure that the local government is financing.

Key Assumptions. The ICR did not include any assumptions that relate to the achievement of the stated PDO.

The ToC clearly reflected the relation between the intended activities and the expected outputs, outcomes and longer-term outcomes. However, it lacked any mention of the key assumptions the underpinned the achievement of the stated PDO.

Outputs

The following outputs were reported by the ICR (Annex 1) unless referenced otherwise.

Construction of Main Irrigation Systems, which includes completion of:

- Xizi Main Canal with a total length of about 108 km including tunnels, aqueducts, siphons, gates and other structures (target achieved).
- a reservoir at Jinfeng with intake from the Xizi Canal with a total storage capacity of 98 million m³ consisting of tunnels, aqueducts, siphons, gates and other structures including an asphalt concrete



core sock-fill dam with a height of 88m and a chest length of 454.87m, an irrigation intake and a tunnel to supply and regulate the supply of water to the irrigation system to be constructed.

- Jinlong sub-main canal and 16 branch canals consisting of numerous structures including tunnels, aqueducts, siphons, gates and other structures to divert water to irrigate areas.

Outcomes

By project completion, 108 km of the Xizi main canal and 305.24 km of sub-main or branch canals were fully completed under the project. These works were expected to ensure that water was delivered, through sub-main or branch canal and on-farm works (once completed), to the field. The increased command area for irrigation with the project (PDO outcome indicator #1) reached 929,600 mu (a Chinese unit of land measurement that varies with location but is commonly 0.165 acre, or 666.5 square meters - ICR page 7, footnote#6). While the target for the increase in the command area for irrigation was fully achieved, the ICR did not provide a baseline value for the command area prior to the project intervention. About 1.2 million farmers were expected to benefit from the increased command area for irrigation with the project (PDO outcome indicator #3, target: 1.15 million, exceeded). The ICR (paragraph 30) reported that "all six counties have prepared and approved investment plans for the construction of on-farm works (in addition to the on-farm works already completed in the three demonstration areas). Construction was underway in three counties at the end of September 2020 on 11 lateral canals (of the total of 52, including the one from the demonstration site) in the scheme areas and three (of nine) water treatment plants. The remaining three counties are scheduled to start construction by end 2020."

Based on the above-mentioned assessment, efficacy of achieving this outcome is rated Substantial.

Rating

Substantial

OBJECTIVE 2

Objective

To increase bulk water supply capacity for small rural communities and industries in the project area.

Rationale

Theory of Change (ToC). To increase bulk water supply capacity for small rural communities and industries in the project area, the the project financed the upstream infrastructure (main, sub-main and branch canals). This included: the construction of Xizi Main Canal with a total length of 108 km, the construction of 24.24 km of the Jinlong sub-main Canal, and the construction of 16 branch canals with a total combined length of 325 km. Improving the upstream irrigation infrastructure was expected to result in increasing bulk water supply capacity for small rural communities and industries in the project areas. Anticipated longer-term outcome was the provision of reliable bulk water supply to rural communities and industries to ensure sustainable development of agriculture.



Key Assumptions. The ICR did not include any assumptions that relate to the achievement of the stated PDO.

The ToC clearly reflected the relation between the intended activities and the expected outputs, outcomes and longer-term outcomes. However, it lacked any mention of the key assumptions the underpinned the achievement of the stated PDO.

Outputs

The following outputs were reported by the ICR (Annex 1) unless referenced otherwise.

The outputs mentioned under Objective 1 pertain to this objective as well.

Outcome

As a result of the completion of the main and sub-branch canals, there was sufficient water available in the canal to be diverted by local industrial and domestic water users. By project completion, the Increased annual industrial and domestic water supply capacity (PDO outcome indicator #2) reached 137.52 million cubic meter per year (m3/year, target achieved). The ICR did not provide a baseline for this indicator. According to the ICR (paragraph 33) "completion of the increased water supply capacity has sped up the construction of rural water supply networks to provide clean water to the rural communities along the water supply canals to ensure drinking water safety, and have contributed greatly to China's National Program on Drinking Water Safety in the project areas."

Based on the above-mentioned information and on the achievements under PDO1, it is plausible to assume that the project succeeded in increasing bulk water supply capacity for small rural communities and industries in the project area. Therefore, efficacy of achieving this outcome is rated Substantial.

Rating

Substantial

OBJECTIVE 3

Objective

To introduce community based participatory approach in the management of water facilities and infrastructure in the demonstration areas.

Rationale

Theory of Change (ToC). To introduce community based participatory approach in the management of water facilities and infrastructure in the demonstration areas, the project would organize study tours and capacity building activities as well as establishing water user associations (WUAs) with respective O&M plans. These activities were expected to in result in community based participatory approach in the management of water facilities and infrastructure in the demonstration area. Anticipated longer-term outcomes include an enhanced of irrigation services in the project area which would lead to increased and higher-value agricultural



production, and the provision of reliable bulk water supply to rural communities and industries to ensure sustainable development of agriculture.

Key Assumptions. The ICR did not include any assumptions that relate to the achievement of the stated PDO.

The ToC clearly reflected the relation between the intended activities and the expected outputs, outcomes and longer-term outcomes. However, it lacked any mention of the key assumptions the underpinned the achievement of the stated PDO.

Outputs

The following outputs were reported by the ICR (Annex 1) unless referenced otherwise.

- Development of 63 additional WUAs (as of project closure) in non-demonstration areas, with an additional 127 WUAs in the pipeline that will extend coverage to the entire project area, thus confirming the sustainability and replicability of the model demonstrated under the project.
- To strengthen capacity of project management, 40 PMO staff were familiarized with project concept, approach and operational procedures (target achieved), and 80 female project staff participating in domestic and overseas study tours organized by the project (target achieved).
- 38.91 km of laterals and sub-laterals were completed in demonstration sites which ensures that water was delivered directly to the farmland in the demonstration areas.

Outcomes

The project organized WUAs and producer co-operatives based on a community demand driven approach. The ICR did not report on the number of cooperatives involved in the project, but stated that "various producer cooperatives and organizations became proactive in their involvement in WUA operations, including oilseed cooperatives, pig raising cooperatives, horticulture associations, and shrimp farming associations (ICR, paragraph 38)." To maximize the benefit of irrigated water delivered to the field and help increase farmers' production and income, the project provided an integrated package of agricultural inputs and supporting services in each of the three demonstration areas to smallholder agricultural producers and farmer groups (ICR, paragraph 37).

The WUAs developed under the project were registered with the local Civil Affairs Authority as autonomous entities with a mandate for O&M of on-farm works and water management (ICR, paragraph 38). The WUAs carried out on-farm works and operated and maintained them on completion of construction. Also, WUAs helped readjust cropping patterns and increase cropping intensities with irrigation water delivered during the critical stages of crop management. By project completion, 22 O&M plans were prepared for both main system and on-farm system in the demonstration areas (PDO outcome indicator #4, target achieved). O&M plans for the on-farm works were prepared and will be financed through inputs in kind and a limited water tariff surcharge to be decided by the WUA members. While the WUAs were expected to address low cost O&M repairs, local Governments "would assume responsibilities for big repairs of on-farm works (mainly for laterals, rather than farm ditches)" (ICR, paragraph 38).

According to the ICR (paragraph 40), when compared to non-demonstration villages, the data showed that the CDD demonstration villages saw the summer crop yields increase by 20% and cropping intensity by 30% as a result of additional vegetable production in Changliang village, one of three demonstration sites in Zitong



County. Also, farm household incomes were estimated to have increased between 30-70% depending on the cropping pattern. This Review agrees with the assessment in the ICR (paragraph 40) that "further increases in income are expected in the coming years from improved crop yields, changes in cropping patterns (shifting to higher value crops), increased cropping intensities, and diversifying into aquaculture/livestock production."

Based on the above-mentioned assessment, efficacy of achieving this objective is rated Substantial.

Rating
Substantial

OVERALL EFFICACY

Rationale

Overall Efficacy is rated Substantial. The provided evidence point to the success of the project in increasing the irrigation command area through the completion of the main and branch canals in the project area (PDO#1). As a result of the completion of the main and sub-branch canals, there was sufficient water available in the canal to be diverted by local industrial and domestic water users (PDO#2). By project completion, the Increased annual industrial and domestic water supply capacity (PDO outcome indicator #2) reached 137.52 million cubic meter per year (m³/year, target achieved). Finally, the project successfully introduced community based participatory approach in the management of water facilities and infrastructure in the demonstration areas (PDO#3). It also demonstrated results in terms of increased production and the replicability of the participatory on-farm water management for the scheme as whole .

Overall Efficacy Rating

Substantial

5. Efficiency

Economic and Financial Efficiency

ex ante

- The overall project economic rate of return (ERR) was estimated at 13%, and the NPV (at a discount rate of 12%) was estimated at US\$278.98 million.
- Economic Analysis. A cost benefit analysis was conducted at appraisal. The major quantifiable benefits of the project (on an incremental basis) were derived from: (a) agricultural production from increased irrigation service areas; (b) value of water for industrial uses; and (c) value of water for domestic use.
- Non-quantifiable benefits that were not included in the analysis: flooding control/drainage function provided by the irrigation canal system; development of improved water management, social capital and



institutional capacity; and the improved quality of soil and agricultural products due to the adoption of good agricultural production practices.

- Financial Analysis. Financial analysis was conducted to gauge project impact on farmers' incomes, and to set the minimum water price charged for reservoir water users to cover the O&M costs. Crop budget and farm models were formulated under "with" and "without" project situations to gauge the financial attractiveness to farmers from: (a) improved crop yields; (b) changed cropping pattern (shifting to higher value crop); and (c) increase cropping intensities.
- The PAD included a brief description of the economic and financial analysis and it did not include a detailed Annex as expected. The assumptions used in the analysis were not clearly reported, and there was no sensitivity analysis included.

ex post

- The ERR at completion was estimated at 11%, which was moderately lower than the ERR estimated at appraisal (13%), but against the Opportunity Cost of Capital of 5% represented a high return. According to the ICR (paragraph 43) the lower ex-post ERR was "due to the scheme-wide on-farm works starting after project closure, instead of before project closure." The analysis followed the same approach adopted at appraisal.
- Assumptions. The economic life of the scheme was assumed to be 30 years; both cost and benefit flows are based on 2019 constant prices; costs are net of duties and taxes; the discount rate adopted by the analysis was 5% ; and the construction schedule of the on-farm works was based on the latest local government investment plan by county.
- Sensitivity analysis. To gauge the impact of a delay in on-farm investments beyond the next FYP (2021-2025), a sensitivity analysis indicated that the ERR would drop to 6%. It worth noting that the on-farm investments were not financed by the Bank (ICR, paragraph 54).

Administrative and Institutional Efficiency.

The project required a 22 months extension of the closing date. According to the ICR (paragraph 46), this extension was needed to accommodate delays that stemmed from "procurement issues and delayed government approval of the preliminary design (ICR, paragraph 46)." Despite the delays, all project activities were implemented and completed at costs below the appraisal and restructuring estimates (96% of appraisal estimates and 93% of estimates at restructuring), mostly due to bidding savings. The bank loan was fully disbursed.

Overall, Efficiency is rated Substantial. While the estimated ex-post ERR was moderately lower than the ERR at appraisal (11% compared to 13%), it was still considerably higher than the opportunity cost of capital at 6%. The project faced implementation delays that were largely beyond the control of the project. Finally, project implementation costs were below the appraisal and restructuring estimates despite the delays.



Efficiency Rating

Substantial

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

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	13.00	100.00 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	11.00	100.00 <input type="checkbox"/> Not Applicable

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

6. Outcome

Relevance of Objectives was rated Substantial. Overall efficacy was rated Substantial. The evidence provided in the ICR point to the success of the project in increasing the irrigation command area (PDO#1) through the completion of the main and branch canals in the project area. As a result of the completion of the main and sub-branch canals, there was sufficient water available in the canal to be diverted by local industrial and domestic water users (PDO#2). The project also successfully introduced community based participatory approach in the management of water facilities and infrastructure in the demonstration areas (PDO#3). Efficiency was rated Substantial despite that the estimated ex-post ERR was moderately lower than the ERR at appraisal (11% compared to 13%).

Given that all of the three assessed criteria (Relevance of Objectives, Efficacy and Efficiency) were rated Substantial, this project's implementation had minor shortcomings and its overall outcome is therefore rated Satisfactory.

a. Outcome Rating

Satisfactory

7. Risk to Development Outcome

The ICR (paragraph 79) discussed one main risk that could impact the project development outcome:

The risk that slow or insufficiently funded on-farm works investment would negatively impact the materialization of the long-term outcomes of the project. While the ICR (paragraph 79) described this as a



major risk, it stated that adequate measures were taken to address it. These measures included the following:

1. A positive policy environment that puts on-farm investments as a priority for national and provincial water sector development;
2. On-farm works and water supply facilities investment for the second phase Wudu Scheme are also part of an economic stimulus package addressing the outbreak of COVID-19;
3. The investment plans for on-farm works by county and by lateral canal for the entire scheme are being funded by local government bonds and development banks;
4. O&M plans for the main system were approved and funded through the municipal budget;
5. WUAs are being expanded to cover the entire project area and are expected to address on-farm works O&M.

This Review adds the following risk:

The risk concerning the sustainability of the WUAs that the project created. While the WUAs were expected to address low cost O&M repairs, local Governments "would assume responsibilities for big repairs of on-farm works (mainly for laterals, rather than farm ditches)" (ICR, paragraph 38).

8. Assessment of Bank Performance

a. Quality-at-Entry

The project was the second phase of a large-scale water diversion scheme of the Sichuan Province. The first phase was partially financed by the International Development Association (IDA), and was completed in 2002. This project was designated as a national key water-sector project by the Ministry of Water Resources in China's 12th FYP (2011-2015), and it supported the government's strategy in such economic water scarcity areas to increase agricultural production and farmer incomes (ICR, paragraph 4). The original project development objectives were ambitious and beyond the scope of the project activities. These objectives were revised as part of the 2017 restructuring. The project design involved complex works in mountainous areas. Activities were adequately sequenced to complete the upstream works prior to reaching the farms. Implementation arrangements reflected the centralized scheme-wide design, but featured a decentralized approach at the county level (ICR, paragraph 53). A notable design shortcoming was the lack of clarity on the inclusion of on-farm works in the project (ICR, paragraph 74).

According to the ICR (paragraph 54), "risks were assessed appropriately at appraisal and mitigation measures were explicitly identified." Notable risks identified at appraisal included lack of familiarity with Bank requirements and procedures with regards to fiduciary aspects and safeguards, synchronization of



the construction activities, and delay in the completion of the on-farm works-which were not financed by the Bank.

During appraisal, the Bank appraised the on-farm works as part of the project. However, the Sichuan government policies required that the on-farm works be funded through local funds after the completion of the upstream works (main system). The PDO and the indicators were formulated to reflect the Bank's understanding of the project- that the main system would be connected to the on-farm works and water would be transferred to the farm level within the project implementation timeline. While this was corrected in the loan agreement, the PDO and RF in the PAD presented to the World Bank Board of Executive Directors for approval were not revised. These revisions were only made in 2017 right before the original closing date. The ICR did not explain the reason(s) for such late attention to this issue.

M&E suffered from design weaknesses as the results framework (RF) "was not reflective of the project design (ICR, paragraph 53)." Specifically, the PDO indicators were long-term impact indicators that would not be realized by project completion. These were closely linked to on-farm works and water supply facilities investments that were expected to be completed after the project (see section 9a for more details).

Overall, Quality at entry is rated Moderately Unsatisfactory. This rating reflect significant shortcomings that included an overambitious original PDO that was beyond the scope of project activities and M&E design weaknesses.

Quality-at-Entry Rating Moderately Unsatisfactory

b. Quality of supervision

The Bank conducted implementation support missions, but the ICR did not specify the number of missions conducted. It stated that missions were "regular, candid and timely in reporting progress and highlighting issues, and proposed practical follow-up actions (ICR, paragraph 76)." Supervision benefited from basing the Task Team Leader in Beijing for most of the time through preparation and implementation, with the exception of the period from July 2015 to July 2017 (ICR, paragraph 76). Bank supervision focused on the quality of engineering work as well as on the development of CDD-based on-farm works in the demonstration areas, and on project management capacity. Supervision missions also provided timely support on safeguard policies and on fiduciary aspects. The Bank missions worked with the project management on formulating the investment plan for on-farm works, O&M plans for the completed works, and scheme-wide WUA development. Bank supervision promptly identified and addressed implementation bottlenecks including procurement-related delays, and follow up actions were proposed and addressed. The Bank team worked closely with the government to put in place appropriate remedial actions to address the conflicts of interest raised in the 2014 and 2015 audit reports in a timely manner (see section 10 b for more details).

A notable Bank supervision shortcoming was the long time taken to address the the misalignment of the original PDO and related indicators with the project scope. This Review is in agreement with the ICR that



restructuring "the project should have been carried out much earlier during implementation (ICR, paragraph 58)."

Quality of Supervision is rated Moderately Satisfactory given the limited response to using restructuring as a means to quickly improve the project's performance.

Quality of Supervision Rating

Moderately Satisfactory

Overall Bank Performance Rating

Moderately Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design

The project appraisal document (PAD) did not include a Theory of Change (ToC) as it was not mandated at appraisal. Nonetheless, the ICR (page 9) included one which reflected the relation between the planned project activities, its outputs, outcomes and long-term impacts. However, the ToC in the ICR lacked the critical assumptions that underpinned the achievement of the PDOs and could have benefitted from a brief discussion. The achievement of the PDO was to be assessed through five PDO level indicators:

#1. Increased new effective irrigated area with the project, #2. Annual value of agricultural production per mu, #3. Annual amount of industrial and domestic water supply, #4. Number of farmers (and female farmers) benefiting from the supplementary irrigation, and #5. Number of O&M plans prepared and implemented for both main and on-farm systems. PDO indicators # 1, #2 and #4 address the first objective (to increase the coverage of irrigation services in the Project Area in order to increase agricultural production). While these indicators were relevant, specific, measurable, and time bound, increasing agricultural production was beyond the scope of the project. PDO indicator #3 addressed the second objective (to provide water supply, in bulk, to small rural communities and industries in the project area). This indicator was directly linked to the objective and measurable. PDO#5 addressed the third objective (to introduce a community-based participatory approach in the management of water facilities and infrastructure and increase of production capacity of higher-value agro-products in the Project Area to ensure the sustainable development of agriculture). The indicator was measurable and relevant, but it addressed only the first part of the objective. There were no indicators to assess the increase of production capacity of higher-value agro-products in the project area to ensure the sustainable development of agriculture. The ICR (paragraph 59) correctly stated that "the PDO indicators were long-term impact indicators, which could only be realized when on-farm works and water supply facilities investments were completed after the project."

The results framework (RF) included ten intermediate outcome indicators to assess the different activities supported by the project. The majority of these were quantitative capturing different physical targets that would be achieved under the project. Some intermediate outcome indicators were later dropped because they were connected to the on-farm works, these include: Irrigation water use efficiency increased in the irrigation area, and Agricultural value increased per unit of water.



M&E design suffered from a notable shortcoming reflected in the disconnect between the original indicators and the project's scope and interventions. Also, some outcome indicators lacked baseline targets and most output indicators had no targets.

b. M&E Implementation

Data collection and processing was done through an independent institute supported by the county Project Management Offices (PMOs) and the Management Information System (MIS) (ICR, paragraph 60). The project staff at both municipal and county levels were trained in the operation of the MIS. According to the ICR (paragraph 60) "the data verification process was rigorous, backed by engineering quality assurance reports, and cross-checked with contract payments for reliable progress status and indicator values." While M&E reports on the intermediate indicators were prepared regularly, tracking of the original PDO indicators was limited until restructuring in 2017. According to the ICR (paragraph 60) "the original PDO indicators could not have been reported on until only after the project closed."

Restructuring and revision of the RF. Part of the 2017 restructuring was the revision of the RF. This included the following changes: first the PDO was revised (see section 2), second, changes to the original PDO indicators included: increased new effective irrigated area with the project was changed to Increased command area for irrigation with the project; annual value of agricultural production per mu was dropped; number of farmers (and female farmers) benefiting from the supplementary irrigation was changed to number of farmers (and female farmers) that would be benefitting from the increased command area for irrigation with the project; annual amount of industrial and domestic water supply was changed to Annual industrial and domestic water supply capacity; and number of O&M plans prepared and implemented for both main and on-farm systems was changed to number of O&M plans prepared for both main system and on-farm system in the demonstration areas. Third, intermediate outcome indicators were revised with targets revised downwards for three indicators and four indicators were dropped. The ICR (paragraph 20) provided logical explanations for the changes introduced at restructuring, most importantly the changes realistically reflected the scope of the project with its different activities and within its implementation time-frame.

M&E implementation suffered from a notable shortcoming as data collection on PDO indicators were only collected after restructuring in 2017.

c. M&E Utilization

According to the ICR (paragraph 61), the project data was useful and to was used to "evaluate physical progress, calculate costs, assess efficiency, and measure progress towards the realization of the indicators." In addition, the progress reports were based on the verified project data generated by the MIS. These reports informed project management on the status of implementation. Finally, the project's monitoring data and implementation progress reports were used in guiding restructuring as well as the final evaluation of the project.



M&E Quality is rated Modest. Design suffered from a notable shortcoming reflected in the disconnect between the original indicators and the project's scope and interventions. While M&E implementation was successful in tracking the progress of the project through intermediate indicators, collecting data on the main PDO indicators only started in 2017. Finally, utilization suffered from the late collection of PDO data.

M&E Quality Rating

Modest

10. Other Issues

a. Safeguards

The project was an environmental category A. It triggered five safeguard policies: Environmental Assessment (OP4.01), Natural Habitats (OP/BP 4.04), Pest Management (OP4.09), Indigenous peoples (OP 4.10), and Safety of Dams (OP/BP 4.37). Environment Assessment (EA) reports were prepared in accordance with national requirements and the Bank's OP/BP/GP 4.01. The EA concluded that the Project would bring significant positive impacts including: the provision of reliable, equitable and stable water supply to the irrigation areas of 1.053 million mu (70,235.1 hectares); increasing agricultural yield; improving the livelihood of the farmers in the irrigated areas; and promoting benign circulation and sustainable development for the regional economic, social and ecological environment. However, there were also limited negative impacts that might arise during project implementation, including limited negative impacts on soil, air, water, acoustic environments, and solid wastes, mainly during construction. The Environmental Assessment (EA) documents, including EA summary, Environmental Impact Assessment, Environmental Management Plan (EMP) and Pest Management Plan as required by OP 4.09, were disclosed on December 2, 2010 at the Bank Beijing office website and at Bank headquarters (Infoshop).

Environmental Compliance. According to the ICR (paragraph 65) "during project implementation, the mitigation measures and monitoring plan were carried out satisfactorily and the biannual reports on EMP implementation were submitted to the Bank on time." The borrower also followed the Bank's recommendations regarding dam safety with no issues during the project duration (ICR, paragraph 66)."

Social Compliance. During project implementation, 4,408.04 mu (about 9.6 square km) of land were subject to acquisition. This also involved relocating 3,449 people in 992 households. In addition, about 16,500 people were affected by land acquisition to a limited extent in the main canal areas as well. According to the ICR (paragraph 67) "resettlement was implemented and managed in compliance with the Bank safeguard policy requirements as well as with the relevant national laws and regulations."

Overall, the ICR (paragraph 68) concluded that "the project complied with all applicable safeguard policies and the overall safeguards rating was Satisfactory throughout project implementation."

b. Fiduciary Compliance



Financial Management. According to the ICR (paragraph 69) the "project financial management was overall in compliance with Bank requirements." While fourteen unaudited interim financial reports were submitted to the Bank, only half of these were on time. The required annual audit reports were submitted on time since 2015 and the external auditors issued unqualified audit opinions. However, the audit reports of 2014 and 2015 raised an issue regrading conflict of interest in procurement (see below). The final project audit report was submitted to the Bank in August 2020.

Procurement. According to the ICR paragraph 70) "procurement of works, goods and consultant services was carried out satisfactorily in accordance with the legal covenants and the Bank procurement policy and procedural requirements." However, there were procurement issues relating to weak coordination between the municipal PMO and its county level branches in approving designs and contracting of works, which resulted in implementation delays. Finally, the audit reports of 2014 and 2015 raised an issue related to conflict of interest involving a contractor and a supervision company in two Bank-financed contracts. According to the ICR (paragraph 70) "the PMO/Government prepared an action plan acceptable to the Bank and it was implemented in 2016." While the ICR did not explicitly mention that the issue was resolved, it noted that the 2016 audit report did not report any issues relating to conflict of interest.

c. Unintended impacts (Positive or Negative)

None were reported in in the ICR.

d. Other

11. Ratings

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

12. Lessons

The ICR included five lessons. The following three are emphasized with some adaptation of language:



1. To ensure realistic and achievable outcomes of irrigation projects, PDOs need to reflect the scope of the project as negotiated with the Borrower. It is essential to have a mutually agreed understanding on the sequencing of main systems and on-farm works, and define the PDO accordingly. The agricultural productivity related indicators should be selected realistically and conservatively, as improvements in agricultural production lag irrigation works development and take longer than the typical duration of an investment project.

2. For large scale and technically complex projects, out-sourcing M&E to a reliable independent third-party institution contributes to efficient M&E and ensures compliance with environmental and social safeguard policies. Third party external entities specialized in M&E and safeguard issues are in a better position to exercise fair judgment and allow the Project Management Offices (PMOs) to focus on their core management and coordination functions. The PMO employed a professional team responsible for project M&E, and also external monitoring teams responsible for social aspects (including resettlement) and environmental safeguards, respectively, to carry out their respective tasks during project implementation. As a result, safeguard aspects were in full compliance with Bank policies throughout implementation, despite the large scale and technical complexity of the project.

3. Engaging middle income countries like China is important because it allows the Bank to share knowledge and build capacity in critical areas such as social development and environmental management. Although the Bank loan only covered about 15% of the entire second phase of the Wudu irrigation scheme development, Bank policies and procedures (particularly in environmental management and social development) were fully incorporated in the entire Phase II Wudu Scheme. In addition, the Bank's close support to the development of the CDD based on-farm works in demonstration areas was key to its success and on-going scaling up.

4. Realizing the full potential of irrigation infrastructure calls for longer-term involvement in the overall scheme development process. In hindsight, an approach similar to the Multiphase Programmatic Approach would have allowed the Bank to engage with the client in structuring a longer, larger, and more complex engagement as a set of smaller linked operations (or phases), each with interim outcomes that link to make incremental change.

Although the instrument was not available at the time of appraisal, a similar long-term engagement would have enabled the Bank to support the demonstration CDD approach for on-farm works management through the entire Phase II Wudu Scheme for the intended agriculture productivity enhancement.

13. Assessment Recommended?

No

14. Comments on Quality of ICR



Quality of Evidence. M&E suffered from a disconnect between the PDO indicators and the scope of the project. This hindered collecting data on PDO indicators until restructuring in 2017. That said, the M&E system was successful in collecting data on the physical targets related to infrastructure investments.

Quality of Analysis. The ICR provided clear linking between evidence and findings and provided convincing arguments under the different sections, including the discussion on outcomes.

Lessons. Lessons reflected the project experience and were based on evidence and analysis.

Results Orientation. The ICR included a good discussion on the three objectives. It provided a well balanced discussion between reporting on the achievement of outcomes in relation to the indicators and what the project actually achieved on the ground. However, outcome targets lacked baseline values for comparison, and some details could have been a better fit under the Annex section.

Internal Consistency. Various parts of the ICR were internally consistent and logically linked and integrated.

Consistency with guidelines. The ICR successfully used the available data to justify the assigned ratings. Discussion of outcomes was comprehensive, and the efficiency analysis was robust.

Conciseness. The ICR provided comprehensive coverage of the implementation experience and candidly reported on shortcomings. There was enough clarity in the report's messaging. However, the outputs in Annex 1 lacked targets, and the sections on M&E design, implementation and utilization could have benefited from more detail. Also, the Theory of Change did not include any assumptions that underpinned the achievement of the stated PDOs.

Overall, the Quality of the ICR is rated Substantial.

a. Quality of ICR Rating

Substantial