

1. Project Description



Location of the Project Site



Sprinkler Irrigation in Operation

1.1 Background

China is one of the world’s thirteen countries of the scarcest water endowment where the volume of its total water resources is less than a quarter of the world average. Sixty percent of the country’s total cultivated area is located in arid regions under low agricultural productivity due to insufficient water. Among the total water usage, irrigation occupies seventy percent, however, the irrigation sector was faced various obstacles such as low level of facility preparation, deteriorating but un-renewed irrigation facilities, inefficient water use and unreasonably cheap irrigation fees which could hardly cover the cost of operation. Desertification and salt damages in recent years have been decreasing tillable lands as well, but they are considered preventable by appropriate water management to maintain suitable vegetation coverage according to respective topographic conditions by promoting agriculture in flat lands and afforestation on slopes.

Gansu Province is located upstream the Huanghe River basin in the northeast of China continent with its area of 454,000 km² (7th largest among 33 province-level divisions⁸ in China), 1.2 times as large as the total area of Japan, and population of 26.2 million people (22th among the 33 province-level divisions). The provincial capital is Lanzhou located almost in the center of the whole of China. It has been a spot of strategic importance since the ancient era leading to the Silk Road having Mo Gao Ku at Dunhuang, a World Heritage stone cave, in its western end. As an arid province, sev-

⁸ The Province-level Divisions consist of 22 provinces, 5 autonomous regions, 4 direct-controlled municipalities and 2 special administrative regions.

enty percent of the cultivated area is located in the Loess Plateau which is the place of origin where the yellow dust and sand storm rises. With the province's Gross Domestic Regional Products (GRDP) at 317,600 million yuan (about 23,300 million Japanese yen), 27th among the 33 province-level divisions in China, and its low per capita income at 12,000 yuan (about 165,000 Japanese yen), 30th among the 33 province-level divisions, it is classified as one of the poorest provinces of the country. Maximized efficient use of the water resources accompanied by agricultural productivity and people's income increase has been an ancient struggle for the province to overcome those severe conditions.

1.2 Project Outline

The objective of this project is to increase crop yields, expand vegetation coverage and reduce water intake from water sources by developing water-saving irrigation facilities introducing concrete canal lining, sprinkler and other devices for an area of approximately 80,000 ha of the existing six irrigation areas in Gansu Province, thereby contributing to betterment of the farmers' living and improvement of natural environment through preventing desertification, alleviating drying up of the Huanghe River and so forth.

Approved Amount/ Disbursed Amount	6,000 million yen / 5,383 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2001 / March 2001
Terms and Conditions	Interest Rate: 1.3% Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: General Untied
Borrower / Executing Agency	People's Republic of China / Gansu People's Provincial Government (Finance Department)
Final Disbursement Date	March 2007
Main Contractor (Over 1 billion yen)	None
Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	None
Related Projects	JICA "Model Planning Project for Water Saving Measures in Large-scale Irrigation Schemes" (June 2001 ~ May 2006) World Bank "Gansu Hexi Corridor Project" (IDA 90 million US dollars, IBRD 60 million US dollars) 1996 ADB "Optimizing Initiatives to Combat Desertification in Gansu Province" 2000

2. Outline of the Evaluation Study

2.1 External Evaluator

Masami Sugimoto, Representative Director, Certified Public Accountant (C.P.A.), SHINKO Overseas Management Consulting, Inc.

2.2 Duration of Evaluation Study

Duration of the Study: September 15, 2009 – July 30, 2010

Duration of the Field Study: December 10, 2009 – December 24, 2009

March 11, 2010 – March 25, 2010

2.3 Constraints during the Evaluation Study

None

3. Results of the Evaluation (Overall Rating: A)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plans of China

3.1.1.1 Relevance with the Development Plans at Appraisal

Placing emphasis on promoting water-saving irrigation as a countermeasure for the water problem that was growing more serious, China set forth the following objectives in the 9th Five Year Plan (1996 ~ 2000).

(1) Designation of 300 prioritized model countries for water-saving and agricultural intensification (targeted water-saving irrigation area: 6,600 ha) and purposed provision of subsidies.

(2) Attainment of 1,867 ha water-saving irrigation by the end of 2000.

(3) Agricultural water saving at 6,000 million m³ per annum.

Following 10th Five Year Plan (2001 ~ 2005) put further stress especially on maintaining vegetation coverage in desertification-prone dry areas. It is made more of unit yield increases rather than extension of cultivated acreage to cope with the food demand increases and promoted highly efficient water-saving irrigation in dry lands which have much potential room for food production increase with concurrent achievement of prevention of desertification and escape from the poverty-ridden status by boosting agricultural output.

3.1.1.2 Relevance with the Development Plans at Ex-post Evaluation

The 11th Five Year Development Plan declares establishment of the “New Socialistic Rural Communities” as a strategic target and puts first priority on tackling a set of “Agriculture,” “Rural Community” and “Farmer” issues at a time. Water-saving programs including irrigation

hold the status with one of the most prioritized development areas also in the regional plans of Gansu Province; namely, the 9th Five Year Economic Development Plan and the Medium and Long-Term Planned Objectives in 2010 Water-saving Irrigation Development Plan of Gansu Province (2010 ~ 2020). The following policies are addressed by the national government to achieve the target for establishing “New Socialistic Rural Communities” that aims to “develop production, realize an affluent society, promote people’s sound mind, beautify communities and carry out democratic management” while maintaining harmony between urban and rural economic and social development.

- (1) Increase total productivity of agriculture, promote structural adjustment of the agricultural sector, develop agricultural infrastructure and increase farmers’ income.
- (2) Carry out prioritized farm and irrigation facility development.
- (3) Train farmers to provide knowledge and technology in order to develop their capacity for agricultural management.
- (4) Prioritize fund allocation for supporting “agriculture,” “rural communities” and “farmers,” and extend public services to cover wider agricultural communities and social support for community development.

As one of the prioritized construction investments, the government declares “Conversion to water-saving structure in large-scale irrigation systems.”

The 11th Water-saving Irrigation Development Plan of Gansu Province (2006 ~ 2010) as a basic guideline for the development of the agricultural sector aims to expand water-saving irrigation area up to 2,750 thousand mu⁹ during the period, with a breakdown into sprinkler irrigation 100 thousand mu, micro irrigation 200 thousand mu, pipe irrigation 600 thousand mu and canal irrigation 1,850 mu with total investment of 1,089.5 million yuan. The investment intends to save 194 million m³ of water and 40,600 mu of land annually.

3.1.2 Relevance with the Development Needs of China

3.1.2.1 Relevance with the Development Needs at Appraisal

Gansu Province has 70% of its cultivated area in Loess Plateau which could be easily desertified without preventing vegetation. The area of cultivated land and forest is only 15% and 9.4% respectively of the total province. Due to the situation under which most of the irrigation facilities are water-wasting mud canals, and being a remarkable water in-taker in the Huanghe River basin, Gansu Province is obliged to minimize its water consumption to alleviate the water insufficiency downstream. At the same time, the attempt to raise agricultural productivity by introducing water-saving irrigation technology in this inland poor region was expected to play a pivotal role to increase income of poverty-ridden farmers and alleviate income differentials against the coastal regions.

⁹ Unit of area in China. 1 mu = 667 m² approximately. Japanese unit “tsubo” has a direct link to “mu.” 1 mu is exactly equal to 200 tsubo.

3.1.2.2 Relevance with the Development Needs at Ex-post Evaluation

The water resources in Gansu Province are chronically scarce: average annual rainfall is 277 mm, average total volume of water resources is 28,900 million m³, or 1,100 m³ per capita which is almost half of the national average. The average water for 1-mu farmland is 378 m³ which is less than a quarter of the national average. The provincial water supply-demand gap is tremendous with insufficiency of 1,400 million m³, which has been hindering economic and social development of the province as a significant bottleneck. Therefore a continuous need is attached to this project that develops water-saving irrigation. In addition, it is also much required for Gansu Province to maintain the volume of Huanghe River flow by saving water in order to alleviate desertification in the Inner Mongolia Autonomous Region downstream which is one of the main causes of the yellow sand.

3.1.3 Relevance with Japan's ODA Policy

The prioritized loan assistance policy for China addressed in the Medium-Term Strategy for Overseas Economic Cooperation Operations (December 1999 ~ March 2000) of former JBIC (Japan Bank for International Cooperation) included (1) support for tackling food and poverty issues through improving agricultural productivity, (2) prioritized support for the inland regions to alleviate regional differentials and (3) support for



A slogan “Water is the Source of Life” expressed on a sign placed by the greenhouse equipped with drip irrigation facility under this project.

strengthening social and economic infrastructure to facilitate autonomous economic development, coping with (4) environmental conservation including flood control and afforestation. The objectives of this project for water-saving irrigation to increase the productivity of agriculture in Gansu Province, which is a low-income inland province, are consistent with the aforementioned Japan's ODA policy. Additionally, this project contributes to the environmental improvement by providing extra water saved to the region's afforestation.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy; therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

This project is to make concrete lining of trunk irrigation canals with facility development

of end canals, installation of sprinkler, drip and pipe irrigation facilities for about 80,000 ha in five municipalities in Gansu Province. It consists of civil works, procurement of equipment and installation. A part of the outputs component has shifted from drip and sprinkler facilities to canal lining from the following reasons.

1. The “Short-term Development Plan for Heihe River Basin” which was started in August 2001 following the decision of the State Council replaced the drip and sprinkler irrigation facilities to be installed under this project along the river basin in Zhangye City in large, Jinta County of Jiuquan City.
2. Actual farmers’ demand turned out to be stronger for canal irrigation rather than drip and sprinkler facilities which require higher technique and more work for the maintenance.
3. Unsuitable plans were adjusted; such as installation of sprinkler facility in windy Jiuquan City.
4. A number of farmers gave up drip facilities because of unfavorable market trend against targeted crops like greenhouse vegetables, grapes, hops, etc.
5. Market price appreciation of plastic materials for pipe, drip and sprinkler facilities affected by the sharp increase in oil price from 2003 lifted their installation cost.

The component of outputs has been thus changed, however the total area covered turned out to be increased 17% from the original plan. The project site extends to five municipalities in Gansu Province (Jiuquan <including Dunhuang and Yumen>, Zhangye, Jinchang, Wuwei and Lanzhou). The following map shows locations of the project sites with outputs by type of irrigation facility installed¹⁰.

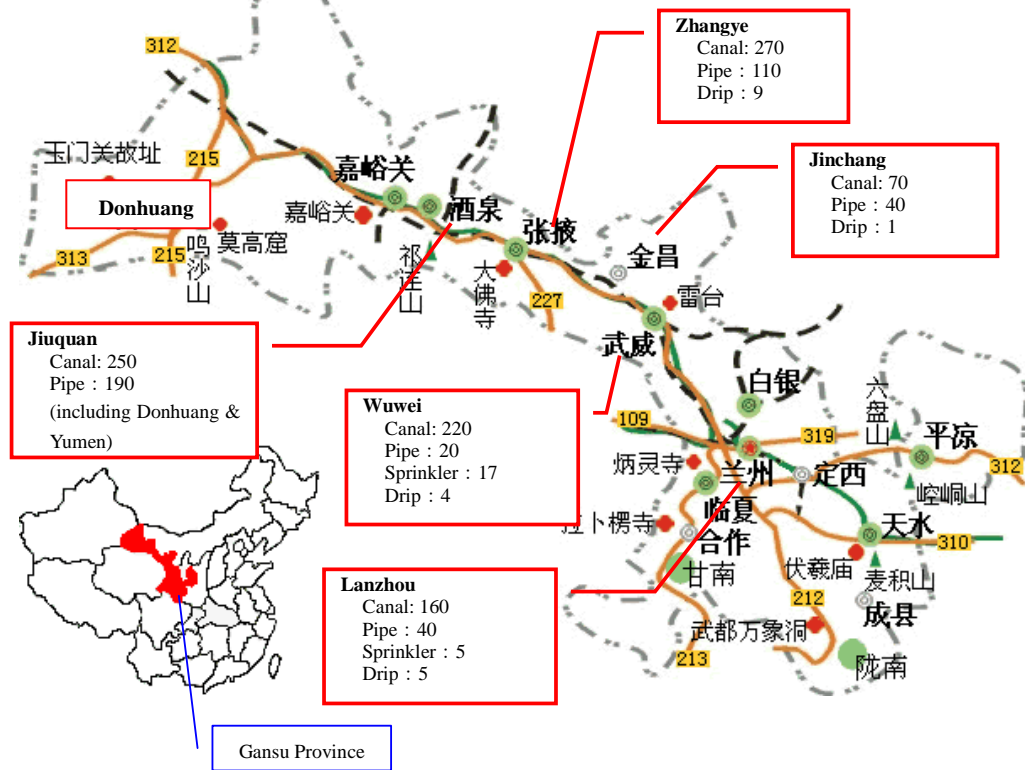
For the implementation of this kind of small-scattered type project, it is desirable not to irrationally stick to the predetermined plan but to adjust the contents to the updated needs in the implementation phase. It can be said the way of implementation of this project that puts that principle into practice was appropriate.



Completed canal with concrete lining

¹⁰ Another 20,000-mu drip irrigation facilities out of these outputs are scatteringly installed under the “Gansu Agriculture Cultivation Group Corporation.” The Group Corporation is a 100% state-owned company which belongs to the Gansu People’s Provincial Government. It is charged with the management of state assets as its main function and also runs agricultural production and marketing.

Figure 1: Project Outputs by Facility Type¹¹



3.2.2 Project Inputs

3.2.2.1 Project Period

Under the initial plan, the total project period was from March 2001 to December 2004 (3 years and 10 months, 46 months), but the actual project period was from March 2001 to June 2006 (5 years 4 months, 64 months), which turned out 39% longer than planned. The prolonged project period was mainly caused by the delay in implementation commencement for the reason as follows. However, the process was expedited after the commencement and the implementation period was eventually saved 8 months from the original plan.

(1) The executing agency (Gansu People’s Provincial Government) was unaccustomed to the Yen-loan administrative procedures as this was their first experience. Additionally, the project contains multiple components widely scattered throughout the vast area of Gansu Province which is 1.2 times the size of Japan and it claimed significantly longer time for internal coordination. Consequently it was not until October 2001 (14 months delay at that moment) that the final approval of the State Planning Commission on the feasibility study has been ob-

¹¹ Gansu Province stretching horizontally along the Hexi Corridor has 4 core countries (Donhuang, Jiuquan, Zhangye and Wuwei) established by emperor Wu of Western Han in 110 B.C. Hexi Corridor leading to inland Xinjiang used to be an important international route as a part of Silk Road that enabled political, economic and cultural exchange between ancient China and the Western World.

tained.

- (2) Approximately 6-month delay in the tendering process because of the government's ban on public meetings and severe inter-regional traffic control due to the spread of SARS (Severe Acute Respiratory Syndrome) occurred in 2003.

3.2.2.2 Project Cost

Planned project cost was 9,999 million yen (of which Japanese ODA loan was 6,000 million yen), and the project cost at the time of ex-post evaluation was 8,911 million yen (of which Japanese ODA loan was 5,383 million yen), 10.9% lower than planned. The total project cost includes 27 million yuan (about 383.5 million yen) as the cost of construction materials contributed by farmers and 22 million yuan (about 312.5 million yen) as the farmers contribution labor¹². In spite of the implementation delay as well as the expanded outputs, the project cost was less than planned. It is mainly due to the successful reduction of total payment through efficient procurement with reasonable prices through fair price competition under competitive bidding.

Although the project cost was lower than planned, the project period was longer than planned. Therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

The Gansu Water Conservancy Agency attaches considerable importance on project effect monitoring and is collecting actual indicative figures before and after the project for 17 countries in 5 municipalities, which they call "sub-projects." The indicators being monitored and their actual figures recorded are as follows.

- Total length of concrete lining and irrigated area by types of irrigation
- Irrigated area by major crops
- Unit yield of major crops
- Volume and rate of water saved
- Water utilization ratio by type of irrigation
- Average annual income of farmers (to be analysed in the impact section later)
- Rate of water fee collection (to be analysed in the sustainability section later)

Since the irrigation facilities developed under this project are relatively small in scale, and they are completed and come into operation individually in the course of project implementation,

¹² Both are booked from the accounting record following the China's internal regulation applying the rate 15 ~ 17 yuan per day for the construction materials contributed by farmers 50 ~ 65 yuan per m³ as the farmers' contribution labor. It is appreciated as quite a desirable practice for sound project management.

the “before” and “after” project columns of the tables do not indicate specific years before and after the project completion, but conditions before and after installation and operation of individual facilities.

Table 1: Irrigated Area by Major Crops

Irrigated Area by Major Crops (unit: 10,000 mu)	Crops	Before Project	After Project	Comparison
	Wheat	49.07	42.15	86%
	Maize	27.96	34.25	122%
	Vegetable	12.49	16.66	133%
	Cotton	26.00	13.51	52%
	Fruit	8.71	8.43	97%
	Barley	3.22	5.63	175%
	Maize Seed	2.24	2.41	108%
	Broad Bean	0.34	0.42	124%
	Potato	1.33	1.32	99%
	Tomato	1.61	1.49	93%
	Hops	0.47	0.47	100%
	Crude Medicine	0.10	0.10	100%
	Others	45.47	44.62	98%

Table 2 : Yield of Major Crops

Yield of major crops (kg / mu)	Crops	Before Project	After Project	Comparison
	Wheat	392	442	113%
	Maize	588	637	108%
	Vegetable	2,309	2,783	121%
	Cotton	259	300	116%
	Fruit	1,864	2,275	122%
	Barley	473	553	117%
	Maize Seed	441	481	109%
	Broad Bean	185	411	222%
	Potato	1,694	2,080	123%
	Tomato	5,755	6,094	106%
	Hops	240	265	110%
	Crude Medicine	700	780	111%
	Others	803	928	116%

Table 3 : Volume and Rate of Water Saved

Type of Irrigation Facility	Water Volume Saved (10,000 m ³)	Rate of Water Saved (%)	Average Water Volume Saved per Mu (m ³)
Canal	4,478	12.3	79.73
Pipe	4,300	21.0	118.99
Sprinkler	419	41.5	144.84
Drip	1,703	42.0	231.25
Total (Average)	10,900	17.9	-

Table 4 : Water Utilization Ratio
(Rate of Water Volume Used in Fields against Volume of Water Supply)

Type of Irrigation Facility	Before Project	After Project
Canal	54~84%	61~96%
Pipe	55~85%	81~97%
Sprinkler	53~63%	87~94%
Drip	52~62%	87~95%

The irrigated area and unit yield have increased after the project; however, the extent of increase is not so significant, except barley for the former and broad beans for the latter. Greenhouse vegetables, fruits and other crops with higher market prices mainly irrigated by sprinklers generally bring larger project effect in value. As stated above in section 3.2.1, 2, there occurred shifts from sprinkler and drip irrigation facilities to canals because of technical reasons for operation & maintenance, and it has resulted in lower effect realized on production increase in value than expected. However that negative factor could have been more or less offset by the 17% increase in irrigated area up to 14,000 ha. As articulated in its title, the primary stress of this project is put on water saving rather than agricultural production increase, and in this context, the project has been highly effective with remarkable water saving endorsed by indicators of volume and rate of water saved and utilized.



Red peppers and tomatoes growing in a greenhouse equipped with drip irrigation facility

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

EIRR (Economic Internal Rate of Return) is calculated; assuming, project life:

50 years, benefit: production increase in value (income increase by incremental production + conversion to more marketable crops), cost: construction cost + operation & maintenance cost).

The rate of return calculated at the project appraisal was 22.0%, and the recalculated value at the ex-post evaluation was 17.1%. The calculation at the appraisal compared production in greenhouse cultivation as the “With” case of profitable drip irrigation with outdoor production as the “Without” case¹³. However, it is not realistic and overestimates the EIRR value because greenhouse production was already prevailing even before the introduction of the drip irrigation. EIRR was therefore recalculated comparing greenhouse production with and without the

¹³ “With” and “Without” represent estimated operational results in respective cases under the conditions if the project has been and has not been implemented.

project and consequently pushed the EIRR value down. There is also a negative factor of the remarkable shift of more profitable sprinkler and drip facilities to canal irrigation, but it has been offset by the increase in actual irrigated area by the project.

The EIRR recalculated exceeds the “social discount rate” at 10% ~ 12% applied for EIRR analyses by the World Bank and other international aid agencies, and indicates sustained profitability sufficient enough to justify the economic aspect of this project.

3.3.2 Qualitative Effects

3.3.2.1 Synergy with JICA Technical Cooperation Project

JICA implemented a technical cooperation project entitled “Model Planning Project for Water Saving Measures in Large-scale Irrigation Schemes” (2001 ~ 2006) with the Ministry of Water Resources. The synergy with this project is as follows.

- (a) The “Water-saving Improvement Manual” prepared in the technical cooperation project is effectively used for the operation and training of water-saving irrigation of small-scale irrigation facilities developed under this project.
- (b) The experts dispatched under the technical cooperation project assisted the interim supervision of this project accompanying the mission to the field, disseminated the “Water-saving Manual” and gave technical advices to the beneficiaries of this project. (October 2004)
- (c) A joint domestic training involving both projects was implemented. (July 2005)
- (d) Four officials from the Department of Water Resources, Gansu Province in charge of this project were invited to the counterpart training of the technical cooperation project (45 days from August to October 2005)

3.3.2.2 Beneficiary Survey

A questionnaire survey to the farmer beneficiaries of this project was conducted during this ex-post evaluation. The survey was carried out following the method described in the next section, and the distribution of the respondents by the irrigation area¹⁴ and type of irrigation facility are summarized in Table 5 and 6 below. Gansu Water Conservancy Agency also conducted a separate questionnaire survey of their own on a large scale (4,000 samples) in the two years after the project’s completion. The survey covered 4,000 stakeholders including direct beneficiaries as key respondents. The result of the survey will be discussed later in section 3.4.2.3 for impact analysis.

Table 5 : Distribution of Respondents by Irrigation Area

	Jin-chang	Don-huang	Jiuquan	Yumen	Zhan- gye	Wuwei	Lan- zhou	Total
Sample	15	9	10	1	30	24	23	112

¹⁴ Donhuang and Yumen are included in Jiuquan in the regional distribution map of Figure 1.

Volume								
Ratio	13.4%	8.0%	8.9%	0.9%	26.8%	21.5%	20.5%	100.0%

Table 6 : Distribution of Respondents by Type of Irrigation Facility

	Canal	Pipe	Drip	Sprinkler	Others No answer	Total
Sample Volume	56	31	10	3	12	112
Ratio	50.0%	27.7%	8.9%	2.7%	10.7%	100.0%

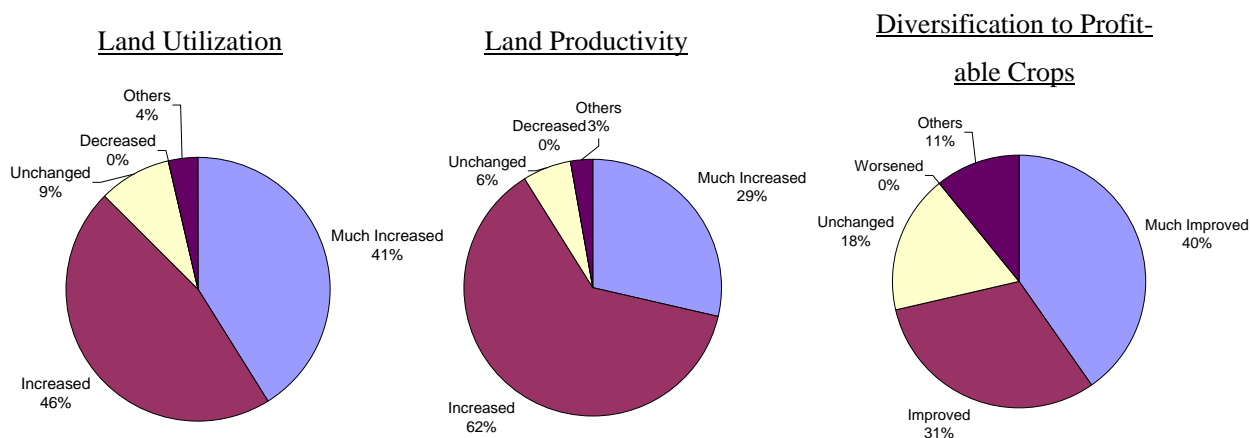
(1) Method of Implementation

Standing on the reliable self-monitoring result of the project effect by the executing agency mentioned above, the survey was conducted with questionnaires and minimum direct interviews during the evaluator’s field visits. The survey took unbiased samples based on the weighted proportion among each type and irrigation area with full coverage and used improved questionnaires pre-tested during the first field survey.

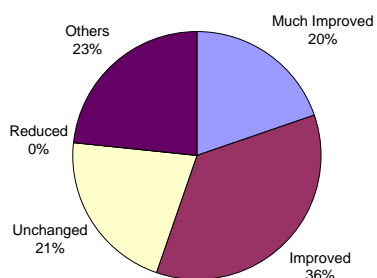
(2) Summary Result

The ratios of responses to the questions asking for a comparison of the present conditions with the situation before the project and the overall evaluation on the project are collectively shown in the following pie charts. They indicate that the project has positively influenced various aspects of the beneficiaries’ life, among which the water-saving effect supported by the majority (65%) articulates that the unit water use has been remarkably reduced and corresponds significantly to the result of the periodic effect monitoring by Gansu Water Conservancy Agency.

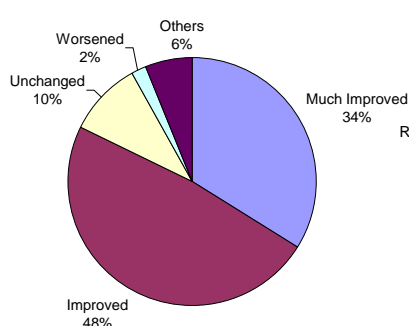
This project has successfully achieved its objectives; therefore its effectiveness is high.



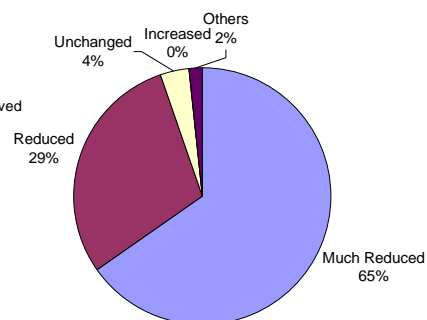
Increase in Inputs



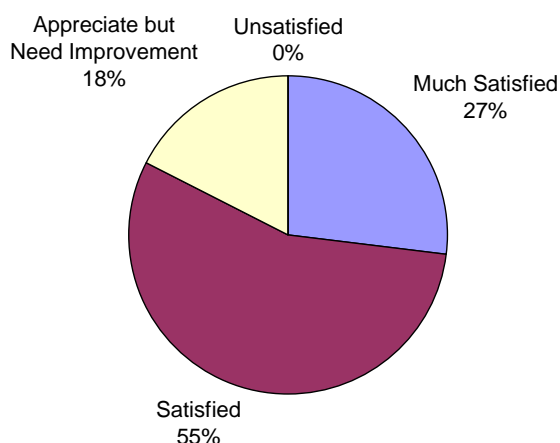
Workload



Unit Water Use (Water-saving)



Overall Evaluation on Project



3.4 Impact

3.4.1 Intended Impacts

3.4.1.1 Increase in Farmers' Income

The size of the project beneficiaries is approximately 905 thousand farmers. According to the effect monitoring by the Gansu Water Conservancy Agency quoted in section 3.3.1.1 above, the average annual income of the farmers in the benefited area was 4,114 yuan before project and turned out 5,191 yuan, 26% increase. As mentioned earlier, most significant project effect has emerged in the aspect of water-saving, however the Production volume of major crops has also increased 15%, especially for fruits (22%), broad beans (122%) and potatoes (23%), which could suggest income increase of the beneficiary farmers.

3.4.1.2 Alleviation of Desertification by Expanded Vegetation Coverage

Of the 11,000 m³ of water saved with this project, a quantity of 1,815 m³ has been utilized to expand vegetation of 40,300 mu in the region. The Ministry of Forest conducts comprehensive monitoring research on reduction in desertification and reported an 83,600 ha decrease during

1999 ~ 2004. This project was prepared and implemented under close cooperation between the Water Conservancy and Forestry Departments of Gansu Province. This cooperation is quite desirable, contributing to enhancement of positive project impact by means of systematic collaboration including effort to utilize saved water to tree and grass planting.

3.4.1.3 Prevention of Huanghe River Dry-up¹⁵ and Desertification of the Inner Mongolia Autonomous Region

The Huanghe River Dry-up does not occur any more after starting discharge control at the dams upstream, and the reduction of water intake by the project has been contributing to water flow increase of Huanghe River. The desertification of Inner Mongolia Autonomous Region, which is a source of yellow dust and sand storms, located downstream of the Heihe River (one of the tributaries of Huanghe River) is badly affected by excess water intake by upstream Gansu Province. This project and the concurrent “Short-term Development Plan for Heihe River Basin” extend big preventive effect; for instance, Gansu Water Conservancy Agency told a story on Juyan Lake at the Inner Mongolia which used to often dry up but is now filled with water and greenization in its basin has been proceeding.

3.4.2 Other Impacts

3.4.2.1 Improvement in Indicators on Farmers’ Income in Gansu Province

As indicated in section 1.1 Background, Gansu Province belongs to the low income regions in China whose per capita GRDP (Gross Regional Domestic Products) is the 27th among 33 province-level divisions. However, it has been achieving steady increase in income and decrease in ratio of the people under the poverty level.

Table 5: Indicators on Farmers’ Income in Gansu Province

	2000	2005	2006	2007
Per Capita Net Income (Yuan)	1,429	1,980	2,134	2,329
Per Capita Agricultural Income (Yuan)	945	1,440	1,554	1,661
Per Capita Expenses for Living Consumption (Yuan)	-	1,820	1,855	2,017
Ratio of People under Poverty Level (%) *	-	2.47	2.08	1.34

Source: Gansu Yearbook 2008

*) The official poverty level revised in 2008 is 1,196 yuan. The figures in this table are percentages under 1,200 yuan.

¹⁵ Dry-up is a phenomenon under which river flow completely stops. Huanghe River which has the second longest length and widest river basin in China following Yangtze River (Chang Jiang) experienced frequent dry-up in 1970s. The most serious case was recorded in 1997, which lasted for 226 days in total.

3.4.2.2 Impacts on Natural and Social Environment (including relocation and land acquisition)

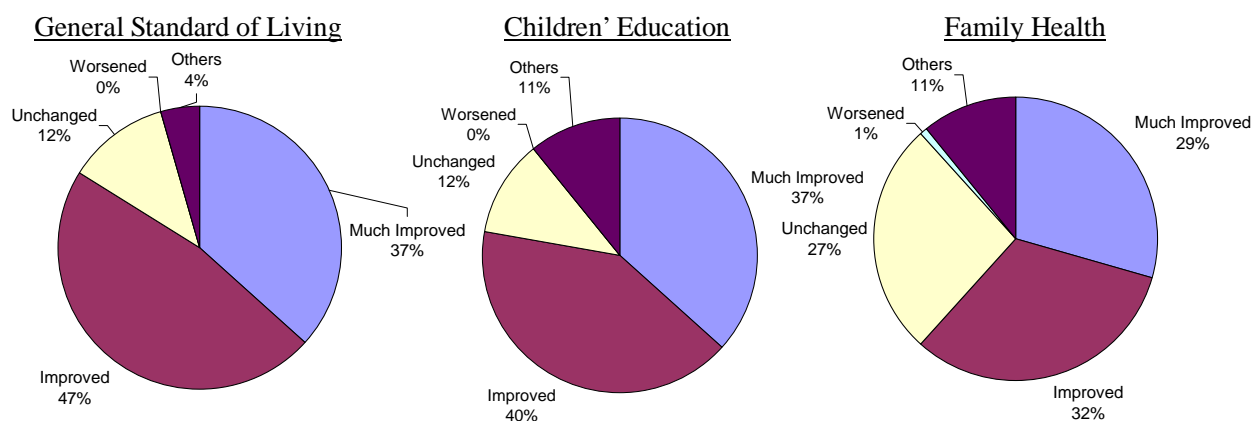
The emphasis of this project is on the aspect of natural environment improvement expecting significant contribution to the prevention of desertification. The environmental impact assessment of the irrigation facilities was conducted by the Environmental Protection Agency of Gansu Province in August 2007 and the project obtained official approval acknowledging that it fulfils the “Three Concurrent Environmental Requirements.”¹⁶ Prior studies for environmental assessment were also conducted by the Chinese Research Academy of Environmental Sciences and Gansu University with the conclusions expressing no specific adverse effect on environment.

This project was not accompanied by land acquisition or residents’ relocation.

3.4.2.3 Results of Beneficiary Survey

(1) Beneficiary Survey under the Ex-post Evaluation

The beneficiary survey under the ex-post evaluation discussed in the previous section 3.3.2.2 also asked questions regarding improvement in farmers’ living standards, and the summarized answers are illustrated in the pie charts below.



The observed improvement of the beneficiaries’ standards of living which is much supported by the China’s general economic development should not be hastily regarded as a direct impact of this project, however, its positive contribution of a more stable water supply was realized and direct income effect from the drip and sprinkler facilities should also be counted.

(2) Questionnaire Survey by Gansu Water Conservancy Agency

As already stated, Gansu Water Conservancy Agency, the implementing agency of this project, has conducted a large-scale questionnaire survey to the beneficiaries and other project stakeholders over two years, from 2005 until 2007 for their own management purpose¹⁷. They

¹⁶ China’s unique system for environmental management requires execution of “planning,” “construction” and “operation” of the main project components and environmental protection facilities concurrently.

¹⁷ It is a fundamental requirement for a project implementing or operating agency to make much of effect monitoring and evaluation and carry them out after project completion. However, it is a practice rarely observed in many development

sent a set of questionnaires to a total of 4,054 stakeholders and collected responses from 3,881 respondents, among which 3,845 answers were accepted as valid. The breakdown of the accepted responses and the results of survey are summarized in Table 6 and 7 respectively.

Table 6: Breakdown of Respondent

Stakeholder	Number of Respondents
Project Beneficiary	2,797
Officials in Charge	425
Other People Concerned	521
Others	102
Total	3,845

Table 7: Questions and Percentages of Answers

Questions	Yes, very much (Excellent)	Yes (Good)	Not so much (Moderate)	No (Bad)
1. Do you appreciate this project?	73%	24%	2%	0.4%
2. Has this project contributed to promote water-saving awareness?	71%	26%	2%	0.2%
3. What is the quality level of this project?	61%	33%	5%	0.9%
4. Has this project deepened recognition for water-saving and production increase?	52%	42%	5%	1%
5. To what extent has this project promoted structural improvement of agricultural sector ¹⁸ ?	50%	32%	17%	1%
6. How about the impact of this project on environment?	40%	52%	7%	1%
7. How big is the influence of this project as a model program?	56%	39%	4%	0.3%
8. Has this project deepened the perception for project management strengthening and improvement?	63%	35%	3%	0%
9. What is the level of satisfaction at the performance of the regional	50%	47%	3%	0.4%

projects in developing countries.

¹⁸ This question asks whether this project successfully promoted structural adjustment of agriculture by diversifying or converting production to products which are more profitable or fitter for local conditions.

government and project supervision agency?				
10. What is the most suitable irrigation facility?	Canal	Pipe	Sprinkler	Drip
	54%	23%	3%	21%

The survey results above reveal that this project has brought a significant impact including promotion of water-saving and management among the beneficiaries and other stakeholders, and is attracting their appreciation.

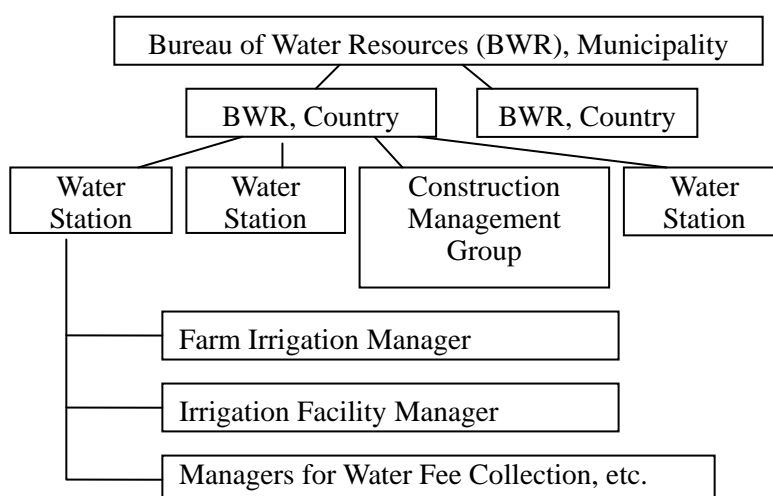
It is therefore recognized that the project has had positive impacts, among them upgrading of the farmers' quality of life, prevention of desertification and other environmental improvement.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

The operation and maintenance structure of trunk irrigation canals has been organized as follows.

Figure 2: Management Structure of Trunk Canals



Under the supervision of the Bureau of Water Resources at the municipality or country level, the management entities at each irrigation area (Water Stations) carry out such tasks as daily round inspection of primary & secondary canals, facility maintenance by periodic inspection in spring and autumn seasons, preparation of annual water distribution plan, monitoring of water flow and collection of water fees. They also arbitrate water conflict and maintain orderly irrigation operations in close cooperation with the Water Users Associations. On the other hand, the Water Users Associations take charge of end canals, pipe and sprinkler facilities for operation and maintenance: drip facilities are handled under the independent responsibility of indi-



A one-mu farm is irrigated by a set of underground pipe irrigation facility whose concrete holes containing an outlet (left) and control valves (right) are installed on the ground. Farmers are doing land preparation for coming planting season.

vidual users.

Except for the drip irrigation facilities under individual responsibility, the operation and maintenance structure from the Municipality Bureau Water Resources down to the Water Users Association is well organized, and the works are being conducted in an orderly manner.

3.5.2 Technical Aspects of Operation and Maintenance

3.5.2.1 Bureau of Water Resources, Municipality

This is the main municipal administration agency for water management which has technical divisions in charge of water management, construction management and so forth staffed with twenty to forty officials of which half of them are engineers.

3.5.2.2 Bureau of Water Resources, Country

This subordinate agency under the municipal bureau also has technical divisions consisting of construction and water management groups. The number of staff is usually twenty to forty officials of which two thirds are engineers.

3.5.2.3 Water Stations

Water Stations are the subordinate units under the country bureau. The number of staff assigned is not uniform, ranging from ten to two hundred depending on the size of the irrigation area in charge. The officials for farm irrigation management, irrigation facility maintenance and water fee collection take charge of facility management, guidance, water fee collection and so forth in the field.

The municipal bureau conducts water management, financial management and other trainings for the country bureau several times a year, and the country bureau systematically provides technical trainings on irrigation and facility management for the water stations normally in the winter agricultural off-season. The provincial bureau of water resource management is of the opinion that the training for sprinkler and drip irrigation facilities which require higher techniques are not satisfactory enough and need to be further strengthened in the future.

Though the training for sprinkler and drip irrigations which require relatively sophisticated operation and maintenance techniques is an issue of further enhancement, the technical capac-

ity for operating and maintaining other irrigation facilities is judged to be satisfactory.

3.5.2.4 Continuing Project Monitoring

Gansu Water Conservancy Agency attaches special importance on monitoring of operational conditions of the facilities and state of effect realization, and conducted an intensive training for the monitoring tasks in 2004 using the “Monitoring Handbook for Users” prepared by the Gansu Water-saving Irrigation Project Implementation Office established as an executing unit of this project at the Provincial Water Conservancy Agency.

3.5.3 Financial Aspects of Operation and Maintenance

3.5.3.1 Trunk Canals

The financial responsibility for the operation and maintenance of the trunk canals was originally planned to be borne by the farmers, however actual situation of the farmers’ financial capacity turned out not to allow for that practice. The plan was therefore modified and the operation and maintenance is now performed by the Municipality and Country Bureaus of Water Resources Management under the finance of the governments’ budgets. The amount of budget allocated for maintenance is predetermined by the regulation at 1.5% of the total investment for major maintenance and 40% of the major maintenance budget for routine maintenance requirements. The total amounts of 9,411 thousand yuan for the former and 3,764 thousand yuan for the latter were allocated for this project, which is not more than enough but is basically able to afford ordinary maintenance.

3.5.3.2 End Canals, Pipe and Sprinkler Irrigations

The fund for maintenance is collected from farmers as water fees through Water Users Associations. Collection rates of the water fees are considerably high: averaging 95.3%, 85.2% at the lowest (Liangzhou District, Wuwei Municipality). However the collected fund is not sufficient for the full coverage (50 ~ 75% coverage according to the official evaluation by the Ministry of Finance), which is an issue to be improved.

Though the fund supply for maintaining trunk as well as end canals and other irrigation facilities in the field has not been satisfactory, the minimum funds needed for maintenance are being budgeted so as not to obstruct facilities’ operation and maintenance. The end canals and other facilities in the field are actively operated and maintained by the farmers’ gratis labor and materials supply as well.

3.5.4 Current Status of Operation and Maintenance

Direct observation in the field study of the ex-post evaluation (Municipalities of Lanzhou, Wuwei, Zhangye and Jiuquan) as well as the official evaluation of the Ministry of Finance found that the installed irrigation facilities were smoothly operating.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is highly relevant with the China's Five Year Plan that makes importance of agricultural development and environmental conservation including desertification prevention, and is consistent as well with the water-saving needs of Gansu Province which is suffering from chronic and significant water insufficiency. The efficiency is fair due to the delay in project implementation, while the effectiveness is considerable, contributing to the regional water saving and agricultural production increase as well as income increases and a consequent upgrade of the people's living standard. It is also judged that the project is sustainable with no major problems in the operation and maintenance system.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

None.

4.3 Lessons Learned

Project effect and reliability is greatly enhanced if a holistic project management system has been established and operated in such a way that it covers whole process of the project process from the implementation up to the operation & maintenance after the completion and involves aspects of continuing monitoring and evaluation. This project is appreciated in that regard especially from the following merits.

- (1) What is desirable for the implementation of this kind of small-scattered type project is not to irrationally stick to the predetermined plan but to adjust it to fit the updated requests (project effect emerges in fragments from the completed portion during the implementation). This project was successfully implemented following that way in practice.
- (2) The project has firmly managed keeping a permanent record for financial (revenue and expenditure) transactions and physical progress.
- (3) The project clearly identifies directly benefited areas and periodically monitors the effects by means of specified key indicators and feeds the results back to the project operation.
- (4) In addition to the above mentioned periodic monitoring, the project has also conducted a social analysis based on a large-scale questionnaire survey to the project beneficiaries and other stakeholders regarding appearance of expected project effects and diffusion of water-saving awareness.

The practice of this project management should be diffused and applied as a case example of good practice to other irrigation projects and other sorts of small-scattered type projects in the future.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs	(1) Trunk canal concrete lining (2) Development of end canals Canal lining: 153.89km Facility development: 42,466ha (3) Development of sprinkler irrigation: 4,278ha (4) Development of drip irrigation: 8,600ha (5) Development of pipe irrigation: 24,600ha Total: 79,944ha	(1) Trunk canal concrete lining (2) Development of end canals Canal lining: 364.0km Facility development: 63,658ha (954.82 thousand mu) (3) Development of sprinkler irrigation: 1,437ha (21.55 thousand mu) (4) Development of drip irrigation: 2,594ha (38.91 thousand mu) (5) Development of pipe irrigation: 26,110ha (391.6272 thousand mu) Total: 93,799ha (1,406,907 thousand mu)
2. Project Period	March 2001 ~ December 2004 (3 years 10months, 46 months)	March 2001 ~ June 2006 (5 years 4 months, 64 months)
3. Project Cost	Amount paid in Foreign currency 0 Amount paid in Local currency 9,999 million yen (769 million yuan) Total 9,999 million yen Japanese ODA loan portion 6,000 million yen Exchange rate US\$ 1 = ¥108、 1 yuan = ¥13 (as of July 2000)	Amount paid in Foreign currency 0 Amount paid in Local currency 8,911 million yen (627 million yuan) Total 8,911 million yen Japanese ODA loan portion 5,383 million yen Exchange rate 1 yuan = ¥14.18 (canal), 1 yuan = ¥14.23 (Pipe, Sprinkler, Drip) (Actual record during July 2003 ~ August 2003)