People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan

"Henan Panshitou Reservoir Construction Project"

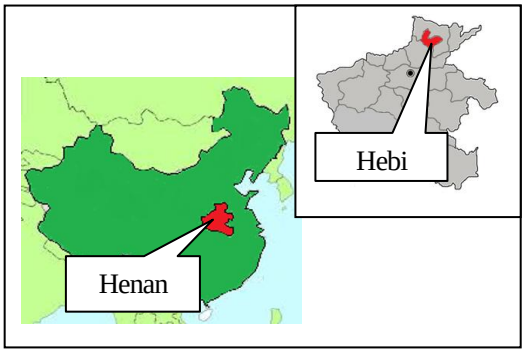
External Evaluators: Yumiko Onishi and Yuko Kishino, IC Net Limited

0. Summary

The objective of the project was to reduce flood damage while providing irrigation, urban water supply and power supply by constructing a multi-purpose dam in the Panshitou area of Qihe River where flood damages are frequent, thereby contributing to the improvement of the living standards of residents in the area and the economic development of the region. At the times of the appraisal and ex-post evaluation, flood control was mentioned as an important area in China's development policy. At the time of the ex-post evaluation, the Panshitou dam is playing an important role for urban water supply and irrigation around Hebi City, and consistency with the development needs at the time of the appraisal was confirmed. In addition, consistency with Japan's ODA policy at the time of the appraisal was confirmed. With regard to efficiency, the outputs were almost as planned, but because of the enactment of a new resettlement law and the delay in F/S approval by the State Council of China, both the cost and the period of the project exceeded the plan significantly. Because of the decreasing precipitation in recent years, the achievement level is low in a few operational indicators such as water level of dam reservoir, but the Panshitou dam, as planned, is made to withstand once in 100-year flood. Stable water supply is provided for urban water and irrigation. In addition, the dam is making a significant contribution to conserve the natural environment of the area surrounding reservoir and downstream. There is a large-scale resettlement in the project, and its process was prolonged because of the enactment of the new resettlement law and changes in the social situation. The process resulted in more respect for the rights and views of the people affected than before. Institutional aspects of operation and maintenance are in place, and the technical level of personnel for operation and maintenance is appropriate. In financial aspects as well, necessary budget allocations for operation and maintenance are likely to continue. No problem was observed in the current status of operation and maintenance.

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

1. Project Description



Project Location

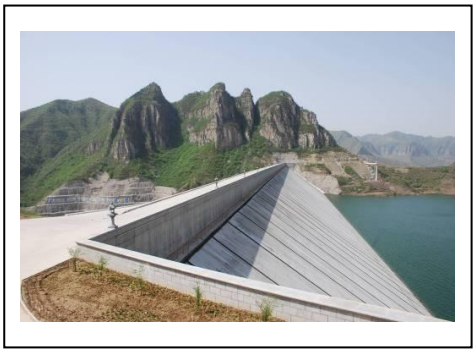


Photo 1: Panshitou Dam

1.1 Background

In China, the distribution of water resources is uneven, and the northern region has limited water resources than the south. This is because the precipitation decreases towards the north and inland areas as most of the water vapor, which is the source of rainfall, originates around the Pacific coast in the south. In particular, because surface water (river stream) constitutes 96.4% of China's 2.81 trillion m^3 water resources, the northern region with low precipitation and a high evaporation rate suffers from chronic shortage of water resources.

By contrast, as the seasonal wind from the Pacific coast containing vapors hits the mountains and then it rains, rainfall is concentrated in two to three months during summer and does not accumulate sufficiently as groundwater, making the northern region susceptible to flooding.

In this way, the Haihe River basin in the North China Plain has suffered damages from recurring floods since the dawn of history. Flood damages have been particularly frequent in northwest Henan Province. The flood of 1963 was particularly devastating, affecting 22 million people and 4.86 million m^2 of agriculture land while causing the economic loss of 6 billion yuan.

Subsequently, the Chinese government launched in 1988 a full-fledged effort to control flood and created a water resource master plan for the Haihe River system (*Haihe River Basin Comprehensive Regulations*) including Weihe River to prepare for floods that are of a scale similar to the 1963 flood.

Based on the master plan, the State Council of China decided in 1993 to construct a multi-purpose dam for flood control, irrigation, urban water supply and power supply in the upstream of Weihe River. In other words, the State Council decided to implement the Panshitou Reservoir Construction Project.

1.2 Project Outline

The objective of the project is to reduce the flood damage in downstream areas while providing irrigation, urban water supply and power supply in the Panshitou area located along a branch of Weihe River, i.e., 15 km southwest of Hebi City of northwest Henan Province, by constructing a multi-purpose dam, thereby contributing to the improvement of the living standards of residents in the area and the economic development of the region.

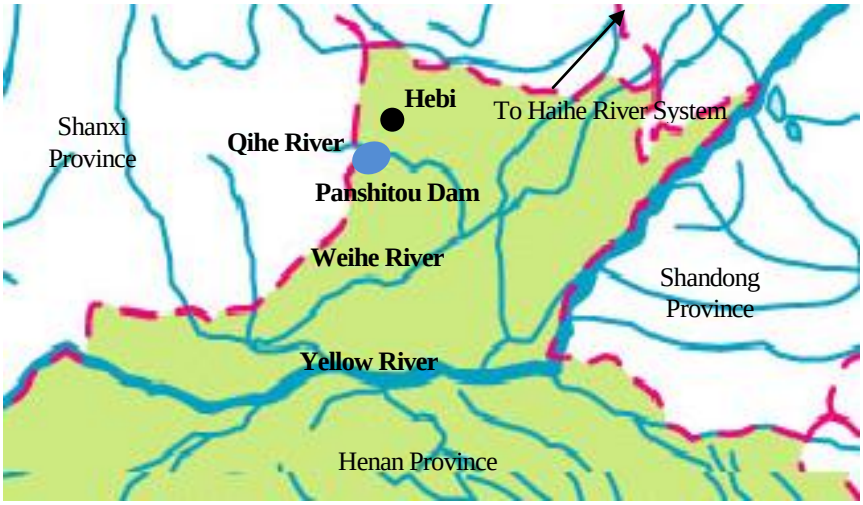


Figure 1: Project Site and Nearby River Systems

Loan Approved Amount/ Disbursed Amount	6,734 million yen / 6,727 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	December 1998 / December 1998
Terms and Conditions	Interest Rate: 1.3% (equipment); 0.75% (generator and consulting services[1]) Repayment Period: 30 years (equipment); 40 years (generator and consulting services[2]) (Grace Period): (10 years) Conditions for Procurement: General untied (Bilateral tied for consulting services[3])
Borrower/ Executing Agency	Government of the People's Republic of China/ Henan Provincial Department of Water Resources
Final Disbursement Date	July 2006
Main Contractor (Over 1 billion yen)	Inner Mongolia North Hauler Joint Stock Co., Ltd (China)
Main Consultant (Over 100 million yen)	N/A
Feasibility Studies, etc.	Henan Water Resources Research Institute, 1990 F/S
Related Projects	ODA Loan: Liaoning Baishi Reservoir Construction Project (1996–2002); Sanjiang Plain Longtouqiao Reservoir Construction Project (1996–2002); Tongyu River Irrigation Development Project (I) (II) (1991–1997, 1995–2000); Guanyinge Multipurpose Dam Project (I) (II) (III) (1988–1995, 1989–1996, 1990–1997); Hunan Urban Flood Control Project (2000–2011); Hubei Urban Flood Control Project (2000-); Jiangxi Urban Flood Control Project (2000-) Technical Cooperation: Capacity Development Project for Management Plan of Dam in China (2009–2013); Regional Training for Flood Hazard Mapping (2008) World Bank: Taihu Basin Flood Control Project (1993–2001); Xiaolangdi Multipurpose Project (1994–2000); Yellow River Flood Management Project (2002–2008); Xining Flood Control and Watershed Management Project (2009-) ADB: Henan Wastewater Management and Water Supply Sector Project (2006–2011); Henan Hebi Qihe River Basin Environment Improvement and Ecological Conservation Project (Planned)

[1] However, the consultants were hired at the Chinese side's own expense after the project started. For details, see "3.2.1.2 Consulting Services."
[2] Same as above.
[3] Same as above.

2. Outline of the Evaluation Study

2.1 External Evaluators

Yumiko Onishi and Yuko Kishino (IC Net Limited)

2.2 Duration of Evaluation Study

Duration of the Study: August 2014 - November 2015

Duration of the Field Study: November 2–14, 2014, and March 8–13, 2015

2.3 Constraints during the Evaluation Study

It was not possible to obtain permission from the Hebi Municipal Government to conduct a beneficiary survey because the resettlement process was still taking place at the time of the ex-post evaluation[4]. Therefore, no survey targeting the beneficiaries of the project was conducted in the ex-post evaluation.

In addition, there are limits to some of the data related to effectiveness and finance of the Panshitou Dam Construction Management Bureau (hereinafter referred to as the "implementing agency") that are provided by the implementing agency because of regulations by the Chinese side on information disclosure. The ex-post evaluation was attempted with the information collected with these constraints.

3. Results of the Evaluation (Overall Rating: B[5])

3.1 Relevance (Rating: ③[6])

3.1.1 Relevance to the Development Plan of China

Triggered by the flood that occurred in the Haihe River basin in 1963, the Chinese government launched a full-fledged effort to control flood. Based on the 1988 water resource master plan on the Haihe River system, the State Council of China decided in 1993 to construct a multi-purpose dam (i.e., the project) upstream of Weihe River. The project was designated as one of the most important ones in the *Ministry of Water Resources (Haihe River Basin Development) Ninth Five-Year Plan* and the *Henan Province Ninth Five-Year Plan*. In addition, as a decision of the State Council, the Chinese government began in October 1997 implementing the industrial water policy for the period between 1997 and 2010. Specifically, seven major river systems[7] including Haihe, Yangtze and Yellow Rivers would continue to be the priority for water resource development. Furthermore, the following were mentioned as major issues:

- Establishment of flood control system that can withstand a flood that may occur once in 50-year in major rivers and urban cities
- Repairing and remodeling of existing outdated water resource facilities
- Expansion of water supply capacity (providing drinking water supply in drought-prone areas, South-North Water Transfer Project (Nanshui Beidiao Gongcheng)[8], watershed conservation, water

[4] The project has been in operation because only a portion of resettlement in the upstream areas has been incomplete and it is possible to store a certain amount of water in the reservoir.
[5] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[6] ③: High, ②: Fair, ①: Low
[7] Songhua River, Lioa River, Haihe River, Yellow River, Huaihe River, Yangtze, and Zhu Jiang.
[8] A project that diverts water from the southern region to the north to resolve chronic water shortage.

saving using advanced technology, agricultural irrigation, drainage, etc.)

- Rational water pricing and establishment of a fee collection system
- Comprehensive water resource use, hydroelectric power, research and development on water resource technologies, etc.

In addition, the Chinese government decided in the summer of 1998 to put high priority on water resource construction and strengthening of facilities for ecological and environmental protection as being central to national economy and social development over the next few years in response to the worst ever flood that occurred around the Yangtze River basin and the northeast region. Specifically, the government envisaged the following: by enhancing the national budget for investment in water resource construction, strengthening the embankment of the seven major rivers, development of medium and small rivers, construction of water resource centers, repairing damaged facilities, and afforestation and protection of natural forest resources in the up- and midstream areas of the seven major rivers.

The *People's Republic of China National Economic and Social Development Twelfth Five-Year Plan* (2011–2015), the national development plan at the time of the ex-post evaluation, still cites as a priority the strengthening of flood control capacity. In addition, the National Water Resource Development Plan (2011–2015) that was formulated in 2012 mentions strengthening flood control in the Yangtze and Yellow River basins where the damage from flood has been historically severe. Regarding the Haihe River system, the latter plan states that water pollution is a serious problem and it is necessary to protect the ecosystem in its watershed. Therefore, flood control remains an important area in China. In addition, the project has contributed to conserving the water quality of Qihe River[9] located in the project area and protection of the environmental and ecological systems in the river's watershed in recent years. These activities match the objective of the National Water Resource Development Plan.

3.1.2 Relevance to the Development Needs of China

The Haihe River basin located in the North China Plain has suffered damages from recurring floods since the dawn of history. In northwestern Henan Province, the damages from floods have been frequent, and the flood of 1963 was particularly devastating. In the Qihe River basin, floods also occurred in 1970 and 1996. The flood of 1996 was scale of once in 18-year and affected an area of 15,800 km^2 and a population of 100,000, causing the economic loss of 900 million yuan.

There has been no flood in the project area after 1996 until the time of the ex-post evaluation; however, the possibility of floods cannot be ruled out. The average annual precipitation of Hebi City of Henan Province where the Panshitou dam is located is 664.9 mm. In recent years, precipitation has decreased. The year 2013 saw so little precipitation that it was said to be the first drought in 63 years. Although it was not possible to obtain the precipitation data of 2013 for Hebi City, those of the same year for Qixian County and Xunxian Country adjacent to Hebi City were only 485.5 mm and 348.5 mm, respectively.

Development needs for urban water supply, irrigation and power generation along with flood control were confirmed ex-post facto. It was not possible to collect data on demand changes on urban water supply in Hebi

[9] The river belongs to the Haihe River system.

City, which is within the project area. However, according to the Hebi City Annual Statistical Yearbook, the city population increased from 0.42 million in 1996 to 1.45 million in 2007, and then 1.62 million in 2013, indicating that the demand for urban water must have also increased tremendously. The project serves the water supply needs of Hebi City by providing stable water supply to the ever-increasing urban population continuously while other sources of water supply are limited.

Henan Province is an agricultural area where the cultivation of maize and wheat has been thriving from earlier time. The project aimed to provide stable supply of irrigation water with an irrigation water guarantee rate[10] of 55%.

No information is available on the power demand of Hebi City from the time of the appraisal. However, according to the Henan Province Statistical Yearbook, the power consumption in the Province increased from 7.244 million ton SCE[11] in 1998 to 1.8 times that amount in 2004, and then more than three times by 2013. The trend in the power consumption of Hebi City from 2007 is also listed in the yearbook; the consumption increased to 1.7 times the 2007 amount in the six-year period to 2013.

Accordingly, in addition to flood control, the Panshitou dam plays an important role in urban water supply and irrigation. Power generation from the project also meets the power demand in China to a limited extent. Therefore, it is fair to say that the project is in line with the development needs of the target area at the times of the appraisal and ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

The First Three-Year[12] of the Fourth Japanese ODA Loan (fiscal years 1996–98) corresponds to the Chinese government's *Ninth Five-Year Plan* by placing priority on assistance to agriculture, addressing regional income disparities, and the environment. In the *Medium-Term Strategy for Overseas Economic Cooperation Operations* (1999–2002) that was in force at the time of the appraisal, a) assistance for poverty alleviation and economic and social development, b) tackling global issues, and c) assistance for economic structural reform were identified as important areas. In addition, the *Economic Cooperation Program for China* formulated in 2001 gave priority to the following six areas:

- Cooperation in addressing global issues such as environmental problems
- Support to reforms
- Promotion of mutual understanding
- Assistance for poverty alleviation
- Support to private sector activities
- Promotion of bilateral cooperation

In the light of the Japanese aid policy at the time of the appraisal, the assistance to the water resource sector, which would result in development of agricultural infrastructure, increase in food production, and reducing regional income disparity, was in line with the *Medium-Term Strategy for Overseas Economic Cooperation*

[10] The water guarantee rate is the ratio of years in which a minimum amount of irrigation water is guaranteed during drought. A guarantee rate of 50% means that a response to drought can be done once every two years.
[11] SCE stands for Standard Coal Equivalent. In China, SCE is used to measure energy consumption.
[12] The Fourth Japanese ODA Loan (fisca years 1996-2000) was divided into two terms, fiscal years 1996-98 was the first three years and fiscal years 1999-2000 was the second three years.

Operations at that time.

Therefore, the project is highly relevant to China's development plan and development needs as well as Japan's ODA policy, and its relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

3.2.1.1 Major Structures

The output of the project is the construction of a multi-purpose dam for flood control, urban and industrial water supply, irrigation and power generation. Table 1 shows the planned and actual major structures of the project.

Table 1: Comparison between Planned and Actual Major Structures

Output		Planned	Actual
Dam	Height	101.0 m	102.2 m
	Length	588 m	626 m
	Width	8 m	8 m
	Storage capacity	616 million m^3	608 million m^3
	Effective storage capacity	586 million m^3	586 million m^3
Spillway		102 m	102 m
Drainage		525.56 m	525.56 m
Power generation		7,890 kw	9,380 kw

Source: Materials provided by JICA (planned) and the executing agency (actual)

There is a slight difference between the planned and actual specifications of the dam including dam height, length and water storage capacity. These changes are made because a few modifications were made in the detailed design after the project started, taking into consideration such matters as the condition of the construction site. With regard to flood control, the main objective of the project, a dam that can withstand once in 100-year flood was constructed, and the flood control area of 1,915 km^2 remained unchanged from the plan.

Photo 2: Spillway[13]

According to the plan at the time of the appraisal, out of the effective storage capacity of 586 million m^3, 333 million m^3 was to be for flood control, 118 million m^3 for irrigation, and 135 million m^3 for urban water supply. The actual effective storage capacity is 363 million m^3 for flood control and 283 million m^3 for other purposes; however, 60 million m^3 overlaps for flood control and other purposes. Urban water supply, irrigation and the environment constitute the portion of the effective storage capacity other than flood control. The environment refers to the water released into Qihe

[13] Gate used for releasing water when flood of a once in 100-year scale occurs.

River for protecting the environment and the ecological system downstream of the Panshitou dam.

The generation capacity of the power station constructed next to the dam was planned to be 7,890 kw at the time of the appraisal, but it was modified to 10,000 kw in the detailed design. However, the actual capacity was changed to 9,380 kw after it was once again reconsidered in line with the storage capacity of the dam and the altitude difference between the dam and the power station. Two stations use the hydropower from the dam; the power station No. 1 has two generators with the capacity of 1,250 kw and one with 630 kw and the power station No. 2 has two 2,500 kw generators and a 1,250 kw one. All the hydroelectricity from the Panshitou dam is supplied to the national grid. Therefore, except for the portion connecting to the national grid, no new transmission and distribution networks were developed.

Besides the dam and the power station that were constructed using the funds from the project, the existing water treatment plants No. 1 and 2 in Hebi City for supplying water in urban areas using the water of the Panshitou dam were expanded. However, the expansion was implemented not by the implementing agency of the project but by Hebi Water Service Company using funds other than those of the project. Also, the Hebi City Water Resources Bureau developed water transmission and distribution lines.

Regarding irrigation using the water from the Panshitou dam, because the project aimed to improve the water guarantee rate in the existing irrigated areas, the field channels in the project area were in existence even before the project, and no new irrigation facilities were developed. The water guarantee rate in the project area is unknown, but a plan was to achieve 55.4% using the Panshitou dam. According to the Hebi City Water Resources Bureau, although there are no detailed data on the actual water guarantee rate, it achieved approximately more than 50%.

As described above, there have been slight changes in major structures; however, the dam was constructed with flood control capacity as per the initial plan. With regard to the power generation capacity, the changes were a result of reconsidering the dam's specifications, and it can be judged that the changes made to the major structures were appropriate.

3.2.1.2 Consulting Services

The plan at the time of the appraisal was to hire international consultants for consulting services in the project. However, after the project started, the implementing agency requested changes in the agreement made at the time of the appraisal between the executing agency and the Japan International Cooperation Agency (hereinafter referred to as JICA)[14] regarding the appropriateness of man-months (M/M) of international consultants and a possibility of doing away with the pre-qualification process. The schedule for employment of consultants was delayed for about one year while changes in consulting services were considered. Meanwhile, to make progress in the project, the implementing agency carried out basic design that international consultants had been supposed to take charge of, and tried minimizing the delay in the project. In addition, of the consulting services envisaged at the time of the appraisal, the implementing agency completed 51 M/M out of 85 M/M for the team leader who was to supervise the design as a whole including the work of such personnel as a design engineer and a geological engineer. Furthermore, it became possible to reduce significantly the

[14] Overseas Economic Cooperation Fund at that time.

amount of procurement-related work because *Standard Bidding Documents under Japanese ODA Loans* was prepared in November 1999 and applied to the project. International consultants' M/M related to procurement was no longer required because procurement for the project did not require special technical consideration. In addition to such circumstances, because China has many design agencies and academic experts that have a wealth of experiences and technical capabilities on the construction of dams with a height of more than 100 m, it was deemed appropriate to hire local consultants. Therefore, in January 2000, it was decided not to hire international consultants, and hire local consultants at the Chinese side's expense instead. Based on these changes, the tasks initially planned to be carried out by international consultants were changed as shown in Table 2.

Table 2: Tasks of International Consultants and Agencies

Task	Agency
Construction management	Local consultant
Advisory for environmental protection measures based on environmental guidelines	Hebi City Bureau of Environmental Protection
Procurement	Panshitou Dam Construction Management Bureau
Reporting to JICA	Panshitou Dam Construction Management Bureau
Training	None

Source: Materials provided by JICA and the executing agency

At the time of the ex-post evaluation, project related personnel of Panshitou Dam Construction Management Bureau which implemented the project explained that the Chinese side asked JICA at the time of the appraisal to hire local consultants for the project. However, because the project was the first ODA Loan project for the executing agency, JICA was concerned about the agency's procurement and management capacity, and decided eventually to hire international consultants. When the change from international consultants to local ones was being considered, the implementing agency carried out such tasks as basic design, and the delay in the project was very limited. Furthermore, hiring the local consultants made it possible to reduce the cost of consulting services. Because the Chinese side bore the cost related to hiring local consultants, the cost of consulting services to be covered by the ODA Loan was used in construction. The implementing agency stated that the performance of the local consultants was highly satisfactory. It is fair to say that it was appropriate in the project to hire local consultants instead of international ones.

3.2.2 Project Inputs

3.2.2.1 Project Cost

Out of the total project cost of 16,382 million yen planned at the time of the appraisal, 6,734 million yen was in foreign currency and 9,648 million yen (603 million yuan) was in local currency. The ODA Loan covered the entire amount of the foreign currency portion. For the local currency portion, the Ministry of Water

Resources was to invest 2,560 million yen (160 million yuan) while the Henan Provincial Government and the Hebi Municipal Government were to invest 4,960 million yen (310 million yuan) and 2,128 million yen (133 million yuan), respectively.

At the time of the ex-post evaluation, the total project cost was confirmed to be 29,513 million yen (180% against the plan). The actual disbursed amount was 6,727 million yen (100% against the plan). Table 3 compares the planned and actual project costs.

Table 3: Comparison of Planned and Actual Project Cost (Unit: million yen)

	a. Foreign currency	b. Local currency	c. Total (a + b x exchange rate)
Planned	6,734	9,648	16,382
Actual	6,727	22,786	29,513

Source: Materials provided by JICA and the executing agency
Note: The exchange rate for "Planned" is 1 yuan = 16 yen (May 1998, at the time of the appraisal) and "Actual" is 1 yuan = 14.10 yen (average rate between December 1998 and October 2014 obtained from OANDA).

The reason that the project cost became significantly higher than the original plan was the increase in the cost of the resettlement. At the time of the appraisal, the cost of the resettlement was 1,848 million yen; however, it was 15,933 million yen (1,130 million yuan) as confirmed during the ex-post evaluation, which was about nine times the planned amount. The main causes of the significant increase in the cost of the resettlement after the project started are the additional cost and well-equipped infrastructure facilities of the resettlement site developed through negotiations with the affected people based on the resettlement law that was newly enacted in 2006. Resettlement is compensated on the basis of domestic laws; in 2006, the existing related law was abolished, and a new resettlement law named "Regulations on Compensation for Land Acquisition and Resettlement for Large- and Medium-scale Construction Projects for Water Resource and Hydropower Generation" was enacted. The new law, emphasizing the rights of people who are affected, increased significantly the compensation for land acquisition from farmers. Under the old law, the norm for the compensation for land acquisition was three to four times the average market price of the past three years, and it was possible to reduce the compensation amount in the case of a large project; however, the new law increased the compensation amount to 16 times the market price, causing a substantial increase in the cost of land acquisition for resettlement sites. In addition, some of the affected people opted for "community migration," a type of resettlement described in a later section, incurring an additional cost for developing well-equipped community infrastructures in the relocation site.

The project cost may increase even more because a portion of the resettlement has not been completed at the time of the ex-post evaluation.

The project cost has exceeded the plan significantly because of the increase in the resettlement cost.

3.2.2.2 Project Period

According to the plan at the time of the appraisal, the project period was from December 1998 (time of signing the Loan Agreement) to June 2003 (four years and seven months, i.e., 55 months) and the project would be completed when all the related projects began their operation. As the actual project period, the

construction of the Panshitou dam was completed in June 2006, and the final disbursement was made in July 2006. Storage of water in the dam started in June 2007 and the operation of urban water supply, irrigation and power generation using the water from the dam started in August 2008. Accordingly, the project period is nine years and nine months (117 months) from December 1998 to August 2008, i.e., 213% against the plan. As described in "3.3 Effectiveness," it was not possible to bring the water level of the reservoir to full because the resettlement is not completed at the time of the ex-post evaluation, but measures are in place to rectify the situation, and the dam can withstand the scale of flood that was originally envisaged. Therefore, it can be judged that the project was completed when the dam and urban water supply, irrigation and power generation using the water from the dam became operational.

The major reasons for the prolonged project period are as follows:

- Delay in the State Council's approval of the feasibility study (F/S): At the time of the appraisal, it was expected that the State Council would grant necessary approval by the end of 1998 for starting the construction in the project; however, the State Council did not approve the F/S until August 2000, resulting in a delay of about 21 months. According to the Panshitou Dam Construction Management Bureau, although the approval for the F/S by the State Council was assured, it was not possible to estimate how long the actual approval process would take. To keep the delay to a minimum, the implementing agency took actions before the start of the dam construction such as proceeding with the resettlement process and constructing an access road to the construction site.
- Delay in the resettlement process: The resettlement process took time because of such reasons as the enactment of the new resettlement law. Although the process was to be completed by December 2001 at the time of the appraisal, it is still continuing at the time of the ex-post evaluation. The delay in the resettlement of people living in the reservoir area caused a 12-month delay in operationalizing the dam. When the project started, the implementing agency was aware that the resettlement law was going to be changed, but did not know the actual timing of the enactment of the new law. When the timing of the enactment of the new law was confirmed, the implementing agency tried to secure additional funding because it became clear that the resettlement cost would increase on the basis of the new law.

Accordingly, the delays in the approval for the F/S and the resettlement process were not necessarily within the control of the implementing agency. However, because the process of F/S approval is relatively time-consuming, the project period should have been planned upon carefully checking the time required for the process when the project started.

The project period was significantly longer than planned.

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

At the time of the appraisal, the Financial Internal Rate of Return (FIRR) was calculated to be 7.6% and the Economic Internal Rate of Return (EIRR) 15.8%. Benefits envisaged at that time were flood control, urban water supply, irrigation, and electricity supply. At the time of the ex-post evaluation, the External Evaluators discussed re-calculation of IRR with the implementing agency. However, it was not possible to re-calculate IRR for the following reasons: (1) the original calculation method of IRR at the time of the appraisal could not have been confirmed; (2) it was not possible to obtain the cooperation of multiple relevant agencies in

collecting data on not only flood control but also other items including urban water supply, irrigation, and electricity.

Both the project cost and the project period significantly exceeded the plan. Therefore, the efficiency of the project is low.

3.3 Effectiveness[15] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

In the project, the construction of the multi-purpose dam, i.e., Panshitou dam, was expected to bring about effects on the following: a) flood control; b) urban water supply (domestic and industrial); c) irrigation water supply; and d) power supply. Among these, the implementing agency confirmed that flood control was the most important in the project. After flood control, urban water supply and irrigation were important but power supply was the least important of the four areas. Based on the priority of the four areas, it was decided to evaluate with emphasis on flood control. This section explains the operational and effect indicators for each of the four areas along with their level of achievement.

[15] Rating is based on the judgment on Effectiveness and Impact.

Table 4: Operational and Effect Indicators

	Baseline	Target[16]	Actual	Actual	Actual
	1998	2003	2008	2010	2014
	Year of appraisal	Year of project completion	Year of project completion	2 years after project completion	6 years after project completion
Operational Indicators					
1. Annual maximum flow (m^3/s)		Design value 6,650	—	—	—
2. Annual highest water level (m)		Design value 254[17]	No data	233.55	238.10
3. Discharge capacity (m^3/s)[18]		Design value Spillway 6,263 Spillway tunnels 2,374	—	—	—
4. Annual total volume of inflow (m^3)	240 million	360 million	No data	130 million	120 million
5. Incidence of flood control (times/year)	0	—	—	—	—
6. Annual supply of industrial and domestic water (m^3)	0	135 million	80 million	82.95 million	92.74 million
7. Irrigated area (ha)	20,000	20,000	20,000	20,000	20,000
8. Annual supply of irrigation water (m^3)		13.77 million	No data	No data	27.00 million
9. Capacity factor (%)[19]		Not established			Average 75
10. Availability factor (%)[20]		Not established			Average 77
11. Unplanned outage hours (hours/year)[21]		0			Average 0
12. Hydropower utilization factor (%)		Not established			Average 77
13. Beneficiary population (people)		1.8 million	No data	No data	2.1 million
Effect Indicators					
14. Corresponding capacity for flood return period		Once in 100-year	Once in 100-year	Once in 100-year	Once in 100-year [22]
15. Annual maximum inundated area (km^2)	15,800	0	—	—	—
16. Population served (%)	96	No data	No data	No data	100
17. Yield of major agriculture crops (kg/mu[23])	Wheat 430 Maize 450	430 450	No data	No data	620 600
18. Annual power generation (kwh)		25.00 million			Average 6.15 million
19. Electricity supply (kwh/year)		No data			Average 390
20. Maximum output (kw)		Design value 9,380	9,380	9,380	9,380

Source: JICA and the executing agency

Note: Actual values of operational and effect indicators 1, 3, 5 and 15 are marked "-" because there has been no flood in the project area since the project started. They do not indicate the achievement level of these indicators.

Flood control

The target values of the operational indicators from 1 to 3 are based on the design of the Panshitou dam. The reservoir, spillway, and spillway tunnels are properly maintained and have capacity as per the design. In recent years, "2. Annual highest water level" has not reached 247 m, the highest level possible while the resettlement is incomplete, because of the reduced precipitation in the project area. "4. Annual total volume of

[16] In the project, operational and effect indicators and their target values were not established at the time of the appraisal. Therefore, representative indicators for flood control, urban water supply, irrigation and the power sector were selected at the time of the ex-post evaluation, and baseline and target values were confirmed ex post facto to the extent possible.

[17] The maximum water level according to the design is 254 m; however, because the resettlement is incomplete upstream at the time of the ex-post evaluation, 247 m is the maximum possible water level.

[18] Spillway is used to release water downstream when once in 100-year flood occurs. Spillway tunnels are used to release water when there is flood smaller than the scale of once in 100-year.

[19] Capacity factor = electricity supply / (maximum output x annual number of hours) x 100

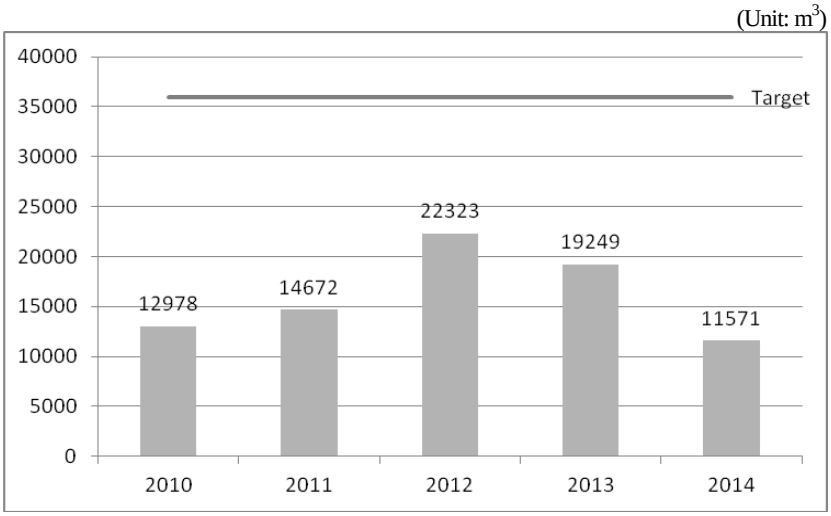
[20] Availability factor = (annual operation hours / annual number of hours) x 100

[21] Unplanned outage hours = (electricity supply / annual possible power generation in the year) x 100

[22] When the maximum water level is 254 m. Currently, to achieve this figure, the residents need to be evacuated because the resettlement is not completed upstream.

[23] Unit indicating the size of agricultural land in China. 1 mu = 1/15 ha.

inflow" has been monitored since 2010 and, as shown in the figure below, the annual total volume of inflow is significantly below the target value because of the reduced precipitation. Actually, the volume of inflow since 2010 has been lower than the baseline value. The average annual precipitation of Hebi City at the time of the appraisal was 674.8mm, but in 2013, the precipitation data of Qixian County and Xunxian County adjacent to Hebi City were 485.5 mm and 348.5 mm, respectively.



Source: Executing agency

Figure 2: Changes in Annual Total Volume of Inflow

Similarly, for the effect indicator "14. Corresponding capacity for flood return period," the Panshitou dam is capable of withstanding once in 100-year flood.

Because the relocation of residents has not been completed, based on the instructions from the Henan Province Flood Control Office, there is a regulation to evacuate upstream residents and protect the people downstream if a major flood of once in 100-year occurs. According to the implementing agency, there is a regulation to compensate for damaged houses and agriculture land of the residents who are forcefully evacuated in an emergency situation.

Urban water supply

With regard to "6. Annual supply of industrial and domestic water" using the water from the Panshitou dam, the average actual value from 2008 to 2014 is 85.59 million m^3 and the achievement against the target is 63%. The probable reason that the achievement is below the target is the low water level in the reservoir in recent years. Approximately 30 to 40% of the water supplied is provided to water treatment plants as domestic water, and the rest of the water is supplied to industries such as cement factory around Hebi City.

"16. Population served" in Hebi City by the water connection was 96% in 1998, i.e., the time of the appraisal, and is estimated to have reached 100% in 2014. In addition, although it was not selected as an indicator because of the lack of detailed data, according to the implementing agency, water supply hours that had been restricted became 24 hours a day because of the project, implying that stable water supply is provided to the residents. In addition, as described in "3.4.2 Other Impacts," the water quality of the dam is one of the

best in China, and high-quality soft water is supplied to Hebi City.

Irrigation

At the time of the appraisal, supply of water to a total of 20,000 ha in four irrigation areas was planned. The four irrigation areas were existing ones, and after considering the size of the areas, three irrigation areas ended up using the water from the Panshitou dam. The actual value of "8. Annual supply of irrigation water" is an estimate by the Hebi Water Resources Bureau. However, the figure is 196% against the target, making it an unrealistically high figure considering the low level of water in the reservoir. The figure includes the irrigation using groundwater, and it was not possible to measure only the effect of the project.

The target and actual values of "17. Yield of major agriculture crops" are the average of Hebi City. The increase in the yield of agriculture crops may be due to not only the irrigation but several other reasons such as improvement in agricultural technology.

Power supply

For power supply, except "11. Unplanned outage hours" and "18. Annual power generation," it was not possible to set the target values of operational indicators ex-post facto. The target and actual values of "20. Maximum output" are based on the design of the generator. With regard to actual values of power generation, only the average actual values between the time that the power stations started operating and the ex-post evaluation were provided.

Because target values were not set, it was difficult to determine the degree of achievement in regard to the actual values. Therefore, "9. Capacity factor" and "10. Availability factor" were checked with a hydropower expert of the Hangzhou Regional Center for Small Hydro Power. The expert stated that the actual values of the project were relatively high. For reference, in the Hubei Small-Sized Hydropower Project (Loan Agreement signed in 2001), the target for the capacity factor is set at 34 to 49%. For "12. Hydropower utilization factor," the average in China is 45% according to the Hangzhou Regional Center for Small Hydro Power, and it is clear that the rate for the project is relatively high.

"18. Annual power generation" is significantly below the target because of the low precipitation and the low level of water in the dam that also affected power generation.

3.3.2 Qualitative Effects

In the project, appropriate flood control and reduction in flood damage were expected as qualitative effects. As described earlier, there has been no flood in the project area from the start of the project to the time of the ex-post evaluation. Therefore, it is not possible to confirm specific effects that may appear at the time of a flood other than those confirmed based on the design of the dam.

"3.4 Impact" describes other qualitative effects of the dam constructed by the project that were confirmed by interviewing the implementing agency.

3.4 Impacts

3.4.1 Intended Impacts

As impacts of the project, improvement of the living standards of local residents and economic development of the region were expected. At the time of the ex-post evaluation, citing the ongoing resettlement process related to the project, the approval for conducting a beneficiary survey could not have been obtained from Hebi Municipal Government and the survey targeting local residents and businesses was not carried out. Therefore, the information in the following section is based on the interviews with the implementing agency and secondary data.

Improving the income and living standards of local residents

It was not possible to obtain detailed data on the annual income of farmers who live around the Panshitou dam before and after the project implementation and the rate of its increase. However, according to the implementing agency, the income increased by 795 yuan.

The Panshitou dam supplies water to Hebi City. At the time of the ex-post evaluation, the water supply to Hebi City was available 24 hours a day using the water from the dam. However, before the project, the water supply was limited to specific hours daily. As indicated in the change in water supply hours, the dam contributed to improving the living standards of local residents to a certain extent.

Regional economic development

According to the Henan Province Statistical Yearbook, the amount of industrial water consumption in Hebi City in 2013 was 50.85 million m^3. According to the data provided by the Panshitou Dam Construction Management Bureau, 89.45 million m^3 of urban water was supplied from the dam in 2013 out of which 57.27 million m^3 was provided to industrial units such as cement and chemical fertilizer plants. Although there is a slight gap between the data of the Henan Province Statistical Yearbook and the one provided by the implementing agency, it is not an exaggeration to say that the dam plays an important role for the industries in the region because the amount of industrial water supplied from the dam exceeds the industrial water consumption of Hebi City.

3.4.2 Other Impacts

Impacts on the Natural Environment

With regard to the environmental approval on the project, the Environmental Impact Assessment (EIA) was conducted according to the People's Republic of China Environmental Protection Act and Supervision for Environmental Protection in Construction Project Act, and the result of the EIA was ratified by the Ministry of Environmental Protection in June 1993. At the time of the appraisal, the project was classified as category A in the *OECF Guideline for Environmental Considerations Version II* because the project faced an issue of land acquisition. In the EIA, impacts on water quality, volume and temperature were considered relatively high. At the time of the EIA, the water quality in the project area was fairly good and categorized in Class I and II[24] in

[24] The permissible level is specified for several items that indicate the quality of surface water. There are Class I to V, and Class I indicates

the national water quality standards. The need for appropriate environmental measures was pointed out because the dam is close to the Hebi City urban area and there was a concern on the inflow of domestic and industrial wastewater into areas surrounding the dam during and after the project. In addition, after the completion of the reservoir, it was forecasted that the river temperature will change from the range of 4.8-25 ºC at the time of the EIA, to 6.9 -18.9 ºC. It was also pointed out that it was necessary to analyze the impact on agricultural crops and the ecosystem such as fish (organisms that required special protection do not exist) downstream caused by the change in water temperature and take appropriate measures to address the impact. Also regarding water volume, reduction in it was a concern because of the change in the amount of water in the river after the completion of the dam reservoir; therefore, it was pointed out that appropriate water volume management was required. With regard to monitoring, regular monitoring was to be carried out by the environmental protection agency.


Photo 3: Qihe River Wetland Park

At the time of the ex-post evaluation, it was confirmed that, from the period of project implementation until now, the Hebi City Environmental Protection Bureau has been conducting monitoring on water quality of Qihe River every month. Monitoring is conducted for 27 items including biological oxygen demand (BOD) and chemical oxygen demand (COD), and the water quality of the Panshitou dam meets national standard Class I (best quality) for 26 out of the 27 items. Thus the water quality in the areas surrounding the dam is good, and the effort to maintain good water quality and protect the ecosystem in the surrounding area has been recognized and resulted in being certified as a "National Good Ecology and Environment Lake" in 2013. Further, the Chinese government has provided funds to maintain the water quality and protect the ecosystem in the future. In relation to water volume, a record of discharge from the Panshitou dam to downstream is kept every month. With reference to monitoring of the water temperature, the matter was consulted with environmental experts after the project started. It was determined that monitoring was unnecessary because the discharge from the dam merges with other rivers downstream and the water temperature would be kept constant.

The interviews conducted during the ex-post evaluation revealed a positive impact on the environment of the downstream area of Qihe River due to the construction of the dam. According to the implementing agency, before the project, the water volume of Qihe River decreased to less than 70% of usual years in the dry season. However, after the project, thanks to the dam, a constant amount of water flows throughout the year. In addition, in the Qihe River Wetland Park located downstream of the dam, vegetation in the park improved after the construction of the dam.

It was not possible to confirm the status of environmental pollution during the project implementation through a beneficiary survey. However, according to the implementing agency, problems from the

good quality while Class V means poor quality of water.

construction of major structures did not arise because the relocation of residents from the surrounding area was completed when the construction started.

Land Acquisition and Resettlement

The plan at the time of the appraisal envisaged 334 ha of agricultural land acquisition and resettlement of 12,727 people or 3,264 households. Resettlement was to be carried out in stages by dividing the people into three groups: 1,381 people were to be relocated to an area close to the project site, and 11,346 people to the existing national farm in Xunxian County close to Hebi City. For the resettlement, compensation was to be paid in accordance with the domestic law and was to be completed by the end of 2001.

The table below shows the progress of resettlement at the time of the ex-post evaluation. Note that the resettlement of Group 3 is still ongoing at the time of the ex-post evaluation. The resettlement of the remaining 1,000 people is to be completed by June 2015.

Table 5: Progress of Resettlement (As of March 2015)

	Land acquisition	Resettlement	Population	Cost (thousand yuan)
Group 1	August 2000	December 2000	1,746	25,000
Group 2	Nov. 2001–Sept. 2009	Nov. 2001–Oct. 2009	12,660	455,000
Group 3	December 2011–2014	Dec. 2011–June 2015 (planned)	4,710	650,000
Total			19,116	1,130,000

Source: Executing agency

Reasons for increased resettlement population from the original plan are; population increase with the passage of time; and inclusion of people who wanted to be relocated along with other residents although the houses of the former would not be affected but their agricultural land would be submerged. The cost and timeline of the resettlement are as described in "3.2 Efficiency."

For resettlement, briefings were provided to the affected people prior to the resettlement, and repeated negotiations were done regarding compensation and plans for relocation. Each affected person was compensated with 0.07 ha of agricultural land and cash. For housing and community infrastructure in the new site, two types, namely "agricultural migration" and "community migration" were made available. In agricultural migration, the affected people are provided with the cost of housing construction by the implementing agency, and build individual houses in the allocated land area. Group 1 and 2 are those of agricultural migration. By contrast, community migration is an option to relocate to group housing equipped with medical and commercial facilities in addition to basic infrastructure such as electricity, gas

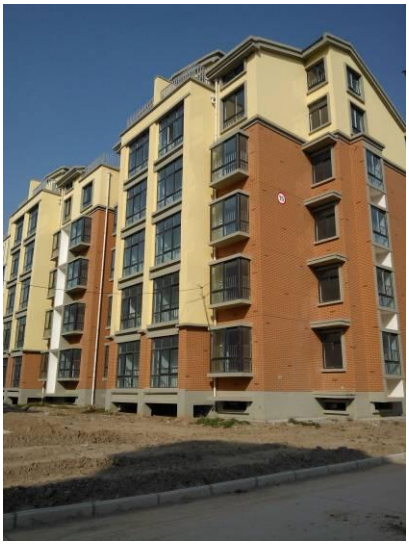


Photo 4: Exterior of Nanhai Community

and the internet based on the demand from the affected people.

At the time of the ex-post evaluation, a few residents were interviewed in "Nanhai community" where the resettlement took place as part of Group 3. One of the residents seemed very satisfied with his new home equipped with running water and gas because, in the village where he had lived before the resettlement, drinking water had to be brought from the river and wood and coal were used for cooking.

Judging the effectiveness and impact overall, the project effects are seen as per the plan in flood control, the most important area. Although the actual value is below the target one for the annual highest water level and the annual total volume of inflow for the reservoir, it does not hamper the effect of flood control because it is caused by reduced precipitation in recent years. In urban water supply, the second most important area after flood control, high-quality water is supplied in a stable manner to the residents and industries of Hebi City. There are somewhat weak effects from urban water supply, irrigation and power, but these are caused by the water shortage in recent years.

The project maintains high-quality water in the reservoir and its downstream area while conserving the ecology of the area by releasing water constantly.

The resettlement was of a large scale and negotiations for compensating the affected people were difficult at times. However, it was eventually done in such a way that it respected the views and rights of the affected people.

This project has largely achieved its objectives. Therefore, effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The executing agency of the project is the Henan Province Water Resources Department that is overseen by the Ministry of Water Resources and the Henan Provincial Government. The implementing agency is the Panshitou Dam Construction Management Bureau that was established in June 1997 by funds from the Henan Province Water Resources Department and the Hebi Municipal Government. According to the plan at the time of the appraisal, for operation and maintenance after the project completion, the Panshitou Dam Management Bureau was to be newly established based on the Panshitou Dam Construction Management Bureau.

The project was implemented as planned by the Panshitou Dam Construction Management Bureau as the implementing agency. The Bureau has ten divisions including those dealing with operation, resettlement, finance and water resources. The number of personnel in the Bureau is 40 and there is no vacancy at the moment. The Bureau intends to keep the same number of personnel even after the completion of the resettlement. This is to avoid a plethora of tasks among the current personnel in operation and maintenance by shifting those who are involved in resettlement to operation and maintenance.

The role of the Panshitou Dam Construction Management Bureau is the operation and management of the dam with special attention to flood control. The system required for this purpose is in place. The release of water during a flood is carried out based on the instructions from the Henan Province Flood Control Office. And, the Hebi City Water Resources Bureau takes charge of the forecast and warning for water release.

Hebi City Water Company is in charge of the water treatment plants of urban water, and the Hebi City

Water Resources Bureau is in charge of irrigation facilities. Heyuan Qianhehu Hydropower Company Ltd. is responsible for the operation and maintenance of the power station, and all the electricity generated from the power station is supplied to the national grid.

3.5.2 Technical Aspects of Operation and Maintenance

At the time of the appraisal, the Henan Province Water Resources Department, the executing agency, had experience in implementing many water-related projects in the province and its capacity for project implementation was deemed to have no problems. The project was actually implemented by the Panshitou Dam Construction Management Bureau without any technical problems.

Out of 40 personnel of the Panshitou Dam Construction Management Bureau, three have a high-level technical certification while 20 have a mid-level and 10 have a basic-level. In addition, five more personnel with a university degree are expected to obtain a technical certification in due course. According to the Panshitou Dam Construction Management Bureau at the time of the ex-post evaluation, the technical level of its personnel is sufficient for carrying out proper maintenance for facilities. To maintain and improve their technical level, there are systems of sending them to university and conducting training by inviting experts; and the systems are used when necessary.

According to the implementing agency, manuals on maintenance of the Panshitou dam have been developed and are used by its personnel properly. Regarding the spillway that will be used when once in 100-year flood occurs, inspection is conducted every month to ensure that it works properly. Therefore, it is fair to say that the technical aspects of operation and maintenance of the Panshitou dam have no issues at the time of the ex-post evaluation.

3.5.3 Financial Aspects of Operation and Maintenance

The Panshitou Dam Construction Management Bureau was expected to have enough assets during and after the project with assistance from the Ministry of Water Resources and the Henan Provincial Government through the Henan Province Water Resources Department. Financial aspects of operation and maintenance of the dam were verified at the time of the ex-post evaluation. The Panshitou Dam Construction Management Bureau receives financial assistance each year for operation and maintenance mainly from the Hebi Municipal Government. Normally, the Bureau prepares budget documents and requests the municipal government for the budget. In fiscal year 2014, the originally requested amount of the budget was 1.5 million yuan and the actual amount spent was 1.71 million yuan. According to the implementing agency, the operation and maintenance budget and expenditure is about 1.5 million yuan each year. The Panshitou dam releases the water required for urban water supply for Hebi City, irrigation and power generation. The agencies in charge of each project collect fees for these purposes. The collected fees do not become direct revenue of the implementing agency because they are given to the municipal government.

Table 6 shows the public finance of the Hebi Municipal Government indicated in the Henan Province Statistical Yearbook. From 2009 to 2013, both revenue and expenditure are on the rise. It is noteworthy that, in the last three years, the public fiscal expenditure is a huge amount of 8 billion yuan against the public fiscal revenue of 3 billion yuan.

Table 6: Public Finance of Hebi City (Unit: million yuan)

Fiscal year	Public fiscal revenue	Public fiscal expenditure
2009	1,801	4,634
2010	2,215	5,913
2011	2,802	7,425
2012	3,266	8,350
2013	3,964	8,692

Source: Henan Province Statistical Yearbook

Meanwhile, the municipal government receives financial reinforcement from the provincial government. In fiscal year 2013, there were transfers of 2.2 billion yuan general revenue and 2.4 billion yuan special revenue from the Henan Provincial Government to the Hebi Municipal Government; the actual fiscal revenue becomes 9.4 billion yuan when other revenues are taken into account. With regard to expenditure, in addition to the public expenditure of 8.7 billion yuan, the total is 9.3 billion yuan including principal repayment of government bonds among other items. Thus it is fair to say that the public finance of Hebi City is sound.

Budgetary provision from Hebi City and the Henan Provincial Government to the implementing agency is expected to continue hereafter as well. The Panshitou dam is very important from the perspective of flood control and urban water supply for Hebi City located in its downstream area. In addition, the maintenance budget allocated to the Panshitou Dam Construction Management Bureau is only 4% of the fiscal revenue of the municipal government in 2013, which is not a huge financial burden. Therefore, the finance of the implementing agency as well as the Hebi Municipal Government that allocates budget to the implementing agency does not have any major problems, and stable budget allocation is expected in the future as well.

3.5.4 Current Status of Operation and Maintenance

At the time of the field survey, it was confirmed that the dam and the spillway were kept in proper conditions. Regarding the spillway, to ensure that it works properly, regular inspection is conducted to prepare for flood. So far, there has been no siltation problem. There are no spare parts that are difficult to procure within the country for the project. There has not been any trouble until today since the dam started its operation.

Other than in the field of flood control, the irrigation channels are in relatively good condition. The power station is also kept clean and seems to be in good condition. It was not possible to visit the urban water treatment plant because there was no cooperation from Hebi Water Service Company.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project was to reduce flood damage while providing irrigation, urban water supply and power supply by constructing a multi-purpose dam in the Panshitou area of Qihe River where flood damages are frequent, thereby contributing to the improvement of the living standards of residents in the area and the economic development of the region. At the times of the appraisal and ex-post evaluation, flood control was mentioned as an important area in China's development policy. At the time of the ex-post evaluation, the Panshitou dam is playing an important role for urban water supply and irrigation around Hebi City, and consistency with development needs at the time of the appraisal was confirmed. In addition, consistency with Japan's ODA policy at the time of the appraisal was confirmed. In efficiency, the outputs were almost as planned, but both the cost and period of the project exceeded the plan significantly because of the enactment of a new resettlement law and the delay in F/S approval by the State Council. Because of the decreasing precipitation in recent years, the achievement level was low in a few operational indicators such as water level of reservoir, but the Panshitou dam is made to withstand once in 100-year flood. Stable water supply is provided for urban water and irrigation. In addition, the dam is contributing significantly to conserving the natural environment of the area surrounding the reservoir and downstream. There is a large-scale resettlement in the project, and its process was prolonged, but it was due to the enactment of the new resettlement law and changes in the social situation. The process resulted in more respect for the rights and views of the people affected than before. Institutional aspects of operation and maintenance are in place, and the technical level of personnel for operation and maintenance is appropriate. In financial aspects as well, necessary budget allocations for operation and maintenance are likely to continue. No problem was observed in the current status of operation and maintenance.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

At the time of the ex-post evaluation, resettlement of approximately 1,000 people has not been completed. It is recommended that the executing agency keep working to complete the resettlement firmly and as soon as possible.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Check carefully the procedure and time required for starting construction at the time of the appraisal

In the project, the project period was prolonged significantly because of the delay in the approval of the F/S by the State Council. The process of F/S approval requires a relatively long time. Therefore, at the time of the appraisal, the executing agency and JICA should check the required procedure and process for starting the construction in a project as well as the approval status at the time and possibilities of delay thereafter. After

checking these matters, if a delay is likely, then the executing agency and JICA should set the time for starting the project and the project period in such a way that certain delay can be absorbed.

END.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Dam		
Height	101 m	102.2 m
Length	588 m	626 m
Width	8 m	As planned
Storage capacity	616 million m^3	608 million m^3
Effective storage capacity	586 million m^3	As planned
Spillway	102 m	As planned
Drainage	525.56 m	As planned
Power station	7,890 kw	9,380 kw
2. Project Period	December 1998 – June 2003 (55 months)	December 1998 – August 2008 (117 months)
3. Project Cost		
Amount paid in Foreign currency	6,734 million yen	6,727 million yen
Amount paid in Local currency	9,648 million yen (603 million yuan)	22,786 million yen (1,616 million yuan)
Total	16,382 million yen	29,513 million yen
Japanese ODA loan portion	6,734 million yen	6,727 million yen
Exchange rate	1 yuan = 16.00 yen (As of May 1998)	1 yuan = 14.10 yen (Average between December 1998 and October 2014)