

Ex post evaluation – People’s Republic of China



Sector: Water supply and sanitation – large systems (CRS code 140200)
Project: Municipal Sewage Treatment Programme II (Yangtze)
 (BMZ no.: 1999 65 518*/2020 96 287)
Implementing agency: City of Yuncheng; City of Jishou, Chunsheng Holding in Fuyang, City of Jiamusi



Ex post evaluation report: 2020

All figures in EUR million	Planned	Actual
Investment costs (total)	134.56	156.36
Counterpart contribution	92.08	114.19
Financing**	42.48	42.17
of which BMZ budget funds	24.96	24.65

*) Random sample 2019

***) HH loan and promotional loan

Summary: The FC project “Municipal Sewage Disposal II (Yangtze)”, which was designed as an open programme, aimed to improve wastewater disposal in particularly polluted cities in the catchment area of the Yangtze and its tributaries by building wastewater treatment plants. The plan was to use programme funds to finance the foreign exchange costs of the electro-mechanical equipment to be imported for 4-6 wastewater treatment plants. The domestic costs for the construction of the wastewater treatment plants and the necessary expansion of the collection network were to be financed locally. Altogether, the programme co-financed four wastewater disposal projects in four provinces: the individual components of Fuyang in Zhejiang Province in the east and Jishou in Hunan Province in the south were financed entirely from budget funds, while the components of Jiamusi (Heilongjiang Province in the north-east) and Yuncheng (Shanxi Province in the north) were financed with market funds.

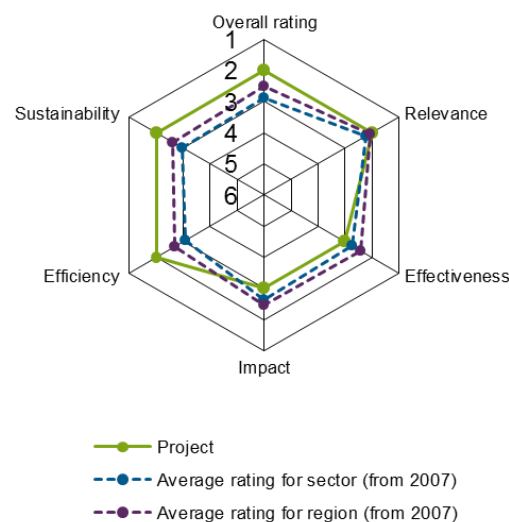
Objectives: The overall objective of the project on which the evaluation was based was to contribute to protecting water and the environment and to reducing the health hazards to the population in the programme cities caused by contaminated groundwater and surface water (impact). The module objective was to treat the municipal wastewater of the programme cities included in the project in compliance with the applicable Chinese standards, which appeared suitable to ensure adequate water protection (outcome).

Target group: The direct target group is the population living in the programme cities, the indirect target group is the residents of the water catchment area (downstream riparian).

Overall rating: 2

Rationale: Overall, the project addresses an acute need of the project cities, is in line with Chinese national priorities and is therefore highly relevant. The project efficiently achieved the target indicators of the programme or is well on the way to achieving them, even if some planning aspects should have been clarified earlier. The wastewater treatment plants are operated properly, and operation and maintenance can be financed largely through wastewater fees. The risks to sustainability are considered to be low.

Highlights: Compliance with national standards in the treatment of municipal wastewater is a high priority in China. The Ministry of the Environment monitors the discharge values of all municipal wastewater treatment plants in real time. The high level of initiative taken by the local authorities is also worth mentioning: all of the municipal administrations visited made substantial contributions of their own and invested in extensions and improvements after the project was completed.



Rating according to DAC criteria

Overall rating: 2

Ratings:

Relevance	2
Effectiveness	3
Efficiency	2
Impact	3
Sustainability	2

General conditions and classification of the project

Wastewater projects in China are planned on a decentralised basis. The national government sets the general framework (wastewater standards, water standards, etc.) and sectoral priorities in documents such as the respective 5-year plans and monitors compliance with national standards. The national level also informs the provinces of the availability of international funds and programmes. The provinces compile the concrete proposals of the municipalities, which are then discussed and selected at national level. The project executing agencies then take out the loans through one of the national partner banks (CDB, Eximbank, etc.), which on-lend the funds from the MoF to the project executing agency. For the programme “Municipal Sewage Disposal II (Yangtze)”, this meant that, in consultation with KfW and BMZ, cities outside the Yangtze catchment area were also eligible to participate in the programme. This appears reasonable from a development policy perspective as water protection is also highly relevant in other river catchment areas (Yuncheng in the catchment area of the Huang He, Jiamusi in the catchment area of the Songhua and Fuyang in the catchment area of the Fuchun). From the perspective of the respective provinces, the selection of the programme cities is easy to understand, but no national priorities are set.

Breakdown of total costs

The Chinese counterpart contributions are expressed in Chinese yuan (RMB). Due to exchange rate fluctuations over the years, the exact amount in EUR cannot be determined. The amounts indicated in the respective final review report were also used here.

EUR	Fuyang (Planned)	Fuyang (Actual)	Jishou (Planned)	Jishou (Actual)	Jiamusi (Planned)	Jiamusi (Actual)
Investment costs	23,500,000	23,500,000	30,000,000	33,000,000	43,790,000	59,200,000
Counterpart contribution*	17,000,000	17,296,261.75	25,020,000	28,030,108.16	28,790,000	44,200,000
Financing**	6,500,000	6,203,738.25	4,980,000	4,969,891.84	15,000,000	15,000,000
of which BMZ funds	6,500,000	6,203,738.25	4,980,000	4,969,891.84	6,521,739.12	6,521,739.12

*) Funds from own budget, Chinese financial contributions or loans from national banks

**) The HH loan was supplemented by a promotional loan at the Jiamusi and Yuncheng locations. For Jiamusi the HH loan was supplemented by a promotional loan of 8,478,260.88

	Yuncheng (Planned)	Yuncheng (Actual)	Total (Planned)	Total (Actual)
Investment costs	37,271,510	40,662,011	134,561,510	156,362,011
Counterpart contribution*	21,271,510	24,662,011	92,081,510	114,188,380.91
Financing**	16,000,000	16,000,000	42,480,000	42,173,630.09
of which BMZ funds	6,956,521.74	6,956,521.74	24,958,260.86	24,651,890.95

*) Funds from own budget, Chinese financial contributions or loans from national banks

**) The HH loan was supplemented by a promotional loan at the Jiamusi and Yuncheng locations. For Yuncheng the HH loan was supplemented by a promotional loan of 9,043,478.26.

Relevance

The open programme was originally intended for cities in the Yangtze river catchment area and, in line with the sectoral priorities of the Chinese government, was designed to contribute to improving water quality.

The development objective of the programme was to contribute to protecting water and the environment and to reducing the health risks to the population in the programme cities caused by contaminated groundwater and surface water (impact). The objective at module level was to treat the municipal wastewater of the programme cities included in the project in compliance with the applicable Chinese standards, which appeared suitable to ensure adequate water protection. According to the impact matrix, the aim was that 4-6 wastewater treatment plants, the construction/expansion of the sewerage network to be financed by the partner, and the training of operating staff would ensure that the wastewater in the programme cities met Chinese wastewater standards and thus contributed to improving water quality. Although the impact chain also appears plausible from today's perspective, an allocation gap between the programme objective and the development objective was already evident at the project appraisal, as the impact of just a few wastewater treatment plants on a large river catchment area such as the Yangtze is limited. It was therefore proposed that the development objective be considered achieved once the programme objective had been achieved.

As early as the late 1990s, the Chinese government saw the growing problems with the quality of surface water resulting from industrialisation and growth of the urban population (core problem). The increasingly poor quality of surface water has consequences for the quality of drinking water, for the possibilities of using surface water for agriculture and for biodiversity. The legal requirements and limit values for wastewater and drinking water are based on international standards. In addition, ambitious targets for improving water quality have been introduced in the most recent 5-year plans and have also been increasingly pursued.

The "Municipal Sewage Disposal II (Yangtze)" programme was incorporated into the national strategies and priorities and supports China in improving water resources. The original focus on the Yangtze catchment area was abandoned at the request of the Chinese government and in consultation with BMZ, as cities in other regions were interested in being included in the programme and other river catchment areas are equally important.

The project is still relevant from today's perspective. The intended direct contribution to reducing water-induced diseases cannot be readily inferred from today's perspective, as water is traditionally boiled before being consumed (e.g. in the form of tea or soup) and it is difficult to provide evidence of correlations. For the purposes of the ex post evaluation, the objective therefore focuses on resource conservation.

Despite improvements in water protection, the monitoring of wastewater at the outlet of the wastewater treatment plants (real-time monitoring of all urban wastewater treatment plants by the competent authorities) and the substantial investments made in urban wastewater treatment plants, the water is still contaminated in many areas. Due to rapidly growing cities and intensive agricultural use, especially in northern China, there is already fear of water scarcity, which underscores the importance of resource conservation.

Wastewater disposal is still highly relevant for the protection of water resources and climate change adaptation in China and is also in line with the Sustainable Development Goals. In addition to treating municipi-

pal wastewater, comprehensive resource conservation also requires addressing other potential sources of contamination, such as agriculture.

Relevance rating: 2

Effectiveness

The objective at module level was to treat the municipal wastewater of the programme cities included in the project in compliance with the applicable Chinese standards, which appeared suitable to ensure adequate water protection. Some of the indicators below were adjusted slightly to provide more clarity (see table below).

The target achievement at outcome level can be summarised as follows:

Indicator	Status PA, target PA	Ex post evaluation
(1) Average capacity utilisation of the financed wastewater treatment plants (in terms of water volume) three years after commissioning.	Target value 70%	Achieved, except in Jiamusi. Capacity utilisation is to be increased there by connecting other regions. Indicator largely achieved.
(2) Percentage of the individual projects financed under the programme that comply with legally prescribed discharge values (at least GB 8978-88)* 3 years after commissioning.	No data for PA, target value 100%	All locations comply with the legally prescribed discharge values. All plants have good purification capacity for carbon, nitrogen and phosphate (C, N, P). Indicator achieved
(3) Percentage of the individual projects financed under the programme that meet the requirements for eco-friendly disposal or recycling of sewage sludge 3 years after commissioning.	No data for PA, target value 100%	Except in Jishou, where sustainable sewage sludge disposal will begin next year at the earliest, the indicator has been met for all locations. Indicator largely achieved.
(4) Percentage of private households and businesses connected to the sewerage system.	No data for PA, target value 70% of households and 60% of businesses	Except in Jiamusi (where, however, all households in the city are connected) the indicator is achieved according to the project executing agency. Indicator largely achieved

*) Chinese wastewater standard for municipal wastewater.

(1) The indicator says nothing about the connection rate and type of polluters (households, industry) in the programme cities. During the EPE, the project executing agency was asked questions about the connection rate.

Jishou: according to information provided by the project executing agency and the municipality, industrial enterprises hardly play a role in the city anymore. The population is largely connected, including the larger blocks of flats that used to have septic tanks. As part of the planned city expansion, the capacities of sewers and wastewater treatment plants have been and are being expanded accordingly.

Yuncheng: according to the project executing agency, the population living in the city is largely connected to the wastewater treatment plant. The pre-treated industrial wastewater is discharged into the wastewater treatment plant. The project executing agency assumes that the industrial wastewater will be pre-treated in compliance with national requirements.

Jiamusi: many larger industrial companies have stopped working. For the existing facilities, the project executing agency assumes that the national requirements will be met. The population of the city shrank after population growth in the early 2000s. The population has stabilised in recent years. The wastewater treatment plant is currently running at overcapacity and a new sewage pumping station is under construction. After completion, other areas of the city will be integrated into the wastewater disposal system. The wastewater treatment plant will then most likely start operating at higher capacity again.

Fuyang: according to the project executing agency, mainly pre-treated wastewater from the paper industry is discharged into the FC-financed wastewater treatment plant. Household wastewater is also treated there. Wastewater disposal in the other part of the city, where most of the population lives, is handled by another wastewater treatment plant.

(2) Since the emission target can also be achieved by diluting the wastewater, consideration was also given to reducing the contamination level. All locations comply with the legally prescribed discharge values. In addition, the reduction of the contaminant level was randomly tested (inlet – outlet, biological and chemical oxygen requirement, N, P). Also in this respect, all plants have good purification capacity for C, N, P.

(3) The individual locations dispose of the sewage sludge differently in line with local conditions; in some cases, sustainable solutions are currently in the pipeline.

Jishou: sewage sludge is currently still being dumped in a landfill. A waste incineration plant is under construction and is scheduled for completion in 2020. The sewage sludge will also be incinerated there. This solution would be the preferred practice in Germany today.

Jiamusi: at present, the sewage sludge is treated in an additional anaerobic sludge digestion plant provided by the project executing agency. The sewage sludge is then used to cover a landfill site and for urban green spaces and similar purposes. Other options, such as incineration, will have to be explored in the medium term.

Fuyang: the sewage sludge is co-incinerated in a nearby cogeneration plant.

Yuncheng: the sewage sludge is processed in a composting facility and spread in public parks.

(4) Only in Jiamusi is the situation somewhat unclear regarding the connection rate: in theory, all households in the city are connected. The areas that will also be connected to the new pumping station are not part of the city, but of the surrounding area. However, this seems sensible in order to fully utilise the capacity of the wastewater treatment plant.

Overall, it can be said that the indicators were largely achieved. The solutions considered in each case appear sensible with regard to capacity utilisation and the connection rate in Jiamusi and sewage sludge disposal in Jishou.

Effectiveness rating: 3

Efficiency

China has invested massively in the construction and expansion of wastewater treatment plants in recent years. Above all, ADB and the World Bank are active as international partners in the sector. While the improvement of water quality and the treatment of municipal wastewater have been highlighted in the last 5-year plans, the central government limits itself to monitoring compliance with the standards. The provinces are mainly responsible for prioritising the locations. Given the size of the country, centralised national prioritisation appears difficult to implement. At all locations, the provincial government was closely involved in drawing up and submitting the applications for the FC funds. In addition, all locations are situated in important and polluted river catchment areas. Unique to Jishou is the fact that the city wants to create a name for itself as a recreational resort in a healthy environment and is supported in these efforts by the provincial government. The investment was particularly important in Fuyang as the centre of the paper industry, as the Chinese government has imposed strict regulations on the paper industry in recent years regarding water consumption and wastewater treatment.

The project was largely in line with projected needs in terms of investment capacity. One exception is Jiamusi. Between 2000 and the project appraisal in 2009 the city recorded population growth. After the

appraisal, however, the population declined and has stagnated in recent years. In the past, Jiamusi was dominated by heavy industry, which has since ceased operations. Since Jiamusi is not an attractive location either in terms of climate or economy, the assumptions of the project executing agency were too optimistic. From today's perspective, it would have made more sense to expand capacity in smaller stages.

In addition, the project executing agency in Jiamusi decided to rely on biogas production from sewage sludge instead of on energy-intensive drying of the sewage sludge, and invested in a suitable facility. The investment in the drying facility could have been used more efficiently. This also applies to the dewatering plant in Fuyang, where no centrifuges are used for sludge dewatering and the sludge is used directly in the nearby cogeneration plant.

Compared internationally, the investment costs per capita are reasonable or even relatively low. Similarly, all facilities are professionally operated except for a few minor defects. Personnel deployment is reasonable when compared internationally.

The delays in implementation were mainly due to delays in raising additional financial resources. After securing the funds, the construction of the wastewater treatment plants usually progressed quickly. However, there were further delays in Yuncheng due to necessary customs formalities and issues related to property.

The locations have outsourced the operation of the wastewater treatment plant to external operators, while the sewerage network is managed by the municipality or a municipal company. The private operators receive a fixed price per m³ of wastewater. There are differences in the responsibility for investments: either the municipality or its wastewater company is responsible for these investments, or the operator must carry them out. While the wastewater fees cover the operation of the wastewater treatment plant, the sewerage network is cross-subsidised by the municipality. In Fuyang, the municipality does not pay anything for the private sewage discharged into the wastewater treatment plant because the amount is insignificant. Fees are charged by m³ from the other industrial dischargers.

Due to the considerable importance of wastewater treatment in the Chinese context and the direct contribution of the measures to resource conservation, the allocation efficiency is also rated as positive.

Efficiency rating: 2

Impact

At the time of the project appraisal, it was proposed that the development objective be considered achieved once the programme objective had been achieved. This also appears to make sense from today's perspective, since in view of the large river catchment areas the contribution of individual wastewater treatment plants cannot be quantified, and the contamination - difficult to measure - contributed by other factors, especially agriculture, would have to be taken into account.

Due to the direct correlation of the measures with water protection and environmental protection, the overarching developmental impact is assessed in accordance with the satisfactory effectiveness of the project. This is also supported by the fact that the water quality at the measuring stations within and near the project cities has improved in all locations in the last few years since the wastewater treatment plants went into operation, in some cases to a considerable degree. This is an indication that the wastewater treatment plants have significantly reduced the quantities of pollutants discharged. However, since industrial plants have also been closed and more resource-saving processes have been introduced, for example in the paper industry in Fuyang, it is not possible to quantify the exact contribution of the wastewater treatment plants to improving water quality. It would be useful to collect more systematic data in the future.

Furthermore, according to the operators in Fuyang and Jiamusi, the number of fish and birds in the river catchment area has increased again. Although this statement cannot be proven in quantitative terms, it would correlate with the improved water quality.

Impact rating: 3

Sustainability

At the time of the project appraisal, sustainability risks were seen in operating personnel (level of training) and cost recovery.

From today's point of view, we see only a minor risk with regard to the quality of operation. Some of the facilities had already been in operation for several years at the time of the ex post evaluation. All system components were in operation or at least ready for operation, the quality of the structures and technical equipment (many German and international products) can be described as good. There is a certain degree of competition between national (state-owned) wastewater treatment plant operators in China, who have so far ensured professional operation at least at the project locations. According to statements by the operators, technical experience regarding operation is shared at different locations within the operating company, but also with other operators. There is also a wastewater association which organises conferences and discussions with the scientific community. However, operators have to train their staff themselves, and there are not yet any national training courses for technical staff.

The income from the wastewater tariffs is sufficient at the locations to cover the costs for the ongoing operation of the wastewater treatment plants. With regard to the sewerage network and necessary replacement and expansion investments, the political decision was made to keep the sewage fees low and to subsidise the operation from municipal funds. Some locations have found models either in cooperation with the industry (Fuyang) or with the operator (depending on the investment to be negotiated) to keep their own contributions for new or replacement investments low. Both municipalities and industrial sectors are under pressure from the Chinese central government to comply with wastewater values and are faced with considerable sanctions in case of non-compliance. As the competent authorities evidently carry out strict monitoring in real time, there is considerable pressure at local level to comply with the requirements for effluent values from wastewater treatment plants. One risk is a change in national priorities should there be a slowdown in economic growth or a recession. In this context, there could be a reassessment of priorities, shifting away from resource protection to industrial economic growth. However, this is offset by the increased importance that the population in the more prosperous regions now attaches to environmental problems. We therefore consider the risks to financial sustainability to be low.

The disposal of sewage sludge is an important issue worldwide. While Fuyang has found a sustainable solution by incinerating sewage sludge in a cogeneration plant, the use of the sludge for composting, as practised in Jiamusi or Yuncheng, may not be sustainable in the long term, depending on the development of sewage and sludge volumes in the coming decades. Both locations should assess alternative or additional concepts in the medium term. Jishou does not yet have a sustainable waste management system. However, an incineration plant will start operation next year, thus leading to long-term and sustainable wastewater sludge disposal.

Overall, we currently consider the sustainability risks to be low.

Sustainability rating: 2

Notes on the methods used to evaluate project success (project rating)

Projects (and programmes) are evaluated on a six-point scale, the criteria being **relevance, effectiveness, efficiency** and **overarching developmental impact**. The ratings are also used to arrive at a **final assessment** of a project's overall developmental efficacy. The scale is as follows:

Level 1	Very good result that clearly exceeds expectations
Level 2	Good result, fully in line with expectations and without any significant shortcomings
Level 3	Satisfactory result – project falls short of expectations but the positive results dominate
Level 4	Unsatisfactory result – significantly below expectations, with negative results dominating despite discernible positive results
Level 5	Clearly inadequate result – despite some positive partial results, the negative results clearly dominate
Level 6	The project has no impact or the situation has actually deteriorated

Rating levels 1-3 denote a positive assessment or successful project while rating levels 4-6 denote a negative assessment.

Sustainability is evaluated according to the following four-point scale:

Sustainability level 1 (very good sustainability): The developmental efficacy of the project (positive to date) is very likely to continue undiminished or even increase.

Sustainability level 2 (good sustainability): The developmental efficacy of the project (positive to date) is very likely to decline only minimally but remain positive overall. (This is what can normally be expected).

Sustainability level 3 (satisfactory sustainability): The developmental efficacy of the project (positive to date) is very likely to decline significantly but remain positive overall. This rating is also assigned if the sustainability of a project is considered inadequate up to the time of the ex post evaluation but is very likely to evolve positively so that the project will ultimately achieve positive developmental efficacy.

Sustainability level 4 (inadequate sustainability): The developmental efficacy of the project is inadequate up to the time of the ex post evaluation and is very unlikely to improve. This rating is also assigned if the sustainability that has been positively evaluated to date is very likely to deteriorate severely and no longer meet the level 3 criteria.

The **overall rating** on the six-point scale is compiled from a weighting of all five individual criteria as appropriate to the project in question. Rating levels 1-3 of the overall rating denote a "successful" project while rating levels 4-6 denote an "unsuccessful" project. It should be noted that a project can generally be considered developmentally "successful" only if the achievement of the project objective ("effectiveness"), the impact on the overall objective ("overarching developmental impact") and the sustainability are rated at least "satisfactory" (level 3).