PR China: Water Supply and Sanitation Haikou

Ex-post Evaluation

OECD sector	14020/Water supply and sanitation – large systems	
BMZ project number	1994 65 956 1995 145 (training measure)	
Project executing agency	Haikou Water Services Group Ltd.	
Consultant	GKW	
Year of ex-post evaluation	**2006**	
	Project appraisal (planned)	**Ex-post evaluation (actual)**
Start of implementation	4th quarter 1994	2nd quarter 1995
Period of implementation	48 months	42 months
Investment costs	EUR 82.62 million	EUR 133.05 million
Counterpart contribution	EUR 67.75 million	EUR 117.79 million
Finance, of which FC funds	EUR 14.89 million	EUR 15.26 million
Training measure	EUR 0.307 million	EUR 0.307 million
Other institutions/donors involved	None	None
Performance rating	1	
• **Relevance**	2	
• **Effectiveness**	1	
• **Efficiency**	1	
• **Impact**	1	
• **Sustainability**	1	

Brief Description, Overall Objective and Project Objectives with Indicators

The project aimed at improving the water supply and sanitation system in Haikou. It comprised the construction of a water source plant with pumping station (240,000 m³/day), a 19 km-long raw water pipeline, the extension of the existing waterworks from 75,000 m³/day to 240,000 m³/day, the rehabilitation and extension of the water distribution network the extension of the sewerage system, the construction of waste water pumping stations, the construction of a sewage plant (300,000 m³/day) and a sea outlet of approximately 1.4 km in length to discharge the treated waste water into the sea.

The project was to contribute to relieving pressure on surface water and protecting groundwater, improving production conditions for trades and industry and raising coastal water quality (overall objective). This was to be achieved through the following: ensuring the reliable supply of hygienically safe drinking water to the population all year round, increasing drinking water treatment capacity to meet demand, raising the connection rate to the water supply system,

increasing the ratio of surface water in raw water production, preventing the discharge of untreated waste water into the coastal waters by means of sewage collection in the catchment area and transmission to a sewage plant and orderly and adequate waste water treatment and control of the treated waste watere discharged into the sea (project objective).

The following indicators were defined to measure project objectives achievement:
- The treated drinking water meets the national quality standard (largely in line with WHO recommendations). The targed was achieved.
- The connection rate to the water supply system should be successively increased from 88% to 98%. This target was exceeded with a current connection rate of 100 %.
- The quality of the treated effluent at the outlet of the sewage plant meets at least the national standard at least (comparable with the German or international standard). This target was reached, too.

The following indicators, were also achieved:
- No interruption of supply since commissioning
- Reduction of groundwater share in water production from 65% to 40%
- Connections rate to the waste water system of about 70%
- Full use of sludge as fertilizer or as raw material for fertilizer production

The borrower was the People's Republic of China, represented by the Ministry of Finance. The project executing agency was the Haikou Water Supply Company (HWSC) and the Haikou Sewage Treatment Company (HSTC) which were merged to form the Haikou Water Services Group Ltd. in 2006. The investment costs for the project totalled EUR 133.06 million, of which EUR 14.89 million was financed from FC funds. The costs for the training measure amounted to EUR 0.307 million and were fully financed from FC funds.

Project Design/Major Deviations from Original Planning and Main Causes

The water supply and sanitation project in Haikou comprised the following main components:
Water supply:
- Construction of a water source plant and a pumping station at the Longtan Dam on the Nandu River
- Construction of a raw water pipeline of approx. 19 km in length to the waterworks
- Extension of the Mipu waterworks with two treatment lines
- Extension and rehabilitation of the water distribution network, especially the main transmission pipelines to the network, replacement of obsolete pipelines and reduction of water losses by repairing leakages and replacing or repairing water meters

Sewage disposal:
- Construction of the Baishamen mechanical-biological sewage plant, including sludge treatment
- Construction of a sea outlet of approx. 1.4 km in length
- Extension of the entire sewerage system (approx. 120 km in length)
- Construction of four additional waste water pumping stations

In addition, an extensive training measure was carried out. The plant personnel were also prepared for their tasks under instructions from the equipment suppliers and were given training. Altogether, over 250 personnel underwent further training, particularly in sanitation and in running large waterworks and sewage plants, some during a two-month stay in Germany and in China (Qingdao). With one exception, all these personnel are still working in qualified positions in the group.

The investment measures agreed on during project appraisal were implemented in the project without any major design changes, but the sewage plant, originally planned as a two stage

facility was built with a single stage; this does not impair its performance, however, owing to the composition of the sewage. The sewerage system could be extended by a third more than planned at project appraisal. The facilities were laid out to raise water supply capacity to 240,000 m³/day and sewage disposal capacity to 600,000 m³/day for the collection net and 300,000 m³/day for the treatment plant. The plan is to double treatment plant capacity and with that the whole sewerage system. Financial constraints on the Chinese side during implementation caused some delays in the components. Except for a sewage pumping station (presently still under construction) all other system components have now been installed. Finally, sludge digestion and gas utilization were put into operation in the sewage plant in March 2005.

Along with the other system components, the waterworks and the sewage plant have been in operation without interruption since commissioning and deliver the planned and anticipated quantity and quality of water. Water supply and sanitation systems have thus been set up and have been in operation since startup.

Also in hindsight, the conceptual design of the water supply and sanitation meets the technical and economic requirements. The layout of the facilities strikes a good compromise between current capacity utilization and the expansion horizon. In retrospect, then, the project measures can be judged as adequate in terms of choice of process and capacity layout.

Key Results of Impact Analysis and Performance Rating

Altogether, the water supply and sanitation facilities make a very good impression. The executing agency has the technical, personnel, administrative and financial capabilities for the proper and sustainable operation and servicing of all facilities with low total losses of about 17% and a high collection efficiency of 99%; no system failure has been recorded in recent years. The technical and administrative risks to sustainable operation are very low.

However, problems arose with obtaining replacements for faulty imported measurement and control equipment. Operations can, however, be properly maintained by means of manual alternatives.

The project eased pressure on surface water and periurban coastal waters, conserved groundwater through the collection and purification of sewage and assured the reliable supply of the population with hygienically safe drinking water all year round, thus reducing health hazards. Water quality meets the national standard and is regularly monitored. Groundwater offtake keeps to its regenerative capability so that no saltwater enters the aquifer.

The project appraisal ascertained that a part of the population not connected to the mains was obliged to obtain water from low quality wells. At the time, however, no evidence was available of water-induced diseases. The project has raised the percentage of mains connections in the population and with that reduced the use of wells and the attendant health risks. As a result, urban statistics have not recorded any water-induced diseases untill now.

Present figures indicate that specific water consumption in Haikou is in the order of about 170 l/cd. This relatively high consumption (also due to the subtropical climate) should be lowered with suitable measures (introducing a tangible tariff progression, doing away with joint meters in blocks of rented flats). Higher water consumption is also the reason why larger capacities need to be built or operated on the sewage side as well. The executing agency is aware of this and is also gradually working on improvements.

The project had no direct effect on gender equality. The percentage of mains connections was already high at project start, relieving women of the strenuous and time-consuming task of fetching water. The quality of drinking water was already good at project start as well so there

have been no changes in the health status and the need for nursing, which is performed by women.

Since less than half of the target group are poor, the project had no direct or indirect bearing on poverty. The socially equitable tariffs account for the poverty aspect. The project was not aligned with participation and good governance.

The project has made an important contribution to remedying the development constraints identified at project appraisal and to attaining the overall objectives: The pressure on surface water has been relieved through sewage treatment, the quality of the coastal waters is good and meets the statutory national standards, groundwater offtake is kept within its regenerative capability and the figures indicate a resulting rise in groundwater level through substitution by surface water and a reduction in losses. So the intended results chain from measures and outputs through to project and overall objective achievement was logically correct and properly implemented. Very high per capita consumption has, however, been recorded. Even if this had been reduced to 120 l/day, though, the treatment capacities would still have had to be increased. Nor has the high per capita consumption had any adverse effects on the groundwater situation and the attendant higher quantity of sewage and its treatment have not had any additional impact on surface water, either. As breakeven has been reached in water supply, the high per capita consumption does not detract from relevance. The technologies selected suited the abilities of the technical personnel and fitted well with the water supply system already in use before project start, so that the operation and servicing of the individual facilities (including the sewage component) are sustainable. The developmental goal of the project is still very important for the Chinese partner, as evidenced by the priority area agreed on with German development cooperation - environment policy and the conservation and sustainable use of natural resources. Close sector dialogue is conducted with the other donors, the guideline for all donors being the national sectoral strategies framed by the PR China in cooperation with ADB. We therefore classify relevance as good (subrating 2).

Also measured against the new indicators introduced at ex-post evaluation, the project objectives have been met. This applies for the continuous provision of hygienically safe drinking water, the substitution of groundwater with surface water, the percentage of sewage mains connections and for sludge disposal. The indicators on drinking water quality, sewage plant discharge and the percentage of mains connections in water supply were even exceeded. The effectiveness of the project is therefore judged to be very good altogether (subrating 1).

Despite higher total costs as compared with the appraisal report, the specific investment costs are still comparatively low. Considering full cost recovery in water supply and operating cost recovery in sewage disposal, the very low technical rate of loss of 17% and a collection efficiency of roughly 100%, the production and allocative efficiency is rated as very good (subrating 1).

The problems identified at project appraisal have been eliminated: The decline in groundwater level has been stopped and the danger of saltwater entering the aquifer has been reduced. This, however, is also due among other things to diminishing water needs as a result of industrial activities in the urban area and also the modernization of production methods (water-saving technologies). Thanks to the new untreated water collection facility, the surface water no longer contains large concentrations of saltwater and can be used for treatment without any problems. Organic water pollution has also been reduced by the new sewage treatment. The project's full sludge recycling serves as a prototype and has attracted interest nationwide as a pilot measure. These developments can be causally attributed to the sectoral framework, the industrial changes and the FC project. The developmental impact can thus be gauged as very good (subrating 1).

The migration of specialists could pose a potential risk to sustainability if the personnel policy, i.e. pay policy, of the new company changes due to the merger (see 4.08). At ex-post evaluation,

however, there were no definite indications, simply misgivings on the part of personnel. Even if these fears prove warranted, it should be possible to mitigate this organizational risk in the medium term and offset it through the advantages of the merger - higher efficiency and greater attractiveness for prospective private investors. The sustainability risks are low and the positive developmental efficacy of the project so far is very likely to continue unchanged (subrating 1). Overall, a very good developmental efficacy can be attested to the project (rating 1).

General Conclusions

To assure the long-term sustainability of investment projects of this type, they should draw more on the region for the possible procurement of spare parts for imported equipment (e.g. laboratory, measurement and control technology), particularly for executing agencies with limited access to foreign currency or where local agents are unavailable.

Contractual obligations should be met at an appropriate time. As far as sustainability is concerned, reaching a certain cost-recovery quota by operation startup makes little sense as the new facilities do not incur operating costs beforehand and these only have to be met afterwards. It is also easier to raise tariffs when new plants are in operation and service delivery or quality has been improved.

Even in a successful project, the causes need to be identified and taken into account as lessons learnt for future projects. We see a major causal success factor in the integrated approach of combining and solving the problems of water supply and sanitation in one overall plan. This has made a significant improvement to water service management, ensuring the sustainable protection of all water resources (Nandu River, the stream channel in the town, coastal waters). Furthermore, project success and in particular its sustainability can be attributed to charging tariffs for water supply but also for sewage disposal, their acceptance by the population and the readiness of the executing agency to make adjustments. The high qualification and motivation of the personnel have also contributed to the efficiency of the executing agency and were also decisive for project success.

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

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

1 Very good rating that clearly exceeds expectations

2 Good rating fully in line with expectations and without any significant shortcomings

3 Satisfactory rating – project falls short of expectations but the positive results dominate

4 Unsatisfactory rating – significantly below expectations, with negative results dominating despite discernible positive results

5 Clearly inadequate rating – despite some positive partial results the negative results clearly dominate

6 The project has no positive results or the situation has actually deteriorated

A rating of 1 to 3 is a positive assessment and indicates a successful project while a rating of 4 to 6 is a negative assessment and indicates a project which has no sufficiently positive results.

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 an improvement is very unlikely. 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.