Socialist Republic of Viet Nam

Ex-Post Evaluation of Japanese ODA Grant Aid Project

"The Project for the Groundwater Development in Central Highland Province"

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0. Summary

The objective of this project was to improve the supply of water to people in the Central Highlands provinces by constructing water supply facilities in five communes within three provinces and providing well drilling equipment. This project has been highly relevant to the country's development plan and development needs, as well as to Japan's ODA policy. This project has somewhat achieved its objective in that more than 26,000 people in total benefited from safe and clean water provided by the five facilities, and the project contributed to a 0.7 point increase in the overall percentage of population with access to hygienic water of the three provinces. However, the achievement of the objective was limited in light of the fact that 1) there is great variation among target facilities (communes) in achieving the number of population served, its ratio, and the quantity of the water supply; and 2) the use of the equipment provided is limited in the target region. Therefore, effectiveness of the project is fair. Although both project cost and period were within the plan, the Vietnamese government had to bear additional cost to achieve the objective, and some important aspect of the Vietnamese side's responsibility (responsibility of provincial authorities) was not conducted on time, which delayed production of results. Therefore, efficiency of the project is fair. Some problems have been observed in terms of financial aspects, including the deficit balance of the facilities and the failure to collect charges in a facility, and in terms of the current status of the operation and maintenance, including the durability of distribution pipes and the monitoring of water quality. Therefore, sustainability of the project effect is fair. In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description

Project Locations

Water Supply Facility at Nhon Hoa, Gia Lai Province

1.1 Background

The Central Highlands provinces are located along the borders with Lao PDR and Cambodia, where many ethnic minorities reside. The area was the least developed area in Vietnam, with the lowest water supply coverage in the nation. Since the commonly used water supply system depending on dug wells and springs inevitably caused problems such as bad water quality and water shortages during the dry season, the government was promoting a transition to the central water supply system based on deep wells for a stable and clean water supply. However, there were gaps in resources and technical capacity to promote this in the Central Highlands provinces, where the exploitable aquifer was located below the hard unconsolidated layer.

In response to a request from the Vietnamese Government, the Government of Japan conducted the Study on Groundwater Development in the Rural Provinces of the Central Highlands (the development study) for the three provinces (Kon Tum, Gia Lai, and Dak Lak) in the Central Highlands from 2001 to 2002. The objectives of the study included: 1) to evaluate potential for development of groundwater resource in 20 communes, including the target communes of this project; 2) to formulate a master plan for 2020 on groundwater development and a water supply scheme in the target area; and 3) to conduct a feasibility study on water supplies for priority communes. In July 2002, based on the results of the above development study, the Government of Vietnam requested the Government of Japan to provide the grant aid for constructing 14 water supply facilities and for the provision of equipment. Prior to this project, Japan had also provided grant aid to the "Project for the Groundwater Development in Rural Parts of the Northern Provinces in Vietnam" (hereinafter referred to as the northern project) in 2002-2006, which was referred to as a related project during the design of this project.

1.2 Project Outline

The objective of this project was to improve the supply of water to people in the provinces of the Central Highlands by constructing water supply facilities utilizing groundwater in five communes within three provinces (Dak Ui commune in Kon Tum province, Kong Tang and Nhon Hoa communes in Gia Lai province, and Ea Drang and Ea Drong communes in Dak Lak province) and providing well-drilling equipment.

Grant Limit /Actual Grant Amount	2,012 million yen /2,001 million yen
Exchange of Notes Date	June 2007
Implementing Agency	National Center for Rural Water Supply and Environmental Sanitation (N-CERWASS), Ministry of Agriculture and Rural Development (MARD)
Project Completion Date	January 2010
Main Contractors	Construction: Hazama Corporation

	Equipment: Tokyo Engineering Consultants Co., Ltd.
Main Consultant	Tokyo Engineering Consultants Co., Ltd.
Basic Design	September 2005-March 2006
Related Projects	"The Study on Groundwater Development in the Rural Provinces of the Central Highlands" (January 2001-March 2002, Technical Cooperation) "The Project for the Groundwater Development in Rural Part of Northern Provinces in Viet Nam" (2002-2006, Grant Aid)

2. Outline of the Evaluation Study

2.1 External Evaluator

Mana Takasugi, International Development Center of Japan Inc.

2.2 Duration of Evaluation Study

Duration of the Study: December 2012-December 2013

Duration of the Field Study: March 24-April 6, 2013, and June 17-June 21, 2013

2.3 Constraints during the Evaluation Study

Since the data of 2010, the target year, could not be obtained, the evaluation analysis was done based on the data of 2012 or the latest.

3. Results of the Evaluation (Overall Rating: C[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Vietnam

At the time of the project design, the government of Vietnam had targeted that 85% of rural people by 2010 and all rural people by 2020 could use 60 liters of safe and clean water per person per day under the "National Rural Clean Water Supply and Sanitation Strategy up to Year 2020" (NRWSS) of 2000. The mountainous Central Highlands is one of three areas with water source problems identified by NRWSS. Also, the introduction of the central water supply system that is relatively large-scale and utilizes deep groundwater and surface water was encouraged by the Center for Rural Water Supply and Environmental Sanitation (CERWASS, currently called N-CERWASS) and relevant agencies rather than the conventional small-scale water supply systems utilizing dug wells and shallow wells .

As of this evaluation, NRWSS is still upheld, and the status of the Central Highlands as one of the priority areas remains unchanged. The promotion of the central water supply systems is also maintained.

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ② Fair, ① Low

3.1.2 Relevance to the Development Needs of Vietnam

At the time of the project design, the Central Highlands was one of the least developed regions in the nation, with water supply coverage (including small and inexpensive systems such as dug wells and shallow wells) at little more than 50% (2005) compared to national coverage of 73% and rural coverage of 67%[3]. The number of central water supply systems in the three target provinces was very limited (none in the target communes). Most of the local population depended on dug wells and surface water, which inevitably caused problems such as water shortages during the dry season, bad water quality in the rainy season, and contamination by sewage from neighboring toilets and fertilizers. As of this evaluation, while the area has been developed since the time of the project design, it is still a poor area with many poor people. Although there are areas where access to water has improved through the construction of private wells and government projects, benefited from economic development, many of the local population still depend on dug wells and surface water, except for the target communes of the project.

Also, the local implementing agencies did not have the experience or capacity to construct a large-scale water supply facility, which requires higher technical skills than small-scale water supply facilities, with which they had some experience in constructing and managing. The existing equipment for drilling wells was not sufficient, either. In particular, the equipment was provided based on strong requests by the recipient government, claiming that sophisticated Japanese equipment was required to meet the geological conditions of the Central Highlands and that there was a need for technology transfer through on-the-job training (OJT).

According to the interviews conducted during the evaluation, the recipient government thinks that the project's relevance was high at the planning and implementation stages, even though the priority for groundwater development is currently not as high as before due to its lower potential because of water shortages in the Central Highlands.

3.1.3 Relevance to Japan's ODA Policy

At the time of the project design, Japan's ODA to Vietnam was conducted under the "Country Assistance Program for the Socialist Republic of Viet Nam" (2004). The program had three priority areas, of which water supply was placed under "improvement of lifestyle and social aspects." One of the priority issues under this priority area was "agriculture and rural development/local development," in which the program clearly states that "priority for assistance is given to the development and management of social and economic infrastructure (including water supply, rural roads, electrification, irrigation, and flood control)." The project was also in line with the Country Program (March 2006) of the Japan International Cooperation Agency (JICA).

This project has been highly relevant to the country's development plan, development needs, as

[3] The Basic Design Study Report of the project (2006).

well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[4] (Rating: ②)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Water Supply Facilities

The project constructed five water supply facilities, one in each of the five communes. This section first reviews the population served, the rate of population served, the quantity of the water supply, and the utilization rate of the facilities to verify whether they meet the target figures and to analyze the factors which influenced the results. As mentioned earlier, this is done based on the data of 2012 or the latest since the data of 2010, the target year, could not be obtained. Second, the supply hours and non-revenue water are reviewed. Finally, it verifies the achievement level of this project's target to "contribute to the increase of the overall percentage of population with access to hygienic water of the three provinces by 1.4% [percentage points]."

(1) Population Served, Rate of Population Served, Quantity of Water Supply, and Utilization Rate of the Facilities

The population served, the rate of population served, and the quantity of the facilities' water supply were all below the target. The achievement level of the population served was 59%. Against the target of 85%, the rate of population served was 43% on average (51% achieved) (Table 1). The average target attainment level of all the five facilities was 79% for daily average supply and 66% for daily maximum supply. The utilization rate of the facilities was 54% on average (70% of the target achieved) (Table 2).

Table 1 Population Served by the Project Facilities and Rate of Population Served

Province	Commune		Population		Population served			Rate of population served (%)		
			Estimate (2010)	Actual (2012 /latest)	Target (2010)	Actual (2012 /latest)	Achieve -ment (%)	Target (2010)	Actual (2012 /latest)	Achieve -ment (%)
Kon Tum	K3-1	Dak Ui	3,243	3,372	2,757	1,135	41	85	34	40
Gia Lai	G1	Kong Tang	7,996	9,278	6,797	1,387	20	85	15	18
	G2	Nhon Hoa	13,521	13,567	11,493	4,565	40	85	34	40
Dak Lak	D2	Ea Drang	19,759	20,616	16,795	13,023	78	85	63	74
	D4-1	Ea Drong	8,391	8,868	7,132	6,232	87	85	70	83
Total			52,910	55,701	44,974	26,342	59	85	43	51

Source: Basic Design Study and data provided by Commune People's Committees, project facilities, and P-CERWASS/DPC of each commune.
Note 1: Populations served in G1 and D2 were calculated based on the number of households served x (commune population / the total number of households in the commune).
Note 2: K3-1 and D4-1were designed to cover only part of the commune rather than the entire commune. This project took up these facilities out of several projects (facilities) proposed in these communes by the development study.
Note 3: The data of 2012 or the latest is used for the "actual" figure since the data of 2010 could not be obtained.

[4] Sub-rating for Effectiveness is to be put with consideration of Impact

Table 2 Quantity of Water Supply and Utilization Rate of the Project Facilities

Province	Commune		Daily Average Supply (Qav:m^3/d)			Daily Maximum Supply (Qmax:m^3/d)			Utilization rate (%)		
			Target (2010)	Actual (2012 /latest)	Achieve -ment (%)	Target (2010)	Actual (2012 /latest)	Achieve -ment (%)	Target (2010)	Actual (2012 /latest)	Achieve -ment (%)
Kon Tum	K3-1	Dak Ui	199	140	70	259	170	66	77	54	70
Gia Lai	G1	Kong Tang	489	200	41	636	230	36	77	31	40
	G2	Nhon Hoa	827	325	39	1,075	430	40	77	30	39
Dak Lak	D2	Ea Drang	1,209	1,500	124	1,572	1,500	95	77	95	123
	D4-1	Ea Drong	514	380	74	668	460	69	77	57	74
Total			3,238	2,545	79	4,210	2,790	66	77	54	70

Source: Basic Design Study and data provided by project facilities and P-CERWASS/DPC
Note 1: The data of 2012 or the latest is used for the "actual" figure since the data of 2010 could not be obtained.
Note 2: Daily average supply and daily maximum supply of G1 in 2010 were 250m^3 and 300m^3, respectively.
Note 3: Utilization rate is daily average supply / capacity of the facility (= target daily maximum supply).

The achievement level of all the above indicators was over 50% on average. However, there is great variation among the target facilities, especially in the rate of population served: While the achievement levels of three facilities in Kon Tum and Gia Lai were below 50%, those of two facilities in Dak Lak were around 70-80%. A possible reason behind this difference is the fact that the two facilities in Dak Lak had been completed earlier, and therefore the handover and commencement of operations occurred one year earlier than the others. With a longer operating record, it can be said that the facilities in Dak Lak got on track earlier, and the importance of safe water became widely recognized among the population[5]. Moreover, Dak Lak Province had made an additional investment of around 12 billion VND (around 54 million yen) during 2009-2013 from the provincial budget and that of the Provincial Center for Rural Water Supply and Environmental Sanitation (P-CERWASS), which manages the facilities, to carry out additional work (the construction of five additional wells, the installation of 60.6km of additional distribution pipes, and the installation of stabilizers to seven wells). Information, Education and Communication (IEC) activities are also actively conducted in Dak Lak. These are considered to have allowed Dak Lak to mitigate the impact of such factors as described below, including water shortages, unstable operation of wells, limited distribution pipeline, and low population awareness.

According to the project facilities and their management bodies, the reasons for the low achievement of the target indicators are multifaceted, including unusual water shortages, the impacts of economic development such as road improvements and population increases, and a lack of awareness among the population, but they can be categorized by the following six factors: First, the rainfall in the rainy season of 2012 was unusually low, which resulted in a major decrease of the water level during the 2012-2013 dry season, when this evaluation was conducted (this affected all five

[5] According to documents provided by JICA, the number of users was very low in the initial period in Dak Lak, too. According to the interviews with facilities and P-CERWASS/DPC, the awareness of the predominant ethnic minorities in the Central Highlands of the importance of safe water is not high, and they have a tendency to wait and see a new service rather than signing up for it immediately. Therefore, the connection rate tends to rise only after a certain period of time.

communes). Of the total 20 wells of the five facilities, five are not operating due to water shortages (two dry wells and three wells with very low water levels). Especially in Kon Tum, the only well of the facility is not operating for this reason, and the facility had temporarily stopped operation at the time of the field visit in this evaluation. Even when the facility was operating, there were areas where water could not reach due to low water pressure. On the other hand, the impact is smaller in Dak Lak, thanks to the construction of additional wells as mentioned earlier. Second, there are three non-operating wells for reasons other than water shortages. One of them is thought to be caused by a pump problem. An electrician was called but could not solve the problem, and P-CERWASS is examining how to solve it (D2 commune). The other well cannot operate due to unstable voltage to the pump, and P-CERWASS does not have the budget to install a stabilizer (G2 commune). Another well has never operated since the handover, as the land acquisition was not completed in order to install electricity to the pump (incoming feeder line) (G2 commune). To summarize, the above two factors affected the number of non-operating wells and therefore the low level of water supply.

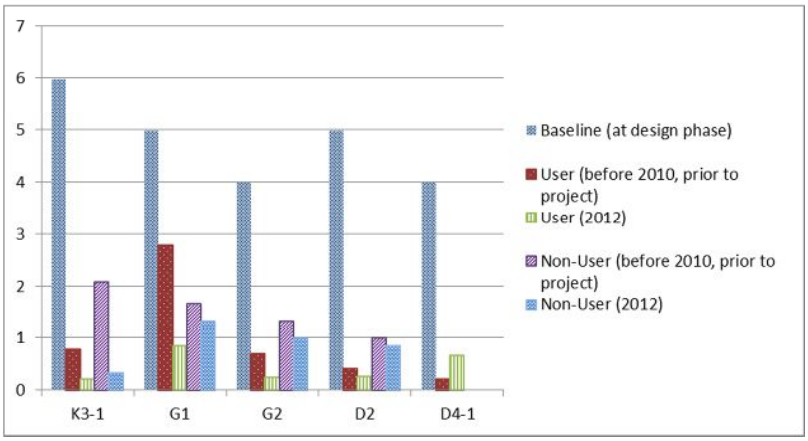
Third, there is a coverage problem with the facilities. In some areas in Gia Lai and Dak Lak, roads have been raised and paved, which hampered the laying of supply pipes from the distribution pipes installed on one side of the road to houses on the other side. This made the coverage area of the facilities smaller than the original plan, and up to 67% of the planned user households could not have a supply pipe connection. This impact was mitigated in Dak Lak, as it made additional investments early to lay extra distribution pipes on the other sides of the roads. Fourth, the population growth was larger than the estimates in all communes. In some communes, population increased rapidly. With a larger denominator, the rate of population served became smaller[6]. If the population estimates were accurate, the rate would have been 1-4 points higher than the actual situation in four communes, except for G2. The total would have been 45% (target achievement rate of 53%), two points higher than the actual situation.

Fifth, the lack of people's awareness of the importance of clean water also contributed to the low achievement of the targets. Many instances, especially in Kon Tum, have been observed in which users leave faucets and supply pipes broken and do not contact the operators. According to the beneficiary survey[7], 90% of the beneficiaries had private wells prior to the introduction of tap water by the project. Therefore, only 18% use tap water as the only source of water, and many others use multiple water sources including tap water (55% use tap water as the main source of water, and 25% use tap water but not as the main source). The reasons for using multiple water sources included "not enough water," "to save water charge," and "water supply time is too short/not convenient."[8] Sixth, by

[6] Three out of five communes have been upgraded to towns as a result of the growth in population and economic activities (G1, G2, and D2 communes). Of the three, G1 and D2 were selected as district capitals.
[7] The beneficiary survey was conducted in April 2013 in all five communes (100 households). Non-users in the five communes were also surveyed (31 households).
[8] According to the survey of 31 non-users, the reasons for not using the water service were: "I have applied and am on the waiting list" (6 respondents), "No pipe coverage in my residential area" (4 respondents), "Satisfied with the current water source" (2 respondents), "Installation fee is too expensive" (2 users), etc. Indeed, Ea Drang commune was suspending new connections at the time of the field visit due to the low quantity of water, thus keeping applicants on the waiting list.

limiting supply hours and quantity to respond to water shortages, users return to other sources of water such as dug wells. This furthered the need for limiting supply hours to meet operating costs. In this way, an insufficient quantity of water and a low user population have become a vicious circle.

Behind the fifth and sixth factors, it can be pointed out that nine years had passed between the development study and the completion of the project. While the population could not benefit from the project, they proceeded with the construction of dug wells or the improvement of their depths against the backdrop of the growing economic development of the region. According to the beneficiary survey, the number of months with water shortages has improved before and after the project. Also, the users had better results than non-users (Figure 1). However, the degree of improvement was much larger between the baseline (as of the Basic Design Study) and before the project (prior to 2010) than between before and after the project. It indicates that, thanks to the above improvement on dug wells, the situation of water shortages had already improved even before the benefit of the project materialized. An insufficient quantity of water in the project facilities also might have affected the relatively small degree of improvement in water shortages.



Source: Basic Design Study (2006) and beneficiary survey (April 2013).

Figure 1 Changes in the Number of Months with Water Shortages

This project had set the year for project completion as the target year to achieve the objective, which means that it was expected that the facilities would become operational, in full scale, soon after the handover and would achieve the target coverage and the consequent quantity of supply calculated based on the target coverage rate. In reality, however, the full-scale service usage by the beneficiaries did not materialize as planned. This is thought to have been caused not only by the six reasons discussed above but also by the population's propensity to wait and see the new service before deciding to sign up for it. The latter is also considered to be one of the contributing factors to the high achievement levels of facilities in Dak Lak, where operations started earlier than the others. In this way, it is demonstrated that it takes a certain period of time to develop the population's awareness in order for the facilities to become fully operational at the planned scale. Therefore, it can be said that

the project's target to achieve the objective in the year of project completion was a little ambitious[9].

(2) Supply Hours

As of 2012, three facilities supplied water for more than 20 hours. Then the water level of the wells in these facilities decreased due to the unusually severe water shortage. As a result, as of the field visit for this evaluation conducted at the end of the dry season, supply hours of the two facilities in G1 and D2 communes dropped by half, and the facility in Kon Tum (K3-1 commune) was temporarily not operating due to the low level of water in its only well. According to the beneficiary survey, the average supply hours recognized by the users were less than the official record (other than K3-1).

In Gia Lai, supply hours have been consistently limited since 2012, unlike those of other provinces affected by water shortages. This is because the operators are trying to save operation cost and to prevent the unintended use of water, such as for farming or washing motorbikes, by limiting water supply to only when farmers are at home.

Table 3 Supply Hours

Province	Commune		2012	As of Mar 2013
Kon Tum	K3-1	Dak Ui	20	0
Gia Lai	G1	Kong Tang	5	2.5
	G2	Nhon Hoa	9	9
Dak Lak	D2	Ea Drang	24	12
	D4-1	Ea Drong	24	24

Source: Data provided by project facilities and P-CERWASS/DPC.

(3) Non-Revenue Water Ratio[10]

The non-revenue water (NRW) ratio of the five facilities was between 19%-34%, with the average at 27%. The causes of NRW are considered to be broken distribution pipes (broken by humans or animals when the pipe is exposed on the road surface due to road construction or soil runoff), leakage from the pipe joint, and broken faucets and bulbs at users' houses (the bulb is installed at the side of the supply pipe rather than at users' houses, and the users do not contact the operator even when they notice leakage so they can use the leaking water for free). The average NRW ratio of Southeast Asian cities is 35%[11], and that of the northern project was between 35-51%[12]. Therefore, the NRW ratio of this project is lower than or at the same level as those of other regions of the country or of neighboring countries.

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9 JICA currently recommends that grant aid projects set the target year at three years after the project completion year as a basic rule.

10 NRW is the difference between the volume of water put into a water distribution system and the volume that is billed to customers. NRW includes unbilled authorized consumption such as washing the facility, unbilled water such as meter errors or meter intangible flow, water leakage, illegal connections to pipes, etc. The ratio of NRW to the total volume of water put into a water distribution system is called the NRW ratio, and, in general, the lower the better. The definition of NRW includes billed but uncollected water, but, in the case of Kon Tum where water charge is not collected, such water seems not to be included, as described below.

11 NRW ratio of below 20% is regarded as a success in this region. Rudolf Frauendorfer and Roland Liemberger *The Issues and Challenges of Reducing Non-Revenue Water.* Asian Development Bank. 2010.

12 Junko Miura "Ex Post Evaluation of Japanese ODA Grant Aid Project: The Project for the Groundwater Development in Rural Part of Northern Provinces in Viet Nam" JICA (2011). The report cites NRW ratios of 26% in Phnom Penh, 28% in Vientiane, 38% in Ho Chi Minh City (the above figures as of 2001), and 12.1% in Siem Reap (2009).

Table 4 Non-Revenue Water Ratio

Province	Commune		NRW (%)
Kon Tum	K3-1	Dak Ui	33
Gia Lai	G1	Kong Tang	34
	G2	Nhon Hoa	23
Dak Lak	D2	Ea Drang	25
	D4-1	Ea Drong	19
		Average	27

Source: Data provided by project facilities and P-CERWASS/DPC

(4) Contribution to the Overall Service Ratio of Three Provinces

The project aimed to contribute to the increase of the overall percentage of population with access to hygienic water of the three provinces (including dug wells and shallow wells) by 1.4 percentage points.[13] This target was not achieved, as the ratio of the actual number of beneficiaries to the total population of the three provinces in 2004 was 0.8%. As mentioned above, the target achievement of population served by the project was merely 59%, therefore the target achievement of the contribution to the overall service ratio of the three provinces was also limited. The ratio of the actual number of beneficiaries to the total population of the three provinces in 2011 was 0.7%. Thus, it can be said that the project has contributed to the increase of the overall service ratio of the three provinces by 0.7 point[14].

To summarize, the overall achievement levels of the quantity of water and utilization rates of the facilities were around 70%. Even though the population served and its ratio achieved only 50%-60% of the target, more than 26,000 people in total benefited from safe and clean water provided by the five facilities in communes where there had been no such service prior to the project. Although water supply hours have decreased temporarily due to a severe water shortage, the facilities are functioning well and have maintained over 20 hours of supply in three out of five facilities before the occurrence of water shortage. There was no major problem in the NRW ratio. Therefore, while there is great variation among target facilities in the achievement of the target, based on the above quantitative analysis, it can be concluded that this project has somewhat achieved its objective.

3.2.1.2 Provision of Equipment

With regard to the target 60 wells to have been dug in the Central Highlands between 2007-2010 using the equipment provided by the project, only five wells (successful wells only) were dug by the end of 2010 (Table 5). In reality, it was only in 2009 when the Vietnamese side could start using the equipment for drilling other wells, as it was handed over in January 2008 and used for drilling the

[13] The ratio of planned beneficiaries of 44,974 to the total population of 3,149,700 of the three provinces (2004). According to the Basic Design Study, the service ratio of that time was 51% in Kon Tum, 52% in Gia Lai, and unknown in Dak Lak.

[14] The service ratio as of this evaluation was 76.4% in Gia Lai, 73.5% in Dak Lak (according to P-CERWASSs), 60.3% in Kon Tum (2009 Census), and 82.8% as the Central Highlands' total ratio (five provinces) (2010, Statistical Year Book).

wells for the project facilities. Considering the situation, the number of wells dug for four years up to 2012 (the same as the planned period of four years) was also compared to the target (column "total" in Table 5). Still, the figure remained a mere seven successful wells. In view of the fact that the data on the success rate of drilling wells were not available at the time of the project design, the total number of wells dug (including unsuccessful wells) was also considered. Even so, only 14 wells (four in Gia Lai, two in Dak Lak, three in Dak Nong, and five in Lam Dong) were drilled.

Table 5 Number of Wells Dug by Equipment Provided by the Project

		2007	2008	2009	2010	2011	2012	Total	Achievement (%)
Target	National	15	15	15	15	-	-	60	
	Central Highlands	15	15	15	15	-	-	60	
Actual	National	0	0	6(3)	8(7)	5(2)	14(10)	33(22)	55 (37)
	Central Highlands	0	0	4(1)	5(4)	5(2)	0	14(7)	23 (12)

Source: Basic Design Study (2006) and data provided by N-CERWASS
Note: ( ) is the figure of successful wells. The figure for 2012 includes the number up to March 2013.

The following issues have affected the low level of target achievements:

- It was planned that, after being used to drill wells for the project facilities, the equipment would be located in the Central Highlands and used for drilling wells in the region by P-CERWASSs. Instead, it has been located in Hanoi since 2008, when the drilling was completed for the project facilities. Therefore, those who use the equipment in the Central Highlands must bear the transportation cost from Hanoi to the site. (The issue of the location of the equipment is discussed further in "3.5 Sustainability.")
- The development budget to drill new wells in the Central Highlands is limited.
- Although the equipment provided can drill wells in less time than pre-existing equipment can, its operating cost (for fuel and the number of operators required) is higher, and it requires wide-open spaces.
- Because of climate change, the potential for groundwater in the Central Highlands has decreased and, as a result, the success rate in drilling wells is also decreasing. In view of this, the Vietnamese government has shifted its policy on the main source of water for the central water supply system in this region from deep groundwater to surface water.
- Considering the above situation, N-CERWASS has utilized the equipment for large-scale and urgent national projects in regions other than the Central Highlands when it is not used there, so as to effectively utilize the equipment.

Indeed, more than half the wells drilled by the project equipment were constructed outside the Central Highlands. The total number of drilled wells including these was 22 (successful wells only) in four years, still below the target. Still, the average number of wells drilled per year (including unsuccessful wells) was 8.25, which was similar to the target and actual figures of the northern

project[15]. This suggests that the target of this project might have been set too high.

To summarize, even though the target achievement level is low in the Central Highlands, it is concluded that the equipment provided was utilized to a certain extent, contributing to the achievement of NRWSS at the national level. This is based on the total number of wells drilled, including those drilled outside the target region. The recipient government tried to fully utilize the equipment despite unfavorable conditions in the target region. Even so, the low level of target achievement in the Central Highlands is still a problem, as this was the original objective of the equipment provision. To avoid this, there should have been a more detailed usage plan at the project design phase (to be further elaborated on in "4.3 Lessons Learned (2)").

3.2.2 Qualitative Effects

(1) Water Quality

According to the beneficiary survey, users' satisfaction levels on water quantity remained low, with only 34% answering "always sufficient" and 38% answering "always in shortage." On the other hand, the satisfaction level on water quality improved from the baseline survey of the Basic Design Study in all communes, with 75% of the respondents answering "always good."

Table 6 Degree of Satisfaction of Quantity and Quality of Water

Commune		K3-1 Dak Ui	G1 Kong Tang	G2 Nhon Hoa	D2 Ea Drang	D4-1 Ea Drong
Satisfaction on current water quantity	Baseline (at design phase)	B	A	B	B	B
	Beneficiary survey (ex-post evaluation) (on tap water)	A:100%	A:60% B:20% C:20%	A:0% B:24% C:76%	A:30% B:20% C:50%	A:0% B:79% C:21%
Satisfaction on current water quality	Baseline (at design phase)	A	A	B	A	B
	Beneficiary survey (ex-post evaluation) (on tap water)	A:0% B:5% C:95%	A:5% B:0% C:95%	A:0% B:5% C:95%	A:15% B:55% C:30%	A:0% B:42% C:58%

Source: Basic Design Study (2006) and beneficiary survey (April 2013).
Note: Index criteria

	Satisfaction on water quantity	Satisfaction on water quality
A	Always in shortage	Always poor (turbidity, nasty smell, etc.)
B	Shortage during dry season	Poor during certain periods (turbidity, nasty smell, etc.)
C	Always sufficient	Always good

As Table 6 suggests, the users are generally satisfied with the quality of water, and several facilities observed that their users drink water even without boiling it. This could not be confirmed with substantial evidence, as the results of water quality tests were not filed in the management bodies of the facilities in Gia Lai and Kon Tum. Even so, since the test result of Dak Lak did not have any problem and there was no claim of any major water quality problem in the other provinces, it can be concluded that, in general, "safe and clean water" is supplied by the project facilities. Minor complaints about the chlorine smell and about hard water are observed in many facilities. In response

[15] It was planned to use the equipment provided to drill eight wells per year in the northern project (according to the Basic Design Study Report of this project). It actually drilled the average of 8.3 wells per year between 2006 and 2011 (The ex-post evaluation report of the northern project, 2011).

to the first complaint, facilities in Gia Lai do not chlorinate the water, as they claim that water from the source is of good quality even without chlorination. This might be necessary as a transition measure but should be reviewed in the future.

(2) Technology Transfer on Operation and Maintenance of Equipment Provided

This project aimed at contributing to the improvement of the well-drilling capacity of the Vietnamese side by transferring technology to N-CERWASS technicians through OJT of the drilling of wells with equipment provided. According to interviews with N-CERWASS officers, the project enhanced the capacity to drill deep wells and to operate and maintain necessary equipment. As a result, N-CERWASS became able to do tasks they had previously outsourced.

Based on the above quantitative and qualitative analysis, this project has somewhat achieved its objective to provide clean and safe water to the people. However, the achievement of the objective was limited in light of the fact that 1) there is great variation among target communes in the achievement of population served, its ratio, and the quantity of water supply; 2) the use of the equipment provided is limited in the target region. Therefore, effectiveness of the project is fair.

3.3 Impact

3.3.1 Intended Impacts

According to the project plan, the project was expected to reduce the prevalence of water-borne diseases as an indirect impact, as a result of a supply of safe and clean water. This could not be confirmed by this evaluation for three reasons: First, data on the prevalence rate of water-borne diseases were not available at the time of both project design and evaluation. Second, the population is still using water sources other than tap water. Third, the prevalence of water-borne diseases seems to have not been so great from the outset, considering the situation where private dug wells were deepened or newly constructed between the baseline survey of the Basic Design Study and the completion of the project, which resulted in better water quality. Indeed, 75% of the beneficiary survey respondents answered that they have not experienced any water-borne disease either before or after the introduction of tap water by the project.

3.3.2 Other Impacts

No problem was identified in terms of impacts on the natural environment and on gender and minority considerations. There was no resettlement, as the construction sites of the facilities are public lands. Nine of 16 locations for water intake (wells) were private lands which, although small, required land acquisition. The low success rate of well drilling resulted in an increase in the number of drilling sites and in necessary land acquisition. There were some cases in which agreements on compensation amounts took time and affected the construction schedule. Even so, the land acquisition was conducted in accordance with Vietnamese law, and no comment was raised on any major problem. Although the project was also expected to serve as a model of a commune-level central water supply system during the project design, any subsequent

project using this project as a model was not confirmed[16].

According to the beneficiary survey, 75% of the users recognized that the availability of clean water provided by this project has brought positive change to their lives. Specifically, they explained the change as: "having good feelings about the water quality" (35%), "not afraid of lacking water" (28%), "not afraid of getting water-borne diseases" (25%), "saving the cost of water filters" (8%), and "saving time to fetch water" (3%). This indicates that the project has had a psychological impact on the target population by providing safe and clean water.

Water faucet at a beneficiary household. Prior to the project, the family used a dug well. Now tap water is the main source of water for cooking, drinking, washing, etc., and the amount of water used has doubled from before the introduction of tap water.

Water faucet and meter box at a café / house. After the introduction of tap water, the family stopped using the dug well since it was located close to the toilet. Now, tap water is used for household use, glass washing at the café, and hand washing by café customers.

To summarize, an intended impact to reduce the prevalence of water-borne diseases could not be confirmed due to insufficient data. A psychological impact, such as users feeling secure about water quality, was confirmed qualitatively. There was no negative impact.

Overall, this project has somewhat achieved its objectives, therefore its effectiveness and impact is fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The project constructed five water supply facilities utilizing 20 deep wells, which includes 16 newly constructed wells and four existing wells (exploratory test wells drilled during the development study were used as production wells), mostly as planned. As a result, five water supply facilities with the planned capacity were completed. As shown in Table 7 below, changes in specifications from the original plan under the responsibility of the Japanese side were all minor and did not affect the achievement of the objective, the construction schedule, or the project cost.

[16] On the other hand, the preceding northern project serves as the model for a similar project and host visits from the target provinces of the World Bank project. Therefore, this project also has the potential to become a model for similar projects if such projects are implemented in the Central Highlands in the future.

Elevated tank (Kong Tang)

Signboard (Ea Drong)

Distribution pump (Nhon Hoa)

Table 7 Output (Planned / Actual)

	Planned	Actual
Japanese side	- Water intake (deep well, pump, well shed, electrical equipment, etc.) - Water treatment plant (aeration chamber, sedimentation basin, rapid sand filter, distribution reservoir, elevated water tank, pH control equipment, disinfection equipment, administration building, lifting pump building, supply pump, mechanical equipment, electrical equipment, etc.) - Conveyance and distribution pipes - Individual service pipe (ferrule provided with saddle, service pipe, meter) (only material) - Well drilling equipment 1. Well Drilling Equipment - Drilling rig: 1 unit - High pressure air compressor: 1 unit - Miscellaneous ancillary equipment: 1 set - Air lift equipment: 1 unit 2. Supporting Equipment - Crane cargo truck: 1 unit - Pumping test equipment (submersible pump, generator, triangular weir): 1 set - Well logging equipment: 1 set - Soft-components: establishment of operation centers, preparation of a general regulation and operation and maintenance (O&M) manual, implementation of IEC, development of management system (including customer ledger, database for water charge collection, OJT on water meter reading and water charge collection).	The plan was implemented mostly as planned. The following modifications have been made: - Change of the location of the water treatment plants and water intake (2 facilities each) and the subsequent extension of conveyance and distribution pipes (a few dozen to several hundred meters). - As a result of the water quality test, while a well did not need the planned pH control equipment, another well needed it. Thus the equipment was transferred from the planned well to the other well. - In one facility, where the distribution pipe crosses a river, the crossing method was changed from the planned method of attaching the pipe to an existing bridge to an inverted siphon, in accordance with the policy of the road authority. - As a result of the survey, it was found that there was a mistake in elevation of one part, which would cause a lack of water in part of the distribution pipe. To avoid this, a booster pump was added.
Vietnamese side	Land acquisition, land creation, gate & fence, etc.; incoming feeder intake for water intake and water treatment plant (electricity installation), laying individual service pipe, provision of faucet, drain ditch, disposal of unexploded ordnance, management cost of PMU, computer and other equipment for soft-components, construction cost of the equipment team.	In Nhon Hoa, Gia Lai, incoming feeder intake (electricity installation) for a well has not been completed. In Ea Drong, Dak Lak, no computer was installed in the water supply facility. Except for these, the responsibility was executed as planned.

Source: Basic Design Study (2006), interviews and questionnaires of this evaluation (2013).

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project's grant limit amount was 2,012 million yen. The actual cost was lower than planned,

at 2,001 million yen (99% of the planned cost). The local funds equivalent of 249 million yen was to be provided by the Government of Vietnam as counterpart funds. The actual cost was lower than planned at 235 million yen (94% of the planned cost).

However, P-CERWASS Dak Lak made an additional investment of about 12 billion VND (approximately 54 million yen) between 2009 and 2013 to carry out additional work for the two facilities (60.6km of additional pipes, drilling of five additional wells, and installation of stabilizers to seven well pumps). Among these, the installation of additional pipes in 2010 had an especially large impact on the achievement level of the target in that it mitigated the problem that about 50% of the planned beneficiary households could not have the supply pipe connection due to road improvement, as described earlier in "3.2 Effectiveness." The cost for this was also large, at about 8.5 billion VND (about 38 million yen). This work was purely additional and not foreseen in the original plan. According to documents provided by the Vietnamese side, they requested the assistance of the project consultant in designing these additional pipelines as of February 2008. Therefore, it can be assumed that the adverse effect of road improvement was recognized at a relatively early stage of the project. In view of this, the possibility of road improvement should have been investigated and countermeasures should have been included in the project design. Even if it was difficult to anticipate this as of the planning, some kind of measures should have been taken within the framework of the project as soon as the project came to know about the road improvement plan, considering the scale of its impact on the project result.

3.4.2.2 Project Period

The planned project period was 31 months, from June 2007 to January 2010. The actual project was completed as planned. It is difficult to strike the aquifer of the target area, as it is located 200m deep in the hard bedrock and only exists in bedrock incision (crack) rather than spread as a layer. In this situation, well drilling, including the necessary land acquisition, took longer than expected, as the success rate of drilling wells turned out to be 45%, much lower than the expected 80-85% in the plan. Even so, the project was completed within the planned project period.

However, in Nhon Hoa Commune, Gia Lai Province, the land acquisition was not completed in order to install electricity to the pump (incoming feeder intake) for a well. Because of this problem, as of this evaluation, the well has never been operational since the handover[17]. In the two facilities in Gia Lai, the incoming feeder intake for other wells also took long—four and seven months, respectively—following the handover in February 2010. As a result, the start of the water supply service was in July and November 2012, respectively, or five and nine months after the handover.

Although both project cost and period were within the plan, some inputs were not appropriate for

[17] According to the Vietnamese side, although P-CERWASS Gia Lai and relevant agencies have sought an agreement, no agreement has been reached to complete the land acquisition because the amount of compensation requested by the household concerned has been much higher than the compensation price framework.

producing the outputs, which led to the Vietnamese government bearing additional cost, and some important items borne by the Vietnamese side were not conducted on time, which negatively affected the effectiveness. Therefore, efficiency of the project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

3.5.1.1 Water Supply Facilities

In Vietnam, water supply facilities used to be handed over to and managed by the Commune People's Committee (CPC) after construction was completed. However, operation and management by the CPC lacked human resources, expertise, and experience in water supply service. The method of communication between P-CERWASS and CPC, or the chain of command and control, was not established. Considering these factors, the project proposed a management structure in which an operation center is established in each facility under the management of P-CERWASS. This was implemented in Dak Lak and Gia Lai provinces. These P-CERWASSs directly manage the project's water supply facilities by employing operation center staff who conduct daily operations, maintenance, and water charge collection under the supervision of P-CERWASS and report to P-CERWASS. As of this evaluation, 16 of 82 central water supply systems in Dak Lak Province (including the two facilities of this project) are directly managed by P-CERWASS. In Gia Lai, only the two facilities of the project are directly managed by P-CERWASS. N-CERWASS highly appreciates the management system by P-CERWASS as a specialized agency, and regards the project as the model of the target region (see box column at the end of this section).

In Kon Tum Province, on the other hand, the project implementation body had been the District People's Committee (DPC), which still manages the facility by placing the operation center directly under its supervision. This is because the sizes of both the facility and P-CERWASS are relatively small, the target commune is located away from the provincial capital but relatively close to the district capital, and the pre-existing facility was upgraded by the project. The water supply facility of the project is the only such facility managed by the DPC[18].

The number of staff at operation centers is shown in Table 8. Each center has a smaller number of staff than planned for the following reasons: While it was planned that each center would employ four operators and a designated

Table 8 Number of Staff at Operation Centers

Province	Commune		Plan (2010)	As of ex post evaluation (Mar. 2013)
Kon Tum	K3-1	Dak Ui	6	5
Gia Lai	G1	Kong Tang	8	1
	G2	Nhon Hoa	9	3
Dak Lak	D2	Ea Drang	12	4
	D4-1	Ea Drong	8	3

Source: Data provided by project facilities.

[18] The authority to decide who should manage a water supply facility is at the Province People's Committee (PPC). In the Basic Design Study, it was expected that, once target communes increase to a certain number, the water management unit (WMU) would be established, with P-CERWASS being the project implementation body and the operation centers being the subordinate body of WMU. However, activities to realize this vision, such as the establishment of the WMU, was not included in the project design, and the number of central water supply systems under P-CERWASS has not drastically increased in the target provinces. Therefore, WMU has not been established as of this evaluation.

number of charge collectors corresponding to the size of the commune, in reality, operators also perform the tasks of charge collectors so as to save costs. Although comments on some delays in repair work were heard in G1 commune, where the number of staff is only one, all facilities are performing the tasks as planned.

Communication between the operation centers and P-CERWASS/DPC as their managers is established through either monthly meetings (Dak Lak) or monthly reports (Gia Lai and Kon Tum). When a problem arises, operation centers communicate with P-CERWASS/DPC by phone. P-CERWASS/DPC visit operation centers once or twice a month in Dak Lak and when the need arises in Gia Lai and Kon Tum.

3.5.1.2 Equipment Provided

Since there is no operation and maintenance center for well drilling equipment in the Central Highlands, the Basic Design Study stipulated that N-CERWASS would establish the equipment team in the Central Highlands responsible for well drilling, and for operation and maintenance of the equipment. In reality, since 2008, when drilling in the five communes was completed, the equipment has been stationed at the Center of Consultancy and Technology Transfer (CCTT) of N-CERWASS based in Hanoi, which is responsible for operation and maintenance (O&M) of the equipment of N-CERWASS. The equipment provided by the project has been managed by eight designated staff members (one manager, five operators, and two maintenance workers). According to N-CEWRASS, the station of the equipment and team was changed due to the following reasons:

- A large area to place the equipment could not be secured in the Central Highlands.
- Highly skilled technicians necessary to manage the sophisticated Japanese equipment cannot be found in the Central Highlands.
- The budget for drilling new wells is limited in the Central Highlands, thus the equipment would not be put to regular use.
- Each P-CERWASS is under the jurisdiction of each PPC and there is little organizational link among P-CERWASSs. N-CERWASS does not have a direct presence, such as a branch office, in the Central Highlands. Therefore, it is difficult for N-CERWASS to select one province or P-CERWASS to station the equipment.

There is no problem in terms of the use of the equipment as the operation status of the equipment is good, and in terms of the staff allocation to the equipment team, the number is secured almost as planned. However, the change of location is one of the reasons for the low achievement level of the excavation target of the equipment provided (seven wells against the targeted 60 wells in the Central Highlands), thus negatively impacting the effectiveness of the project. In addition, this change was decided by N-CERWASS as

The air compressor on regular maintenance at CCTT

early as December 2007, which was prior to the handover of the equipment, and was confirmed during the project and the Warranty Period Inspection. Nevertheless, there was no mention of this change in relevant reports. As a result, this evaluation came to recognize this only after communication with the Vietnamese side during the preparation of the field visit and interview. A utilization situation like this, which is different from the original plan, should be documented in these reports in the same way as other changes in project design.

In light of the above, while there are some changes from the original plan, the necessary organizational structure is arranged according to the actual situation, both in terms of water supply facilities and equipment provided, and the division of roles is clear among different organizations. The minimum necessary number of staff is secured despite a few minor problems. Therefore, it can be concluded that sustainability of the institutional aspects of O&M is ensured. In addition, as for the facility in Kon Tum Province, sustainability will be enhanced if a system is established in which DPC can seek technical advice from P-CERWASSs of Kon Tum or neighbouring Gia Lai, water supply corporations in nearby cities, or N-CERWASS, considering its limited experience and low achievement level of the target figures.

3.5.2 Technical Aspects of Operation and Maintenance

The water supply facilities are planned and designed to apply a conventional system of manual operation and facility monitoring with a minimum of required items, which is common in Vietnam. Therefore, there was no observation of technical difficulties in day-to-day operations during the interviews with operation centers and their management bodies. These entities have operated and managed the facilities with no major difficulties.

O&M training and OJT by the project were implemented as planned. There are staff members in each operation center who received the training/OJT by the project, thus the content of the training is firmly transferred to the centers. In terms of O&M of the equipment provided, more than half the staff members who received OJT in the project still remain on the equipment team. Thus, the training content is firmly established in the team, which has no technical problems. On the other hand, the dispatching of staff to external training and seminars, or to joint workshops among the three provinces—as suggested in the project design—was not fully implemented. This was partly because the Basic Design Study Report did not clarify who should take responsibility for this and when it should be implemented. Another reason is the limited budget on the Vietnamese side. Moreover, the O&M Manual developed by the soft-component of the project was still kept at the operation centers at Gia Lai and Kon Tum but missing in Dak Lak, as of the field visit of this evaluation. In all facilities, the staff members regarded themselves as fully familiar with the content of the manual without reading it again, as some of them had originally received the training from the project.

Thus, the bodies responsible for O&M of the water supply facilities and the equipment provided have the necessary technical skills, in general. Still, in view of aging and deterioration, and of the

possible need for major repairs in the future, the sustainability of technical aspects of O&M will be enhanced if the following situation can be improved: opportunities for refreshed or updated training of staff members is limited and they do not necessarily have advanced techniques for complicated repair work.

3.5.3 Financial Aspects of Operation and Maintenance

3.5.3.1 Water Supply Facilities

The customer ledger was completed and updated in each commune. The system of water charge collection is established. The water tariff and collection rate of the charge are shown in Table 9. The water tariff is set at a proper or low level, compared to the average annual income of the population, the standard of the Ministry of Finance, and tariffs of similar projects. According to the beneficiary survey, 90% of the users are satisfied with the water tariff.

Table 9 Water Tariff and Collection Rate

Province	Commune		Water tariff (VND/m^3)	Collection rate (%)
Kon Tum	K3-1	Dak Ui	3,000	0
Gia Lai	G1	Kong Tang	4,000	95
	G2	Nhon Hoa	4,000	95
Dak Lak	D2	Ea Drang	3,000	98
	D4-1	Ea Drong	3,000	100

Source: Data provided by project facilities and P-CERWASS/DPC

While the collection rate is over 95% in four out of five facilities, it is 0% in Dak Ui Commune in Kon Tum. In this commune, the water supply was made free of charge in the first year to promote the use of tap water, but people have not paid even in subsequent years for the following reasons: The commune's population is poor and cannot afford to pay the charges (however, the average annual income of the commune was not the lowest among the target communes of the project), and the area receives various government subsidies given that it is a famous battlefield of the Vietnam War (the Resistance War against America), with many poor, ethnic minority populations. This easily led the people to misunderstand that the free water supply in the first year meant a free supply forever. Also, there are alternative sources of water such as dug wells.

The revenue and expenditures of the facilities are shown in Table 10. The annual total operation and maintenance costs of two facilities (K3-1 and D2) exceed those in the plan, with K3-1 being more than double the planned amount. The other facilities spend less than the planned O&M costs. However, the reasons for the lower costs are considered to be a lower utilization rate of the facility and a smaller number of staff members. All five facilities are in deficit, and DPC/P-CERWASSs are making up the balance. P-CERWASSs of Dak Lak and Gia Lai have applied for raising the tariffs (to 3,200VND and 6,000VND, respectively) to PPC. While in Dak Lak it is expected to be approved soon, P-CERWASS Gia Lai has been waiting for approval for more than a year. The deficit of the two

facilities in Dak Lak and G2 commune in Gia Lai is limited to within 10% of the expenditures and 1% of the total budget of P-CERWASS. On the other hand, the G1 facility partly receives a government subsidy and the deficit of K3-1 is 100% of the expenditure, as the charge is not collected.

Table 10 Revenue and Expenditures of the Water Supply Facilities (2012)

(unit: 1,000VND)

Province	Commune		Annual O&M cost (plan)	Revenue (actual)	Expenditures (actual)				
					Total	Salary	Electricity	Repair and other expenses	Balance
Kon Tum	K3-1	Dak Ui	132,458	0	283,570	149,742	63,828	70,000	-283,570
Gia Lai	G1	Kong Tang	358,813	78,723	138,786	56,766	64,632	17,388	-60,063
	G2	Nhon Hoa	608,255	404,826	427,945	195,994	222,914	9,037	-23,119
Dak Lak	D2	Ea Drang	930,705	938,453	955,230	NA	NA	NA	-16,777
	D4-1	Ea Drong	412,786	299,212	340,204	NA	NA	NA	-40,992

Source: Basic Design Study Report and data provided by P-CERWASS/DPC

The water supply facilities are in deficit, despite the fact that the water tariff is set higher than the planned tariff and that the collection rate is generally high, except for Kon Tum. Possible reasons for this include: the population served is smaller than the plan; while the total O&M cost is less than the plan, it is relatively high compared to the utilization rate of the facility; and the electricity rate, which accounts for a large part of the O&M cost, has frequently increased.

3.5.3.2 Equipment Provided

The CCTT to which the equipment team belongs has sufficient budget to operate and maintain the equipment provided, as the CCTT's budget is partly independent, and it has revenue from not only the government budget but also from service charges to private companies for repairing their machines.

On the other hand, material and construction costs for well drilling are borne by project investors (P-CERWASS or District/Commune People's Committee based on the budget allocation by PPC). For example, the investment budget of P-CERWASS Dak Lak is decreasing, compared to the time of Basic Design Study. According to N-CERWASS, generally speaking, the development budget for water supply in 2013 is limited nationwide. Although the budget allocation is the responsibility of PPC and cannot be generalized, it can be said that the budget for well drilling is not sufficient.

As shown above, the operation and maintenance of the water supply facilities run without a major financial constraint since P-CERWASS/DPC are making up the deficit. However, in terms of financial sustainability, the fact that all five facilities are in deficit, although the extent varies, is a problem. In terms of the financial sustainability of the equipment provided, though the O&M cost is secured, the development budget for drilling new wells is limited.

3.5.4 Current Status of Operation and Maintenance

Each facility is keeping an operations record, and the water supply systems of all five facilities are functioning (however, K3-1 commune is temporarily not operating due to low water levels). According to the beneficiary survey, 90% of the users are satisfied with the service of the facilities. There was no comment from the facilities/management bodies about difficulties in obtaining spare parts.

Looking at the individual wells of the facilities, only 12 of the total 20 wells are in operation. As explained in "3.2 Effectiveness," eight wells are not in operation. Of these, one well is not operating due to unstable voltage to the pump. P-CERWASS Dak Lak procured and installed stabilizers to the pump through its own initiative and solved this problem. The same issue of unstable voltage in general was raised in Gia Lai and Kon Tum provinces.

Polyvinyl chloride (PVC) pipe was adopted for the project because it was possible to procure in Vietnam, and there are advantages such as strength for pressure, anti-corrosion, easy construction, and economic benefit. For budgetary reasons, an inexpensive kind of pipe that joins several small parts was selected. However, the durability of the pipe is low, which is believed to have caused many water leakages one year after completion. The implementing agencies claim that, although this problem was foreseen and they had explained their concerns to the project consultant, no measures was taken because of the budgetary limitation. In this way, when a future O&M problem is foreseen and it is difficult for the contractors to take measures, it might be necessary for the JICA Office to listen to the recipient government's concerns and explain the conditions of the Japanese side and, where necessary, discuss how to improve the situation with the contractor.

As for the equipment provided, it is functioning well and receives regular maintenance based on a set schedule.

In terms of the system of water quality monitoring, the health authority of each area is responsible for conducting regular tests twice a year. This evaluation obtained the test results of the facilities in Dak Lak only. In Gia Lai, P-CERWASS believed that the water quality test was conducted in the project facilities, but it had not received any test results. When the P-CERWASS inquired of the health authority, it was found that they have not conducted any tests, based on their understanding that the water quality was good because of the test conducted upon handover. In Kon Tum, the facility knew of at least one test received in the past, though they have not received the results. Each operation center did not know whether the test was conducted or not and assumed that the health authority obtained the sample directly from user households without notifying the operation center. To summarize, although a system is in place by the government to monitor water quality and it is widely recognized, its implementation and results could not be confirmed in some facilities.

In this way, the current status of operation and maintenance is proper in general, though there are some issues in the physical durability of some parts of the facility and in the structure of water quality monitoring.

Some problems have been observed in terms of the financial aspects and the current status of

O&M, therefore sustainability of the project effect is fair.

BOX. Piloting the Operation and Management System with a Consideration to Sustainability

This project introduced an operation and management structure by a specialized agency, P-CERWASS, rather than by CPC, which is customarily responsible for the management of water supply facilities to two out of three provinces[19]. This is based on the following analysis of the Basic Design Study: operation and management by the CPC lacked human resources, expertise, and experience in water supply service; the method of communication between P-CERWASS and CPC, or the chain of command and control, was not established; P-CERWASS has experience in constructing, operating, and maintaining small-scale water supply facilities; and, in Dak Lak, there was a move toward transferring the facility management responsibility to P-CERWASS.

In fact, the operation and management, including monitoring of the facilities, problem solving, and charge collection are functioning without any major issue in the two provinces that introduced management by P-CERWASS. On the other hand, the facility in Kon Tum, managed by DPC with little experience in water supply, faces many operational issues, including a non-functioning water charge collection and a suspension of operation due to a decreasing water level. In terms of the target achievement, moreover, P-CERWASS Dak Lak has demonstrated a high level of ownership by constructing additional wells and pipelines; that is reflected in achievement levels higher than those of other provinces. This was also affected by the fact that the P-CERWASS had a relatively high capacity to manage water supply facilities, even prior to the project, thanks to technical assistance by the Danish International Development Agency (DANIDA) (2000-2010).

According to N-CERWASS, the management system by P-CERWASS had been practiced in southern Vietnam but was newly introduced by the Japanese grant aid in the north and in the Central Highlands. Witnessing the success of this model, the PPCs in Dak Lak and the northern provinces started to delegate the management of water supply facilities developed by other investors, such as the government, to P-CERWASSs. In Dak Lak, for example, 16 facilities, including the two project facilities, of the total 82 facilities in the province are directly managed by P-CERWASS as of this evaluation[20]. As a result, the advantage of managing multiple facilities has been realized, including supplementing the deficits of the project facilities by the profits of other facilities. Some model effect has also been seen in the northern project, where a similar project by the World Bank adopts the P-CERWASS management model, and its stakeholders visit the project facilities.

[19] As of the development study (2001-2002), the management structure centered on CPC was proposed. The Basic Design Study (2005-2006) proposed the management system by P-CERWASS to all facilities based on the analysis explained below.

[20] In Dak Lak, a plan had been proposed to the provincial assembly for the adoption of a system change to enable P-CERWASS to manage all water supply facilities in the province as of 2005 when the Basic Design Study was conducted. However, it had not been realized as of this evaluation.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to improve the supply of water to people in the Central Highlands provinces by constructing water supply facilities in five communes within three provinces and providing well drilling equipment. This project has been highly relevant to the country's development plan and development needs, as well as to Japan's ODA policy. This project has somewhat achieved its objective in that more than 26,000 people in total benefited from safe and clean water provided by the five facilities, and the project contributed to a 0.7 point increase in the overall percentage of population with access to hygienic water of the three provinces. However, the achievement of the objective was limited in light of the fact that 1) there is great variation among target facilities (communes) in achieving the number of population served, its ratio, and the quantity of the water supply; and 2) the use of the equipment provided is limited in the target region. Therefore, effectiveness of the project is fair. Although both project cost and period were within the plan, the Vietnamese government had to bear additional cost to achieve the objective, and some important aspect of the Vietnamese side's responsibility (responsibility of provincial authorities) was not conducted on time, which delayed production of results. Therefore, efficiency of the project is fair. Some problems have been observed in terms of financial aspects, including the deficit balance of the facilities and the failure to collect charges in a facility, and in terms of the current status of the operation and maintenance, including the durability of distribution pipes and the monitoring of water quality. Therefore, sustainability of the project effect is fair. In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementation Agency

(1) Improvement of Quantity of Water Supply and Population Served (Effectiveness and Financial Sustainability)

The quantity of the water supply and the user population are both lower than originally planned and have been trapped into a vicious circle. This has led to where the financial balances of all five facilities are in deficit. To improve this situation, it is recommended that P-CERWASS Gia Lai and DPC Dak Ha start from the measures listed below that require relatively low cost in order to improve the quantity of water intake and supply, supply hours, and the number of users. It is strongly recommended that the Vietnamese side take up these measures, since the same were also proposed during the Warranty Period Inspection.

- Installing stabilizers to the wells
- Obtaining an agreement to supply electricity to the non-operating well
- Repairing distribution and supply pipes, and service meters
- Conducting IEC activities in collaboration with CPC

Some operation centers commented that they limit supply hours in order to prevent wasting water

for unintended purposes. However, in Dak Lak, where the operation started earlier than other provinces, unintended use is prevented through active IEC utilizing radios, and penalties imposed for unintended use by CPC, rather than reducing supply hours. This is a good practice that can be followed by the other two provinces. In the future, it is recommended that the construction of additional water sources (wells, etc.) and/or distribution pipes be considered. In addition, it is recommended that DPC Dak Ha obtain advice from P-CERWASS Kon Tum or Gia Lai, or N-CERWASS, on the O&M of the facility, including measures to tackle decreasing water levels, since it does not have previous experience in managing a water supply facility.

(2) Strengthening of Charge Collection and Gradual Increase of Water Tariff (Financial Sustainability)

While the improvement of water quantity and the number of users through recommendation (1) above is expected to improve the financial balances, it is advisable to take additional measures, especially for Dak Ui commune (K3-1), where the water charge is not collected at all, and for Kong Tang commune (G1), where some non-payment issues were raised. For example, awareness raising among users should be done by collaborating with CPC. In addition, for the four facilities in Gia Lai and Dak Lak, where the application to raise the water tariff has already been submitted to the province, it is desirable to pursue the raise, but in a gradual manner, by considering proper timing to minimize the impact of increased tariffs on increase of users and on improvement of the collection rate.

Improvement in the financial condition will allow the proper maintenance of facilities and a subsequent reduction in non-revenue water, which further improves the financial condition. Also, if P-CERWASS/DPC does not need to supplement the facilities' budgets, it could invest more in such areas as training and in measures to mitigate decreasing water levels.

(3) Strengthening of Water Quality Monitoring Structure (Effectiveness and Sustainability)

No problem was identified in the quality of water in each facility. However, neither the facility nor their management bodies in Gia Lai and Kon Tum received the results of water quality tests from the health authority. Therefore, it was impossible to confirm whether the monitoring structure of water quality is functioning. It is recommended that the facilities and P-CERWASS/DPC communicate closely with the health authority, ensure the test is conducted regularly, and receive the written results each time. In addition, although there is currently no problem with water quality, the situation in which facilities in Gia Lai do not chlorinate the water should be rectified in the future by, for example, incrementally increasing the amount of chlorine until users get used to the smell.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

(1) Reflecting the Characteristics of the Target Area and Future Estimation in Project Planning

This evaluation raised six factors that affected and limited achievement of population covered and

quantity of water supplied (see "3.2.1.1 Water Supply Facilities"). These suggest the importance of properly including and analyzing the characteristics of the target region and its future estimation in the project design. In particular, the following aspects should be taken into consideration when similar projects will be planned in the future, in order to attain high achievement levels of the project objective:

- While it is difficult to take complete measures to mitigate water shortages, as they are influenced by such issues as climate change, it might be effective to consider various water sources such as surface water in addition to deep groundwater to mitigate the impact of decreasing water levels in areas where geological conditions are harsh, as in this project[21].
- It is advisable to confirm the stability of electrical pressure and assess the need of taking any measures in designing a similar project. The problem of electrical pressure was pointed out in all three provinces. If stabilizers were included in the original specification of the project, problems such as breakdowns of pumps could have been avoided.
- In rapidly developing countries like Vietnam, especially in target areas located along major roads as in this project, the existence and content of road development/improvement plans should be checked in the project design phase. Also, population estimates should properly consider potential growth in the population. These will allow realistic target setting and minimize the impact of socioeconomic development on the project. For example, in areas where road improvement is expected, the project could adjust the construction schedule with the road authority, install the distribution pipes on both sides of the roads, or discuss with the recipient government the possible plan to dig up the improved road and install the pipes. Moreover, during the Detailed Design, the latest road improvement plan should be reviewed to see whether there is no change in the plan since the Basic Design Study, so that necessary revision is made in the project design. To do so, in addition to the above measures, it should be considered as much as possible to allocate the project cost to cover at least part of the additional construction work by utilizing the remaining funds of the project, in cases where it is applicable[22].
- In this project, it took nine years to complete since the development study. During the time the population could not benefit from the project, they proceeded with the construction of dug wells or the improvement of their depths, resulting in low growth of the user population of the project's facilities. In projects that take a long time from the initial needs assessment to the project completion, it is possible that planned beneficiaries turn to alternative measures, as

[21] Although it was not anticipated as of the design of this project, the Vietnamese government has shifted its policy on the main source of water for the central water supply system in the Central Highlands from deep groundwater to surface water. There is also a case in which a project facility constructed additional shallow wells near a lake to supplement water.

[22] The difference between the grant limit agreed between the governments and actual grant amounts (total contract amounts of consultants and contractors). This is normally returned to the national treasury, but, when certain criteria are met, with JICA's approval, it can be utilized as an addition to the contract amount to cover the change of the design.

they did in this case. To avoid this, JICA should notify the recipient government of the project's status and prospects, even after the assessment/study, and request that it explain the situation to the local population. At the same time, in projects dealing with urgent issues like water supply, both governments should manage the entire procedure—including study, request, adoption, design, and implementation—without any intervals and try their best to realize the anticipated impact as soon as possible.

- In target areas which require special attention, such as those with high ratios of ethnic minorities and the like, elaborate plan is required. For example, IEC activities should be carefully planned, such as conducting IEC continuously throughout the planning and implementation and after the handover. Although various surveys and stakeholder meetings were conducted during the Basic Design Study and the project implementation, some issues were observed in communes with high proportions of ethnic minorities, including: taking a longer time for the population to decide to use the tap water, taking good care of the facilities, and charge collection. Considering that the need for further IEC in K3-1 commune in Kon Tum was especially emphasized in the development study, the project could have taken further measures, such as strengthening IEC in the commune. This is considered to be effective given that the commune with a large number of minority populations in Dak Lak demonstrated relatively high achievement levels of the target, where P-CERWASS carries out continuous IEC.

(2) Clear Planning and Monitoring of the Use of Equipment Provided

In this project, the equipment provided and the team to operate and maintain it are located in the capital of Hanoi rather than in the target region as agreed upon in the Basic Design Study. The timing to establish the equipment team was not specified in the study, and the change of the location was not documented either in the relevant reports of JICA. From the fact that the equipment provided by this project was not fully utilized to attain the planned target because of the change in location, the lack of a development budget, and unrealistic target setting, the following two lessons can be learned:

1) To realistically set the target value to be achieved by the recipient government utilizing provided equipment. Although some information, such as the success rate of drilling wells, may not be available at the planning phase, it is advisable to realistically analyze such aspects as the actual period in which the recipient can utilize the equipment compared to the project period, examples of similar projects, the financial situation of the recipient, and the mentality about the cost-quality balance of the recipient. This will help in setting more realistic targets.

2) When the equipment is planned to be used in specific target areas, and especially when the implementing agency does not have a pre-existing office in that area, it is recommended that the Japanese side request that the recipient government submit a utilization plan that includes the location and timing to place the equipment, staffing, the list of projects and their schedules, the budget, and so

on, rather than simply indicating the expected usage in the Basic Design Study Report. The utilization plan should be put into practice before completion of the project so that the Japanese side can confirm the initial implementation of the plan and document it in relevant reports. Then JICA should monitor its implementation at occasions such as the Warranty Period Inspection. It should be noted that, in the case of Vietnam, it is PPC, not N-CERWASS or P-CERWASS, who has the authority to decide on new groundwater development projects and budget allocations. Therefore, it would be necessary to involve PPC in developing such a plan.