Federal Democratic Republic of Ethiopia

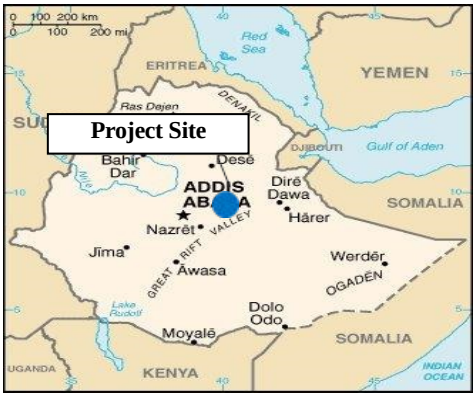
FY2015 Ex-Post Evaluation of Technical Cooperation Project
"The Ethiopia Water Technology Center Project[1]"
("The Project for Groundwater Development and Water Supply Training[2] Phase II")
External Evaluator: Noriyo Aoki, Alfapremia Co., Ltd.

0. Summary

The Ethiopia Water Technology Center Project ("The Project for Groundwater Development and Water Supply Training Phase II") was implemented to enhance the capacity of the human resources for groundwater and water supply management in Ethiopia. The details of the project are relevant to the development policies of Ethiopia and the priority fields of ODA policies of Japan, for which there are high development needs. Therefore, its relevance is high. Although the project period was within the plan, the project cost was higher than planned. Therefore, its efficiency is fair. The effectiveness is evaluated to be high because this project is developing human resources for groundwater and water supply management both qualitatively and quantitatively. The effects have been continuously manifested until the time of the ex-post evaluation due to training provided in Phase III and by the Ethiopia Water Technology Institute (hereinafter referred to as "EWTI"), a succeeding organization of this Center. The technologies and teaching materials for training are utilized by ex-trainees who are engaged in groundwater development and water supply for their work at the time of the ex-post evaluation. The impact of the project is also high. The sustainability of the policies is high and the organizational system of EWTI as an independent organization has been mostly established. The sustainability in terms of both organizations and systems is high. The financial sustainability is also high because an appropriate budget is secured for the plan. The sustainability is generally evaluated to be fair because the technical sustainability is regarded as an issue. There is a need for instructors with abundant work experience who could teach not only theories but also practical skills and the existing instructors also needed capacity enhancement.

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

1. Project Description



Project Location

Ethiopia Water Technology Institute (EWTI)

[1] Ethiopia Water Technology Center; hereinafter referred to as "EWTEC"

[2] The Project for Groundwater Development and Water Supply Training consists of three phases: Phase I (1998 – 2003), Phase II (this project) and Phase III (2005 – 2008). This project is named "Ethiopia Water Technology Center" but is called "Phase II" because the abbreviation of the project name is EWTEC, which is the same as the center name.

1.1 Background

After transition of Ethiopia to a federal system in 1995, the decentralization of the water supply administration was promoted. In the disparity between regions, the major issue was a shortage of human resources with water supply and groundwater development technologies. A low rate of access to safe water in the rural area forced many residents to spend much time and labor on securing water for their daily life. Therefore, the Ministry of Water Resources had planned providing the personnel and engineers engaged in groundwater development and water supply with training on planning, survey, well drilling, maintenance of wells and equipment and guidance on operation of water supply facilities at the community level. Then the Ministry submitted a request for assistance for this plan to the Government of Japan. In response, the Government of Japan implemented a seven-year human resources training project including a two-year extension period from January 1998, "Groundwater Development and Water Supply Training Project" (hereinafter referred to as "Phase I"). In Phase I, a new training center[3] was established in Addis Ababa that provided permanent training courses focused on well drilling technologies and supplemental courses. In the permanent training courses, the personnel of the regional governments and the Ministry of Water Resources received training. At the start of Phase II, the training center was beginning to be recognized as the core organization for development of human resources engaged in water resource development[4].

Table 1 Outline of Backgrounds Related to Phase I

Phase I: First five years January 1998 to January 2003	Phase I: Extension for two years January 2003 to January 2005
[Background] • Impoverishment of domestic economy due to civil war and drought • Transition to a federal system in 1995 • Shortage of human resources with water supply and ground water development technologies • The lowest water supply and sanitation coverage in Africa	[Background] • Acceleration of decentralization (enhancement of Regional Water Resources Bureaus and District Water Resources Offices) • Enhancement of human resources at the regional level • Establishment of District Water Resources Offices

Source: Created by the author based on the Project Design Matrix of Phase II

1.2 Project Outline

Overall Goal[5]		Access to facilities of water supply improves through water resource development and management.
Project Purpose		Human resources for appropriate groundwater and water supply management increase.
Output	Output 1	Technical trainings regarding groundwater and water supply management are conducted.

[3] Called EWTEC in Phase II and later.
[4] Based on the interview survey with Japanese former experts.
[5] English expressions in some parts of the project outline have been modified from the original ones.

	Output 2	The training courses are developed and improved through research activities.
	Output 3	Technical materials on groundwater management and water supply are developed.
Total Cost (Japanese Side)		436 million yen
Period of Cooperation		March 15, 2005 – March 14, 2008 (3 years)
Implementing Agency		Ministry of Water Resources
Other Relevant Agencies/ Organizations		None in particular
Supporting Agency/ Organization in Japan		None in particular
Related Projects		[Technical Cooperation Projects] "Groundwater Development and Water Supply Training Project Phase I" (1998 – 2005) "The Ethiopian Water Technology Centre Project Phase III" (2008 – 2013) "The Water Sector Capacity Development Project in Southern Nations, Nationalities and People's Region" (2007 – 2011) "Project for Rural Water Supply, Sanitation and Livelihood Improvement through Dissemination of Rope Pumps (RPs) for Drinking Water" (2013 – 2016) [Grant Aid Cooperation Projects] "The Project for the Water Supply in Amhara Regional State" (2005) "The Project for Water Supply in Southern Nations, Nationalities and Peoples' Regional State" (2005) "The Project for Water Supply in Afar Region" (2007) "The Project for Rural Water Supply in Tigray Region" (2010) "The Project for Rural Water Supply in Oromia Region" (2009)

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Time of the Terminal Evaluation

The number of trainees who have completed the training course exceeded the initially planned number of 748 and reached 908 at the time of the terminal evaluation[6]. In the questionnaire survey, 87% of the trainees completed the training courses answered that the content of the training had been "very good" or "good" and 81% of the bosses of the ex-trainees answered that "their performance improved" and 77% of them answered that "the efficiency of work improved,"[7] which means that the project was evaluated to be highly likely to achieve its purpose in terms of the quantity and quality of training[8].

[6] July 2007
[7] Terminal Evaluation Report, p. A5-2.
[8] Terminal Evaluation Report, p. 24.

1.3.2 Achievement Status of Overall Goal at the Time of the Terminal Evaluation (Including Other Impacts)

A rural water supply rate[9] of 24% was specified as the standard value at the time of the ex-ante evaluation. However, the rural water supply rate based on a definition in the Universal Access Plan (hereinafter referred to as "UAP"), a new set of policies in the water supply sector, made a favorable growth afterwards, marking 35% in 2005 and 41% in 2006[10]. After the terminal evaluation, the rural water supply rate continued to improve and was expected to accomplish the 2015 rural water supply rate, an index specified as the overall goal.

Table 2 Standard, Actual Performance and Target Values of Water Supply Rates in Ethiopia

Indicator	Water supply rate: Standard value	Water supply rate: Performance value	Water supply rate: Performance value	Water supply rate: Overall goal value
	2004	2005	2006	2015
	Ex-ante evaluation time	One year after implementation	Two years after implementation	
Nationwide water supply rate	36.7%	45.7%	47.2%	-
Urban water supply rate	-	41.2%	78.0%	-
Rural water supply rate	24.2%	35.0%	41.6%	67.0%
Definition of rural water supply rate	WSDP* 20L per person a day	UAP 15L per person a day	UAP 15L per person a day	WSDP 20L per person a day

* The definition of the water supply rate at the ex-ante evaluation is based on WSDP established in 2002. It is different from the definition of the UAP water supply rate specified in 2005 after the start of the project. Since the definition of the water supply rate as the overall goal value was specified in WSDP at the ex-ante evaluation, the water supply rate in WSDP is used in this table. Note that the definitions of the WSDP and UAP water supply rates do not include the distance to a water supply point.
Source: Report on Record of Discussions, Terminal Evaluation Report and Data from the Ministry of Water Resources

Another impact was that the completion certificate for the Drilling Technology Course became the only official document that certifies a qualification of a drilling engineer during the implementation of the project[11].

1.3.3 Recommendations at the Time of the Terminal Evaluation

[Activities expected to be implemented by the end of this project]

Recommendation 1: Staff shall be assigned promptly as instructors to four of the five basic training courses for which they are needed.

Recommendation 2: The results of the research about the groundwater development and management and the water supply shall be summarized in order to

[9] The rural water supply rate was used as the principal indicator because training was basically provided with a focus on the improvement of the water supply rate in the rural area since Phase I.
[10] Based on the interview survey conducted at the Regional Water Supply Bureaus, Ministry of Water Resources.
[11] Project Completion Report p.59, Implementation and Management Summary Sheet p.1

complete the six teaching materials for the basic and advanced training courses.

Recommendation 3: The communications between the Ministry of Water Resources and EWTEC staff shall be improved for operation and management of the project.

[Activities expected to be implemented by or after the end of this project]

Recommendation 1: The Ministry of Water Resources shall take appropriate measures to secure budget for EWTEC and assign instructors from the viewpoint of operation and sustainability of this project by EWTEC.

Recommendation 2: The legal position of EWTEC shall be promptly established as an organization to define the roles, responsibilities and authorities of EWTEC.

Recommendation 3: EWTEC shall make further efforts to improve the curriculum and teaching materials of the training courses to develop human resources to contribute to improving the water supply rates.

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriyo Aoki, Alfapremia Co., Ltd.

2.2 Duration of Evaluation Study

The following evaluation study was conducted for this ex-post evaluation.

Duration of the Study: October 2015 –February 2017

Duration of Field Study: March 3 - 28, 2016 and May 23 - 26, 2016

2.3 Constraints during the Evaluation Study

2.3.1 Sampling of Beneficiary Survey

The beneficiary survey was planned to extract 200 effective answers from the ex-trainees of Phase II. For the ex-trainees of Phase II, unfortunately only the name and organization at the time of training were recorded; only for ex-trainees of the Rope Pump Manufacturing Course[12] were telephone numbers and other information recorded. It was attempted that information on the ex-trainees of Phase II to be gained from the water resource-related bureaus and Water Works Construction Enterprises of the four major regions (Oromia Region, Amhara Region, Southern Nations, Nationalities and People's Region and Tigray Region). However, as eight or ten years have elapsed since the completion of training, only 95 effective answers[13] were able

[12] A rope pump is a kind of pump installed on a shallow well to enable easy and safe lifting of water using a rope. A rope pump was included in one of the training courses because it can be installed at a low cost and reduce water drawing labor.

[13] Out of all the answers from the Phase II ex-trainees, 95 samples of effective answers were extracted. Out of them, 32 samples of effective answers were extracted using a different questionnaire sheet sent to the ex-trainees of the Rope Pump Manufacturing Course.

to be extracted. The target persons in the survey were also the water supply staff who worked continuously in this field so that a bias in terms of extraction could not be avoided.

2.3.2 Project Design Matrix (hereinafter referred to as "PDM"[14])

Although PDM at the time of ex-ante evaluation needed revising, this project modified the Plan of Operation (hereinafter referred to as "PO")[15] instead of revising PDM, conducted activities based on PO and underwent the terminal evaluation. Although this evaluation examined the project purpose, overall goal and outputs described in PDM, the numeric targets for outputs were compared also with the indicators in PDMe[16] created at the time of the terminal evaluation and partially modified where needed to evaluate this project.

Furthermore, there is logical failure between the project purpose to the overall goal specified in the PDM at the time of ex-ante evaluation. PDM sets "a budget for improving the facilities for water supply is secured to ensure continuation of the water supply service" and "a maintenance system appropriate for the water supply facilities is established" as important assumptions. Although this ex-post evaluation was supposed to analyze also the contribution to achievement of the overall goals other than this project, the specified important assumptions were too large to verify and the evaluation on such aspect was difficult to be conducted. To enable appropriate monitoring of progress of activities and evaluation of this project, the overall goal, important assumptions and objectively verifiable indicators should have been modified to ones appropriate for the project purpose at an early date.

3. Results of the Evaluation (Overall Rating: B[17])

3.1 Relevance (Rating: ③[18])

3.1.1 Relevance to the Development Plan of Ethiopia

In 2002, the Government of Ethiopia established the "Sustainable Development and Poverty Reduction Program" (hereinafter referred to as "SDPRP"; 2005 - 2010) and designated the water sector as one of the high-priority issues. The "Water Sector Development Plan" (hereinafter referred to as "WSDP"; 2002 - 2016) established in the same year as above attached importance to the water resource development for the sake of poverty reduction and sustainable development and set the goal of improving the rural water supply rates throughout Ethiopia[19] from 23% in 2001 to 72% in 2015. The "National Water Supply and Sanitation Master Plan" established in January 2003 pointed out the necessity for securing personnel of

[14] The Project Design Matrix (PDM) is an outline plan of a Technical Cooperation Project and consists of goals, target values, activities, important assumptions, etc.
[15] The Plan of Operation (PO) is the schedule of planned activities.
[16] Although PDMe was not recently created for evaluation purposes, the objectively verifiable indicators were specified in PDMe particularly for Outputs 2 and 3 because PDM did not provide any detailed indicators for them at the time of the terminal evaluation of this project.
[17] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory.
[18] ③: High, ②: Fair, ③: Low.
[19] WSDP defines that the rural water supply rate is the percentage of persons who have access to 20 liters of safe water per day.

the district and regional governments, the implementing agencies and developing their capacities[20].

At the project completion, UAP established in 2005 emphasized the enhancement of development of human resources for water supply[21].

Therefore, this project is confirmed to have relevance with the development policies of Ethiopia both at the time of the ex-ante evaluation and at the project completion.

3.1.2 Relevance to the Development Needs of Ethiopia

Around Phase I, the decentralization policy had promoted the transfer of the rural water supply service to the regional governments and expanded the needs for human resources development at these regional governments. There was a large demand for basic training for the District Water Resources Office staff, an implementing department for the rural water supply project. Therefore, eight Technical Vocational Education Training Colleges (hereinafter referred to as "TVETC"), vocational schools for fostering district staff[22], had been founded at the time of ex-ante evaluation in November 2004. The new teachers hired at TVETC also needed to be provided with training[23].

At the time of the ex-ante evaluation in Phase II, both the central and regional governments recognized the necessity for capacity development of staff engaged in actual operations not only in well drilling technologies but also in planning and technical analysis of water resource development. Therefore, various training demands were manifested, such as the technologies for maintenance and the methods for organizational enhancement[24]. The research of the water field was considered necessary because the water resources were not fully utilized, compared with their potentials[25]. Due to the above needs, the functional enhancement of the training center founded in Phase I was required.

At the time of the terminal evaluation of the project[26] and the project completion[27], the personnel of the region, zone, district and Town Water Supply Services and Water Well Drilling Enterprise needed practical training to accomplish UAP. However, the water sector personnel did not have any other opportunity for practical training than at EWTEC. This project was implemented to satisfy the needs for training of engineers to be engaged in ground water development and water supply[28]. Regarding the needs for improving the capacities of the District Water Resources Office staff, this project provided training to both TVETC trainees

[20] Report on Record of Discussions, p.52. Ministry of Finance and Economic Development & UNDP, Ethiopia-MDGs Needs Assessment Final Draft Report: Water Supply, p.4, 2004.
[21] UAP, p.12.
[22] This is a polytechnic that provides a three-year course to graduates from a lower secondary school and gives them a diploma upon completion of the course. The graduates of the course were supposed to work for a district office at least for six years.
[23] Report on Records of Discussions, p.60-62
[24] Ex-ante evaluation sheet of Project.
[25] Report on Record of Discussions, p.40.
[26] Attachment to Terminal Evaluation Report, Eight Principal Meeting Records.
[27] Ex-ante Evaluation Report on the Project for Groundwater Development and Water Supply Training Phase III, p.5-18
[28] Terminal Evaluation Report, p.27.

and instructors, since the latter of whom were college graduates but did not have sufficient field experience.

The research was conducted on an area with relatively high rainfall but susceptible to adverse influence of droughts to investigate the groundwater potential amount, create well registers and study the volcanic geology information, etc. The establishment of Geographical Information System (hereinafter referred to as GIS) that accumulated various data such as ground water models was an activity that complemented the contents of training for specific case studies at EWTEC. It was appropriate to plan the use of the research results as teaching materials in the training.

The needs for a development of human resources for water supply, which was highly urgent at the time of the ex-ante evaluation, were satisfied by the enhancement of capacities of personnel by the end of this project.

From the above perspectives, the project had contents that were adequately selected and had high priorities and were highly relevant with the development needs from the time of the ex-ante evaluation to the completion of the project.

3.1.3 Relevance to Japan's ODA Policy

The "Country Assistance Program for Ethiopia" formulated in August 2000 listed "environment conservation" as one of the priority areas of assistance and specified to implement assistance for development of water and sewerage services. The Third Tokyo International Conference on African Development (hereinafter referred to as "TICAD III" (2003)) emphasized the necessity for specific assistance in the water resource development and water supply fields regarding two of the three priority fields in Japan's assistance to Africa: "human-centered development" and "poverty reduction through economic growth"[29].

In light of the above, this project has been highly relevant with Ethiopia's development plan and needs as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Effectiveness and Impact (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Project Output

The degrees of achievement of the objectively verifiable indicators are summarized in the attached table.

1) Output 1

The number of training courses was targeted at 21 at the time of the ex-ante evaluation but was modified to 20 in the March 2006 and July 2007 versions of PO. Although the numbers of basic courses[30] and advanced courses[31] were conducted as planned, the number of on-demand

[29] Keynote speech delivered by Prime Minister Koizumi at the Third Tokyo International Conference on African Development in September 2003.

[30] Consist of six permanent courses (Groundwater Management, Drilling Technology, Drilling Machinery Maintenance Technology, Local Social Development, Water Supply Engineering and Electro-Mechanical Maintenance Technology).

courses[32] did not reach the planned number. The targeted total number of trainings provided was evaluated using PO in the terminal evaluation because PDM did not provide a numerical goal. The total number of courses provided was mostly achieved because the value provided in PO was used as a goal. The demand survey about the content of the lectures in the training courses was conducted once in the first year. This demand survey was conducted on the directors or higher executives of the Water Resources Bureaus and Water Works Construction Enterprises of the four major regions (Amhara Region, Oromia Region, Southern Nations, Nationalities and People's Region and Tigray Region) using one of the two methods: (1) Interviews by asking them what kind of training they wanted their subordinates to receive and what kind of knowledge they wanted them to gain and (2) multiple-choice system in which they were asked to select from many training choices prepared in advance[33].

Table 3 Number of Training Courses: Targets and Actual Performances

Indicator	Number of courses: Target value (Dec. 2005)	Number of courses: Performance value (Jul. 2007)	Number of courses: Performance value (Mar. 2008)
	PO	Terminal evaluation time	Project completion time
Basic Courses	6	6	6
Advanced Courses	6	6	6
On-demand Courses	8	3	4
Total	20	15	16

Table 4 Total Number of Trainings: Targets and Actual Performances

Total number of trainings: Target value (Dec. 2005)	Total number of trainings: Performance value (Jul. 2007)	Total number of trainings: Performance value (Mar. 2008)
PO	Terminal evaluation time	Project completion time
30	24	28
15	11	13
15	12	16
60	47	57

Source: PO, Terminal Evaluation Report, Project Completion Report - Summary Table, Project Completion Report p.2-6.

Regarding the management of training courses, the basic courses implemented by the Ethiopian side were managed by the Ethiopian counterpart in the second year onwards while the advanced and on-demand courses were managed jointly by the Japanese and Ethiopian sides[34]. In the beneficiary survey[35], 94% of the respondents answered that "training had been properly managed."

[31] Consist of six courses for advanced learners (Groundwater Modeling, GIS/Information Management (1), GIS/Information Management (2), Water Supply Engineering (Planning and Designing), Water Supply Engineering (Operation and Maintenance) and Remote Sensing).

[32] Additional courses to the basic and advanced courses, which are supplementally established on a demand basis. The Rehabilitation of Well, Rope Pump Manufacturing and Electro-Mechanical Maintenance Technology are included in the on-demand courses.

[33] Based on the interview survey with Japanese former experts.

[34] Based on the interview survey with Japanese former experts.

[35] The ex-trainees in Phase II were surveyed. Sixty-three samples were collected as effective responses (excluding the 32 samples from the ex-trainees of Rope Pump Manufacturing Course). When classified by attributes, the samples were composed of 44% region personnel, 22% zone personnel, 17% District Water Resources Office personnel, 3% TVETC personnel and 11% Water Works Construction Enterprise personnel. By age groups, they were composed of 5% in 20s, 24% in 30s, 48% in 40s, 21% in 50s and 3% in 60s. By sexes, they were composed of 95% male and 5% female personnel.

2) Output 2

For Output 2, study activities were conducted to develop and improve training courses. The demonstration site for research activities for Output 2 served also as the practical training site for Output 1 and contributed to diversifying the training content both for instructors and trainees. In this sense, the outcome of the study activities contributed to improving and reinforcing the training content for Output 1. The study activities included experimental verification study and activities related to making and popularizing rope pumps based on the verification test from the viewpoint of low cost technology[36]. The Rope Pump Manufacturing Course, established as an on-demand training course, fostered 43 rope pump artisans in the four major regions[37] and distributed 500 rope pumps in the four regions, successfully achieving the goal, with the cooperation of the Regional Water Resources Bureau and District Water Resources Offices. Although the installation of rope pumps was not included in the activities at first, ex-trainees who were trained in the Rope Pump Manufacturing Course to be experts in soldering and manufacturing installed 144 rope pumps under the supervision of the District Water Resources Offices[38]. In view of these series of activities, this project is considered to have achieved Output 2.

3) Output 3

Output 3 regarding development of teaching materials for training courses was regarded as a required improvement in the terminal evaluation. According to the Project Completion Report, however, six teaching materials were completed based on the research activity results from Output 2 by the time of project completion. Since the teaching materials were completed nearly at the end of Phase II, such teaching materials as a hydrogeological map of the Butajira-Ziway areas were utilized in the training in Phase III such as the Groundwater Management and GIS Courses. At present, the series of the survey results are stored in the library of EWTI and used by instructors as references. This project is considered to have achieved Output 3.

3.2.1.2 Achievement of Project Purpose

The Terminal Evaluation Report and the Project Completion Report showed that, regarding Indicator 1 of the project purpose, 162% of the planned number of trainees who completed the training courses was achieved as shown in Table 6. Regarding Indicator 2, the training impact survey conducted on the ex-trainees found that 87% of them thought that the training was either excellent or good. The survey conducted on the immediate bosses found that 76% of them thought that the training was either very effective or fairly effective, thus confirming their high degree of satisfaction.

[36] In this project, "*Tekisei Gijutsu*" in Japanese (appropriate technology) is translated as "low cost technology" in English.
[37] The number of participants in the Rope Pump Manufacturing Course was 68 and included the water service personnel of District Water Resources Offices, etc.
[38] Project Completion Report p.8-2. These installed rope pumps were provided with follow-up and 100% installation was achieved in the "The Water Sector Capacity Development Project in Southern Nations, Nationalities and People's Region (2007 – 2011)."

At the time of the ex-post evaluation, the results of the interview and beneficiary survey were sufficient to conclude that the activities in this project enhanced the capacity of human resources for water supply in Ethiopia both qualitatively and quantitatively and achieved the project purpose.

Table 5 Achievement Status of Project Purpose

Goal	Indicator	Actual performance value
Project purpose	Indicator 1: Number of trainees who completed the training courses	Achieved as shown in Table 6.
	Indicator 2: Degrees of satisfaction of ex-trainees and their bosses regarding the outcome of training	The training impact survey confirmed high degrees of satisfaction.

Table 6 Number of Trainees Who Completed the Training Courses: Plan and Actual Performance
(June 2006 to March 2008) (Unit: Person)

Year	Number of trainees who completed the training courses: Target value (Dec. 2005)	Number of trainees who completed the training courses: Performance value (Jul. 2007)	Number of trainees who completed the training courses: Performance value (Mar. 2008)
	Ex-ante evaluation sheet	Terminal evaluation time	Project completion time
First year	172	519	519
Second year	288	334	334
Third year	288	55	359
Total	748	908	1212

Source: Ex-ante Evaluation Sheet, Terminal Evaluation Report p.20, Project Completion Report - Summary Sheet by Leader

As described earlier, the survey results of Output 2 were summarized into teaching materials of Output 3 during the project period. The teaching materials were created by the experts, project participants and counterpart personnel while the involvement of internal personnel was mostly achieved. Although the utilization of these teaching materials in actual training began only in Phase III, the research site of Output 2 was utilized as the practical training site of Output 1, which contributed to diversifying the training contents and increasing the training time on site[39].

In a comprehensive view of the circumstances, the project purpose was achieved with these three Outputs.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

The objectively verifiable indicator specified for the overall goal (“Access to improved facilities of water supply increases through water resource development and management”) is the rural water supply rate, but the definition of a rural water supply rate at the time of ex-post evaluation was changed. WSDP, the policy at the time of ex-ante evaluation, defines that the

[39] Based on the interview survey with Japanese former experts.

rural water supply rate is the percentage of persons who have access to 20 liters of water per day. However, GTP, the policy at the time of ex-post evaluation, defines that it is the percentage of persons who have access to 15 liters of water per day in an area with a radius of 1.5km or less, with a lower supplied water amount but with a defined distance. Although the definition was changed, Table 7 shows that the actual performance value of 2015 for rural water supply rate is 98.0%, which was high enough to consider that the target value at the time of ex-ante evaluation had been achieved.

Table 7 Water Supply Rates of Ethiopia (Standard, Target and Actual Performance Values)

Indicator	Water supply rate: Standard value	Water supply rate: Long-term target value	Water supply rate: Performance value
	2004	2015	2015
	Ex-ante evaluation time		Ex-post evaluation time
Nationwide water supply rate	36.7%	-	98.5%
Urban water supply rate	-	-	100%
Rural water supply rate	24.2%	67.0%	98.0%
Definition of rural water supply rate	WSDP 20L per person a day	WSDP 20L per person a day	GTP 15L per person a day Radius of 1.5km or less

Source: PO, Terminal Evaluation Report, Project Completion Report p.2-6.

Furthermore, human resources development is continued after the project completion and the technologies and knowledge acquired in the training of this project are utilized at the time of ex-post evaluation. Therefore, the development of human resources engaged in groundwater development and water supply in this project is considered to have generally contributed to improving the access to water supply facilities through water resource development and management.

It is therefore concluded that the project generally achieved the overall goal.

3.2.2.2 Continuation of Training Activities in Phase III, EWTI

1) Training Activities in Phase III

After the completion of Phase II, Phase III was implemented for five years to enhance the functions for development of human resources for underground water development and water supply. While continuing the training courses in Phase II, the Ethiopian side managed the operation of all the courses and the Japanese side provided support from technical point of view so that activities are conducted in a way to enhance the future sustainability. EWTEC was positioned as the project of JICA and the Ministry of Water Resources. In Phase III, organizational enhancement was promoted so that it could become an Ethiopian agency with legal foundation as an exit strategy for the cooperation so far.

2) Training Activities by EWTI

EWTEC was reorganized to EWTI in August 2013 after the project completion of Phase III. As described in the section on sustainability, short-term training for workers in the water field has been provided with the budget and management of the Ethiopian side.

3.2.2.3 Other Positive and Negative Impacts

1) Satisfaction of Assistance Needs of TVETC

The teachers of TVETC were taken into the Electro-Mechanical Maintenance Technology (hereinafter referred to as "EMMT") course of EWTEC. Also, short EMMT courses were held for students at five TVETCs in the local area[40]. These are a kind of on-demand courses at TVETCs to which equipment was brought and at which training were provided to teachers and trainees, which is similar to the form of delivery services. Since the TVETC teachers were not providing their students with training that was practical in the field, the EWTEC lectures based on actual experience and including a variety of examples satisfied the assistance needs of TVETCs at the time[41].

2) Re-evaluation of Training Courses at the Time of Ex-Post Evaluation

The beneficiary survey on ex-trainees was conducted to re-evaluate the training in Phase II. As a result, 78% of the respondents re-evaluated it as "very useful" and 96% answered that the reason was "acquisition of knowledge and technologies useful for work" (multiple answers allowed).

Table 8 Usefulness of Training Courses (Re-evaluation at the Time of Ex-Post Evaluation)

	Number of samples	Ratio
Very useful	**49**	**78%**
Useful	12	19%
Partially useful	2	3%
Not very useful	0	0
Not useful	0	0

Source: Beneficiary survey on the ex-trainees in Phase II.

Table 9 Reason for Answering Useful (Multiple Answers Allowed) (Re-evaluation at the Time of Ex-Post Evaluation)

	Number of samples	Ratio
I acquired knowledge and technologies useful for work.	**58**	**96%**
I can teach knowledge and technologies*.	32	51%
I acquired new knowledge and technologies.	57	91%
A network was created with other participants in training.	9	14%

* This means that the ex-trainees can transfer knowledge and technologies to their colleagues and subordinates.

Source: Beneficiary survey on the ex-trainees in Phase II.

[40] Project Completion Report p.7-8.

[41] Based on the interview survey with former EWTEC instructors and experts.

As an impact to work after the end of training of ex-trainees, it was confirmed, at the time of the ex-post evaluation, that some of them were utilizing the teaching materials used in the training in Phase II. The teaching materials were shared in the organizations to which the ex-trainees belonged and has been used continuously for the past eight to ten years[42]. As shown in Table 10, the beneficiary survey also discovered that 49% of the ex-trainees used the teaching materials utilized in the training for their work. Two trainees who came from other countries (Lesotho and Tanzania) to participate in the training also answered in the e-mail beneficiary survey that they used the teaching materials for their work[43]. Since they used teaching materials that were created mainly in Phase I, they cannot be classified into the output of Phase II. However, it is apparent that the training content was organized effectively so that it can be utilized for daily work.

Table 10 Contents and Utilization of Teaching Materials (Multiple Answers Allowed)
(Re-evaluation at the Time of Ex-Post Evaluation)

	Number of samples	Ratio
The contents are appropriately described.	52	83%
Easy to understand.	49	78%
Difficult.	0	0%
Many technical terms are used.	9	14%
Teaching materials are used for work at present.	**31**	**49%**

Source: Beneficiary survey on the ex-trainees in Phase II.

3) Synergy Effects with Japanese Grant Aid Projects Related to Water Supply

Phase II was implemented in a period when the Japanese grant aid projects for construction of water supply facilities were either planned or implemented in the Southern Nations, Nationalities and People's Region, Afar Region, Amhara Region, Tigray Region and Oromia Region. The numbers of trainees completed the training courses in Phase II are 149 from the Southern Nations, Nationalities and People's Region, 35 from the Afar Region, 103 from the Amhara Region, 71 from the Tigray Region and 175 from the Oromia Region. Some ex-trainees of Phase II gave comments that they were either directly or indirectly engaged in grant aid projects and that they had made the most of the training that they had received at EWTEC in their work[44]. This project provided well rehabilitation training using borehole investigation by television camera targeted at the Regional Water Resources Bureau personnel in consideration of the project in the Afar Region[45].

[42] Based on the interview survey conducted at the Tigray Regional Water Resources Bureau.
[43] The questionnaire sheet for beneficiary survey was sent via e-mail to third-country trainees in Phase II (four effective responses). The questionnaire sheet was sent to 15 ex-trainees.
[44] Based on the interview survey conducted at the Tigray Regional Water Resources Bureau.
[45] Project Completion Report p.7-8.

4) Other Ripple Effects

(1) There were several local water supply experts who pointed out that the long-term supply of training since Phase I in the courses on groundwater investigation, drilling machinery and drilling technology increased the number of groundwater drilling engineers and improved the success rate in drilling wells although these impacts cannot be regarded only as those of Phase II[46]. Since there was no practical training organization before the Phase I cooperation project, this impact can be considered, in a broad sense, as one of the impacts of the groundwater development and water supply training project.

(2) Phase II was a stage for fully informing the water supply personnel of the convenience of rope pumps, which were not yet widely used in Ethiopia at the time and promoting publicity and widespread use among the general public. Therefore, supplemental technical training related to manufacturing was provided. For example, it was necessary to teach how to tension a belt and how to install a rope pump in relation to the depth of a well so that a follow-up was provided during the period of Phase II. Later, the rope pumps distributed and installed over the four major regions in Phase II were provided with further full follow-up as activities in the technical cooperation project, "The Water Sector Capacity Development Project in Southern Nations, Nationalities and People's Region." Specifically, the follow-up included explanation on the installation method, training for quality control of rope pumps and monitoring required after use for a certain period.

Out of the 35 effective responses in the beneficiary survey on the ex-trainees of the rope pump training in Phase II, there were 26 manufacturers. According to the result, Phase II was the stage for creating the demand[47] and, due to the guaranteed purchase by the government, all the manufacturers who were ex-trainees started manufacturing rope pumps immediately after the training. However, there were such problems as difficulty in acquiring parts and materials. In one example reported for Phase II, an installed rope pump was used for small-scale irrigation for cultivation of cash crops in an effort to increase cash income[48]. After the benefit of rope pumps became well-known, private manufacturers of low-price and low-grade rope pumps entered the market, causing such problems as difficulty in sale and loss of trust in the products. However, there are three ex-trainees who continue to manufacture rope pumps while gaining profits on a market basis even at the time of the ex-post evaluation. One of these ex-trainees (a TVETC instructor) who continued to make improvements on his own to ensure technical sustainability manufactured 2,000 units in the Amhara Region by the time of the ex-post evaluation. These rope pumps were distributed through the District Water Resources Offices and are in use in the rural villages in this region[49].

[46] Interview survey on ex-trainees and former instructors of Phases I and II.
[47] Arousing potential demand by showing the convenience and usefulness of rope pumps.
[48] Experts' Report and Experts' Report on Low Cost Technology Expansion Plan
[49] Interview survey.

(3) While it was a commonly accepted view that the groundwater in the Rift Valley Basin contained lots of fluorine, the hydrogeological survey in the Butajira-Ziway areas in Phase II discovered the presence of a stratum with abundant groundwater with exceedingly low fluorine content and fit for drinking, triggering the implementation of a groundwater development study and a water supply project in relation to the Rift Valley Basin[50].

In light of the above, the effectiveness is evaluated to be high because the project has achieved the project purpose of developing human resources for appropriate groundwater management and water supply management. The effects are continuously manifesting themselves due to training provided in Phase III and by EWTI. The impact is also high because a variety of technologies and teaching materials provided in the training are in use by the personnel engaged in groundwater development and water supply even at the time of the ex-post evaluation and the technologies acquired in this project are utilized for work at present. Therefore, the effectiveness and impact of the project are considered to be high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Table 11 Comparison of Plan and Actual Performance of Inputs

Inputs	**Plan**	**Actual Performance** (Project completion time)
(1) Experts	- Long-term: 2 persons Chief Advisor and Coordinator - Short-term: Number of persons not indicated 11 fields: Groundwater modeling, GIS, remote sensing, geophysical investigation, hydrogeology, drilling technology and rehabilitation of well, water supply management, water supply engineering and designing, machinery maintenance workshop management, electro-mechanical maintenance and rural community development	- Long-term: 2 persons Chief Advisor and Coordinator - Short-term: 15 persons Total: 17 persons, 81.35 MM 13 fields: Maintenance technology for electro-mechanical equipment related to water supply, groundwater modeling, borehole investigation by television camera, hydrology and hydraulics, remote sensing, groundwater modeling, GIS/information management, water supply engineering (planning and designing), water supply engineering (structure and calculation), volcanic geology, rehabilitation of well, training course management
(2) Trainees Received	17 million yen (the planned number of trainees was not described)	2 persons
(3) Equipment	48 million yen	6 million yen Spare parts for well drilling equipment, accessories for well drilling, etc.
(4) Third-country Training[51]	Planned but the number of participants is unknown.	78 persons
(5) Project Operation	Not indicated	147 million yen

[50] Based on the interview survey with Japanese former experts.
[51] This training was planned to invite trainees from African countries to Ethiopia (EWTEC) in this project.

Inputs	Plan	Actual Performance (Project completion time)
Expenses		
Total Project Cost (Japanese Side)	360 million yen	436 million yen
Inputs from the Government of Ethiopia	1. Allocation of the counterpart personnel 1) Project Director 2) Project Manager 3) Training Center Manager 4) Assignment of a Course Coordinator for dispatch of short-term experts 2. Providing land and facilities, providing project offices and payment of electric and water expenses 3. Payment of local costs, C/P salaries and payment of part of training implementation costs	1. Allocation of the counterpart personnel: 14 persons 1) 1 Project Director, Ministry of Water Resources 2) 1 Project Manager, Director of Rural Water Bureau 3) 3 Technical Advisors 4) 1 Training Center Manager 5) Assignment of 7 Course Coordinators for dispatch of short-term experts 6) 1 Drilling Engineer and 1 Electric Engineer In addition, 43 persons for administrative staff, drivers and security guards were assigned. 2. Providing land and facilities, providing of project offices and payment of utility charges such as electric and water expenses 3. Local cost of 58 million yen Mainly salaries of contract and temporary employees and daily allowances and transportation costs for training participants during implementation of basic courses

Source: Record of Discussions, Project Completion Report, Terminal Evaluation Report

3.3.1.1 Elements of Inputs

This project adopted a system for dispatching directly employed experts in the first year and experts on a contract basis to perform duties in the second and third years. As for acceptance of trainees, training in Japan was provided to the project-related personnel of the Ministry of Water Resources to strengthen their involvement. Technology transfer was conducted mainly through the project activities in Ethiopia, not through the training in Japan[52].

3.3.1.2 Project Cost

As for the project cost, the planned amount of the Japanese-side cost was 360 million yen whereas the actual amount was 436 million yen. Therefore, it was higher than planned (121% of the planned value). Although the planned project cost did not include Ethiopia's share of the project cost, the Ethiopian side paid 58 million yen for it.

[52] Based on the interview survey with Japanese former experts.

Furthermore, a local consultant was hired for the detailed research activities for Output 2[53]. The cost of this research for Output 2 was the largest spending item in the two-year period of the JICA Consultancy Contract.

The provision of equipment was planned to be 48 million yen at the time of the ex-ante evaluation but was indicated as 6 million yen in the Terminal Evaluation Report. According to a Japanese former expert, spending of 15 million yen was confirmed at the project completion as the material and equipment cost in the two years of the contract. The spending on the equipment cost in the entire project period could not be confirmed.

3.3.1.3 Period of Cooperation

The project period was planned as and actually was 36 months from March 2005 to March 2008. The project was completed as planned.

In light of the above, whereas the project period was as planned, the project cost exceeded than the original plan. Therefore, the efficiency of the project is fair.

3.4 Sustainability (Rating: ②)

3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

At the time of the ex-post evaluation, the water supply sector strategy described in the "Growth and Transformation Plan II (hereinafter referred to as "GTP II" (2016 - 2020)" emphasized the importance of human resources development for the sake of the implementation of the water supply plan and specified the planned number of persons for the training plan. This plan also refers to the training on the drilling technologies and others at EWTI.

The Government of Ethiopia has set a new goal for water supply rate, which specified an amount of water supply and a shorter distance of access to a water supply point[54] and is pursuing development of human resources for water supply in accordance with it. Therefore, the sustainability of this project in terms of policies is high.

3.4.2 Organizational Aspects of the Implementing Agency for the Sustainability of Project Effects

3.4.2.1 Organizational System

At the time of implementation of this project, EWTEC was a project not included in the organizational chart of the Ministry of Water Resources at the time. The position and the long-term role & responsibility of EWTEC were not altogether clear. In August 2013, EWTEC was reorganized to EWTI[55], becoming an independent organization from a project

[53] The spending was for production of geological and hydrogeological maps of the Butajira-Ziway areas, construction of GIS database, inventory survey on existing water sources at 14,700 locations, test drilling of six observation wells, implementation of water level observation for 12 months, production of a research report, a socio-economic survey report on six villages and a groundwater modeling, etc.

[54] Refers to public water taps and wells.

[55] Council of Ministers Regulation, No.293, 2013.

of the Ministry of Water Resources[56]. EWTI receives budget from the Ministry of Finance and Economic Development, has a Director-General appointed by the Council of Ministers attached to the Office of the Prime Minister and submits reports to the Federal Parliamentary Assembly. However, these reports are always submitted also to the Ministry of Water, Irrigation and Energy. Furthermore, EWTI is subject to evaluation and monitoring by the Assembly.

The Business Process Restructuring that provides job descriptions of personnel of EWTI has already been approved. For establishment of the five-year plan (2016 - 2020) of EWTI, a Balance Score Card (BSC)[57] is simultaneously under preparation.

3.4.2.2 Personnel System

In Phase II, the job separation rate was not particularly high except for personnel reshuffles at the Ministry of Water Resources. The job separation rate increased in Phase III and later. Many people left their jobs after EWTEC was reorganized to EWTI after the end of the JICA project cooperation. There were also some employees who quit because of their employment conditions, particularly salaries. At the time of the ex-post evaluation, the employment of new instructors was progressing.

GTP II that addresses the targets of the government, describes the number of human resources to be developed for water supply. EWTI established the GTP II plan of EWTI in accordance with GTP II and set the target numbers of instructors and personnel. Table 12 shows the number of personnel of EWTI.

Table 12 Transition of Number of Instructors & Staff and Future Plan (Unit: Person)

Indicator	Phase II (2005 – 2008)	Ex-post evaluation time (2016)	GTP II targets (2019)
Instructors	16*	21	58
Contract instructors	NA	3	4
Personnel	47	94	177
Total	63	118	239

* Not including Japanese experts.
Source: Terminal Evaluation Report A2-15 and answers to questionnaire sheets.

3.4.2.3 System for Providing Training

In Phase II, EWTEC had classrooms and accommodations with a limited capacity for 40 persons. At the time of the ex-post evaluation, however, the extension and expansion work was in progress. The training courses were limited to short-term courses. However, long-term courses in accordance with the Ethiopian Occupational Standard are planned for the future.

[56] This organization has the following four purposes: 1. Providing middle and long-term training on the water and water-related fields; 2. Conducting survey and technology transfer on the water and water-related fields; 3. Enhancing the capacities of TVETC instructors; 4. Constructing special laboratories and providing laboratory services (Director of Ethiopia Water Technology Institute; EWTI).

[57] BSC serves both as a plan and a tool for evaluating the performance to check whether the plan has been implemented.

For EWTEC, new equipment was procured in the provision of equipment in Phase III and in grant aid project implemented after Phase III.

In FY2015, the planned number of training participants was 298 but there were actually 219 participants. The following table shows the training courses planned to be provided by EWTI. In 2015, additional instructors were hired and the number of courses was increased. The permanent training courses for TVETC teachers are under review. The training demand survey was conducted in Phase III. Even after transition to EWTI, detailed demand survey for personnel related to water supply is conducted[58].

Table 13 Training Courses Planned to Be Provided by EWTI

	EWTI	Annual plan
Basic Courses (classification in Phase II)		
Groundwater Investigation	Yes	60 persons per year
Drilling Technology	Yes	40 persons per year
Drilling Machinery Maintenance Technology	Yes	40 persons per year
Water Supply Engineering	Yes	60 persons per year
Electro-Mechanical Maintenance Technology	Yes	60 persons per year
Advanced Courses (classification in Phase II)		
Groundwater Modeling	No	
GIS/Information Management	Yes	15 persons per year
On-demand Courses (classification in Phase II)		
Rehabilitation of Well	Yes	30 persons per year

Note) Annual plan of trainees in 2016-2017. A new course on irrigation and drainage designing will be added.
Source: EWTI

The sustainability of the organization, which required improvement at the project completion, is being improved and the organization and personnel systems of the implementing organization have been almost established; the system for providing training has been mostly improved.

3.4.3 Technical Aspects of the Implementing Agency for the Sustainability of Project Effects

The part of teaching materials related to technological progress in IT and others is revised by the EWTI instructors. The production of other teaching materials is contracted out to external persons. The training demand survey is also conducted by entrusted external persons. For some of the courses, the EWTEC teaching materials will be updated by instructors who were hired at the time of the ex-post evaluation. There is a need for instructors with a wealth of work experience who are capable of delivering lectures regarding not only theories but also practical skills. To enhance the capacity of the instructors, EWTI is planning to allow newly hired instructors after the establishment of EWTI to study abroad or advance to the PhD and master's courses of universities. It also considers it necessary to support the existing instructors in gaining practical work experience for the sake of substantial capacity

[58] Based on the interview survey with Japanese former experts. Answer to the EWTI questionnaire sheet.

enhancement. Since most of the instructors in the days of EWTEC have resigned, how to hire instructors experienced in actual work including field work for the respective training courses is an issue to be solved.

3.4.4 Financial Aspects of the Implementing Agency for the Sustainability of Project Effects

EWTI is receiving budget directly from the Ministry of Finance and Economic Development based on the GTP II plan of EWTI that was approved by the Council of Ministers attached to the Office of the Prime Minister. As the financial information, the actual expenditure for the EWTI training in 2013 is 1.651 million birr. Although the actual expenditure in 2014 was not available[59], the actual expenditure for the EWTI training in 2015 increased significantly to 4.342 million birr[60]. In 2016, a budget of 6.689 million birr was secured for the EWTI training and, as of May 2016, 5.435 million birr has been spent. It was confirmed with the implementing agency that a budget from the Ministry of Finance and Economic Development would be secured in accordance with the GTP II plan (five-year plan) of EWTI. Therefore, there was no problem identified with the finance.

The sustainability of the policies is high, the organizational system of EWTI as an independent organization has been mostly established and the system for providing training has been generally secured. Therefore, sustainability in terms of both organizations and systems is high. The financial sustainability is also high because an appropriate budget is secured for the plan. However, some minor problems have been observed in terms of the sustainability from technical aspects: There was a need for instructors with abundant work experience who could teach not only theories but also practical skills and the existing instructors also needed capacity enhancement.

Therefore, the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Ethiopia Water Technology Center Project (“The Project for Groundwater Development and Water Supply Training Phase II”) was implemented to enhance development of the human resources for groundwater and water supply management in Ethiopia. The details of the project are relevant to the development policies of Ethiopia and the priority fields of ODA policies of Japan, for which there are high development needs. Therefore, its relevance is high. Although the project period was within the plan, the project cost was higher than planned. Therefore, its efficiency is fair. The effectiveness is evaluated to be high because this project is developing human resources for groundwater and water supply management both qualitatively

[59] No detailed financial information was available because no annual activity plan report was created for 2014 and the person in charge of finance was transferred.
[60] EWTI 2015 Annual Budget Year Completion Report.

and quantitatively. The effects have been continuously manifested until the time of the ex-post evaluation due to training provided in Phase III and by the Ethiopia Water Technology Institute (hereinafter referred to as "EWTI"), a succeeding organization of this Center. The technologies and teaching materials for training are utilized by ex-trainees who are engaged in groundwater development and water supply for their work at the time of the ex-post evaluation. The impact of the project is also high. The sustainability of the policies is high and the organizational system of EWTI as an independent organization has been mostly established. The sustainability in terms of both organizations and systems is high. The financial sustainability is also high because an appropriate budget is secured for the plan. The sustainability is generally evaluated to be fair because the technical sustainability is regarded as an issue. There is a need for instructors with abundant work experience who could teach not only theories but also practical skills and the existing instructors also needed capacity enhancement.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

Utilization of Human Resources with Abundant Work Experience as Instructors

As a capacity enhancement plan for human resources who serve as instructors, EWTI is planning to develop human resources mainly through degree acquisition. To reinforce the contents of training courses, there is a need for instructors with abundant work experience who are capable of delivering lectures regarding not only theories but also practical skills. Since most of the instructors in the days of EWTEC have resigned, it is necessary to hire or make the most of instructors with experience in actual work and in the field for the respective training courses. Refresher training will be provided to the currently employed instructors, starting with those who have more work experience than others.

Reorganization of Knowledge and Experience Gained in the Days of EWTEC and Providing Practical Work-Oriented Training Based on It

The teaching materials and modules used in Phases I, II and III of EWTEC are treasured by the ex-trainees and utilized in some fields even at present. Since these teaching materials were based on work experience, they are utilized also in the organizations to which they belong. Although EWTI was outsourcing the production of teaching materials at the time of the ex-post evaluation, it is required to utilize the teaching materials in the days of EWTEC in the lectures related to practical training to ensure supply of training that is useful in actual work. It is necessary to learn what can be picked up from experience accumulated about the operation and management of the training courses in the days of EWTEC.

4.2.2 Recommendations to JICA

The beneficiary survey and others confirmed that the benefits and impacts of the 15-year cooperation on groundwater development and water supply training plan of the technical

cooperation project are positively materializing in the water supply field of Ethiopia. This ex-post evaluation is targeted at Phase II and therefore is focused on this phase only. It is important to conduct summative evaluation and impact evaluation on the 15-year technical cooperation to clarify the contribution to the water supply field of Ethiopia and extract and record suggestions and lessons to be learned, if any.

4.3 Lessons Learned

Necessity of PDM Guidelines

This project was implemented in three years during which no mid-term evaluation was conducted. Therefore, PDM formulated at the project planning was not revised and PO was modified and used instead until the terminal evaluation. When the second-year JICA Consultancy Contract period was started, the overall goal, project purpose and indicators of the PDM should have been set appropriately so that the description of activities of the PDM matched with the PO for the sake of appropriate project management. If the objectively verifiable indicators of a technical cooperation project have not been set within one year after the project start, or if the goals and/or purposes need structural improvement, JICA should positively encourage the project to revise the PDM. Furthermore, JICA should create PDM guidelines that provide many good and bad examples of PDM, such as those with good organization and leaps in logics, which can be referred to when planning, implementation, monitoring and evaluation. Such PDM guidelines should be utilized to facilitate and ensure appropriate creation, supervision and revision of PDM for JICA technical cooperation projects.

Attached Table: Achievement Status of the Objectively Verifiable Indicators
(PDM and PDMe indicators used for the terminal evaluation and indicators modified at the time of the ex-post evaluation)

	Objectively Verifiable Indicator	Reason for not using indicators; used indicators; their status of achievement
Output 1: Technical trainings regarding groundwater and water supply management are conducted.		
PDM	(Indicators) Implementation of the planned number of the training courses Number of created documents related to training course management 1. Annual plan 2. Implementation plans for respective training courses formulated 3. Evaluation reports for respective training courses formulated	These indicators were not used for the ex-post evaluation because no numeric targets were provided. The PDMe indicators were used instead.
PDMe	(Indicator 1) The planned number of training courses (21) are implemented. (Indicator 2) The documents related to the management of training courses (annual plan, implementation plans for respective training courses and evaluation reports for respective training courses) are created.	(Indicator 1) While 21 courses were planned, 16 courses were implemented. Six basic courses and six advanced courses were implemented as planned. Although six on-demand courses were planned, three courses were implemented. Most of the planned courses were implemented. (Indicator 2) The annual plan of training was formulated by the Manager of EWTEC and the Japanese experts. The implementation plans of basic courses and evaluation reports for respective training courses were compiled by the C/P. All of these documents related to training course management were submitted to and approved by the Director of the Rural Water Supply and Sanitation Bureau, Ministry of Water Resources. The evaluation reports for respective training courses were summarized in the summative evaluation.
Output 2: The training courses are developed and improved through research activities.		
PDM	(Indicators) Number of developed or revised textbooks/teaching materials and curricula of the training courses related to groundwater development and development of low cost technology	These indicators were not used for the ex-post evaluation because no numeric targets were provided. The PDMe indicators were used instead.

	Objectively Verifiable Indicator	Reason for not using indicators; used indicators; their status of achievement
PDMe	(Indicator 1) Status of creation of geological and hydrogeological maps of the Butajira-Ziway survey areas (Target: completion) and status of utilization of these maps as the teaching materials in the training courses	(Indicator 1) Geological and hydrogeological maps were created based on the survey. They were utilized as teaching materials in training in Phase III.
	(Indicator 2) Status of construction of GIS database on the Butajira-Ziway survey areas (Target: completion) and status of utilization of it in the training courses	(Indicator 2) The construction of related maps and GIS database was completed within the project period. They were utilized as teaching materials in training in Phase III.
	(Indicator 3) Number of inventories of existing water sources in the Butajira-Ziway survey areas (Target: 8,000 locations or more)	(Indicator 3) Inventory survey was conducted on all the existing wells including traditionally dug wells. Inventory was created for 14,700 locations, exceeding by far the target of 8,000 locations.
	(Indicator 4) Number of test-drilled observation wells in the Butajira-Ziway survey areas (Target: six locations or more) and number of times of monthly water level observation (Target: 12 times or more)	(Indicator 4) Six observation wells were dug, where monthly water level observation was conducted for 12 months. The result was included in the research report.
	(Indicator 5) Status of production of socio-economic survey report covering six villages in the Butajira-Ziway survey areas	(Indicator 5) Socio-economic survey was conducted in the six villages where observation wells were test-drilled and a report was created.
	(Indicator 6) Status of production of groundwater models (Target: end of production)	(Indicator 6) A model of groundwater flow mechanism in the Butajira-Ziway areas was created.
	(Indicator 7) Status of establishment of low cost technology promotion plan (Target: established) and status of implementation	(Indicator 7) The Low Cost Technology Promotion Plan was established. The experience about the water supply facilities designed and promoted in the project was summarized.
	(Indicator 8) Status of check of endurance of prototype spare parts of Afridev handpumps that are locally produced (Target: checked. Then, the prototype and its manufacturer are recommended to the NGOs and relevant agencies.)	(Indicator 8) The endurance test system was manufactured and used to conduct endurance test. The test was extended by a couple of months to survey how much more the load on parts is increased and whether endurance is influenced if the arm of a pump is extended and a final result was derived. Then, some domestic manufacturers of parts were recommended.
	(Indicator 9) Number of technicians who can manufacture rope pumps as a result of manufacturing training (Target: 40 persons)	(Indicator 9) 63 persons completed their training. Among them, 43 are technicians who started manufacturing rope pumps immediately after the training.
	(Indicator 10) Status of distribution and installation of rope pumps in the four major regions (Target: 500 units)	(Indicator 10) 500 rope pumps were distributed during the project period in the four major regions:
	(Indicator 11) Status of creation of manuals on manufacturing and installation of rope pumps	(Indicator 11) Manuals on manufacturing and installation of rope pumps (in English) were created. The manuals were distributed to the technicians who participated in the training courses.
Output 3	Technical materials on groundwater management and water supply are developed.	
PDM	(Indicator) Numbers of teaching materials, cases, etc. of the water supply project created in relation to the operation, maintenance, construction	These indicators were not used for the ex-post evaluation because no numeric targets were provided. The PDMe indicators were used instead. The number of volumes indicated with an asterisk (*)

	Objectively Verifiable Indicator	Reason for not using indicators; used indicators; their status of achievement
	and rehabilitation for water supply	varies depending on how they are compiled. At the time of the ex-post evaluation, therefore, the target number of volumes was used only as a reference.
PDMe	(Indicator 1) Numbers of teaching materials, cases, etc. of the water supply project created in relation to the operation, maintenance, construction and rehabilitation for water supply (Indicator 2) Number of created teaching materials for training related to water supply using the result of development of low cost technologies (such as water supply facilities, rope pumps, rainwater storage and artificial recharge) (Target: 4 volumes)* (Indicator 3) Number of teaching materials for training on groundwater management such as geological survey, groundwater survey, geophysical exploration, observation wells, GIS and groundwater modeling that utilize the results of the development survey in the Butajira-Ziway areas (Target: six volumes)*	(Indicator 1) The results of activities for Output 2, such as the reports of geological and hydrogeological maps, related maps and GIS database, inventory of the existing wells, survey on test-drilled observation wells' water level observation, socio-economic survey, report on model of groundwater flow mechanism in the Butajira-Ziway areas, were produced as a technical reference. (Indicator 2) The result of activities for low cost technology development were summarized as a teaching material. (Indicator 3) Although the survey results were submitted by the local consultant, the analysis and application of them were modified by the Japanese experts to improve the accuracy. Teaching materials on hydraulic physics, drilling and pump tests, water quality, hydraulic physical maps, GIS mapping and socio-economic survey were produced. The above teaching materials were compiled as six volumes in the end. Since this is experimental study, some of them are only like teaching aids. However, each of the volumes contains 400 pages or more.