Islamic Republic of Pakistan

Ex-Post Evaluation of Technical Cooperation Project

"The Project for Establishment of Environmental Monitoring System"

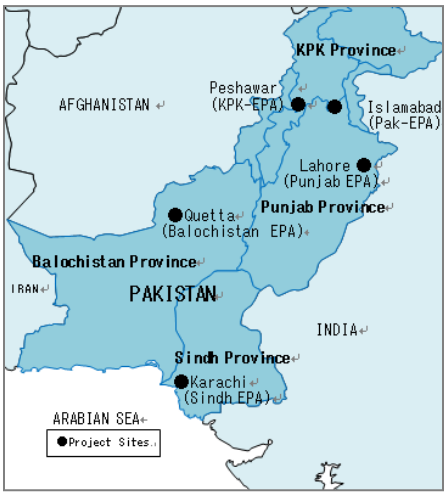
External Evaluator: Hisae Takahashi, Ernst & Young Sustainability Co., Ltd.

0. Summary

This project was conducted with the aim of enhancing the capacity of the Federal (Pak) - EPA and the Provincial EPAs to conduct environmental monitoring on air and water in Pakistan. The purpose of this project was consistent with Pakistan's development policy and needs, which prioritized the environmental protection due to the issue of increasing the pollution, as well as Japanese assistance policy. Thus, its relevance is high. Thanks to the project, Pak-EPA and Provincial EPAs now have enhanced capacities to formulate monitoring plans and are capable of collecting and analyzing data based on a uniform Standard of Procedure which was not existed before the project. A Quality Assurance and Quality Control (QA/QC) system for laboratory activities was introduced in the process, and the capacity to analyze and evaluate data in line with internationally recognized standards was gained. On the other hand, the budget allocation and staff recruitment process were both changed drastically as a consequence of the devolution of the ministries responsible for environment from the Federal to Provincial government. Due to these changes, major monitoring activities were limited at some of the EPAs where budget for monitoring activities was not secured. While the environmental monitoring system was developed, these limitations in monitoring have prevented the system from reaching full functionality in practice. Thus, the effectiveness and impact of the project are fair. While the project period was within the plan, the project cost exceed the plan, thus its efficiency is fair. As for sustainability, coordination among the EPAs was sometimes lacking, and low retention rate of staff employed by the project in terms of institutional aspect as well as expensive maintenance cost and spare parts and consumable cost in terms of financial aspect were raised as EPA's concerns. Thus its sustainability is fair.

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

1. Project Description



Project Locations

(Upper Left)
Fixed Air Monitoring Station

(Bottom Right)
EPA Staff Conducting Monitoring Activities at a Fixed Air Monitoring Station (Punjab EPA)

1.1 Background

In Islamic Republic of Pakistan (Pakistan), air and water pollution were on the rise due to automobile emissions as well as wastewater discharge from domestic and industrial sources. For instances, according to the survey conducted by JICA in 2000, the concentration of pollutants exceeded the Japanese or the World Health Organization (WHO) environmental standards by 20-90%. Concern was growing over the emission of particulate matters in the atmospheres, seepage of wastewater into aquifers, and adverse health effects on population.

However, the country had not established environmental standards that suited its conditions, and laws and regulations on pollution control were not being fully enforced, primarily, due to non-existence of environmental monitoring network and lack of personnel. These issues were addressed for appropriate environmental administration. Given these situations, Japanese Government supported the grant aid project, "The Establishment of Environmental Monitoring System (EMS Project)", in 2006 with the aim of establishing the basis of a permanent nationwide environmental monitoring system in Pakistan. Under the EMS project, a Central Laboratory for Environmental Analysis and Networking was built and equipment for air quality monitoring and analysis equipment for laboratories were installed. This technical cooperation project started aiming at enhancing the technical capacity of EPAs in air and water quality monitoring with the utilization of facilities and equipment provided under the EMS project.

1.2 Project Outline

Overall Goal		Environmental monitoring systems are in place at Pak-EPA and Provincial EPAs.
Project Purpose		Pak-EPA's and Provincial EPA's capacity of environmental monitoring on air and water is enhanced.
Outputs	Output 1	Pak-EPA and Provincial EPAs are capable of formulating Environmental monitoring plans.
	Output 2	Pak-EPA and Provincial EPAs are capable of measuring the major parameters of National Environmental Quality Standards (NEQS) based on uniform methodologies of sampling measurements and analysis.
	Output 3	Laboratory Management System is improved and QA/QC system is established at Pak-EPA and Provincial EPAs.
	Output 4	Pak-EPA and Provincial EPAs are capable of interpreting and evaluating monitoring data based on the internationally recognized environmental standards/ NEQS
	Output 5	Based on the Environment Monitoring Information System (EMIS), Pak-EPA and Provincial EPAs are capable of compiling monitoring data and disseminating to the public.
Total cost (Japanese Side)		450 million yen
Period of Cooperation		February, 2009 – February, 2012
Implementing Agency		Pakistan Environmental Protection Agency (Pak-EPA), Punjab-EPA, Sindh-EPA, Khyber Pakhtun Khwa-EPA and Balochistan-EPA
Other Relevant Agencies / Organizations		-
Supporting Agency/Organization in Japan		-
Related Projects		The Project for the Establishment of Environmental Monitoring System (Grant Aid completed in 2006)

1.3 Outline of the Terminal Evaluation

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

The capacity of technical staff at each EPA in conducting environmental monitoring activities was improved in relative terms. The knowledge and skills of the EPAs in air and water quality monitoring was also enhanced. Thus, the project purpose was deemed to be achieved. However, the capacity enhancement of the EPAs was only in relative terms. The knowledge and skills of EPA staff should be further enhanced in order to effectively conduct environmental monitoring.

1.3.2 Achievement Status of Overall Goal at the time of the Terminal Evaluation

It was reported that the overall goal will be achieved if financial arrangements for monitoring are duly completed and the technical staff persons with enhanced capacity remain. At the time of terminal evaluation, the overall goal appeared most likely to be achieved at the two EPAs where budget was confirmed. The other EPAs, meanwhile, were still in the process of securing the budget and technical staff. There were prospects that the overall goal would be achieved if they succeeded in securing them.

1.3.3 Recommendations at the time of the Terminal Evaluation

Recommendations for after the project completion were raised as follows.

1) The EPAs were requested to go through the process for securing and executing the budget for monitoring activities and to regularize the project staff who enhanced the monitoring capacity through the project. So that the project effect will continue sustainably.
2) EPAs were expected to have periodical follow up meetings for sharing the progress of securing the budget as well as regularization of the project staff for environmental monitoring.
3) Pak-EPA and each provincial EPA were recommended to coordinate themselves to develop a system in which monitoring data are shared among all of them.
4) Respective EPAs were requested to develop a mechanism to share technical information among their staff in each EPA.

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Ernst & Young Sustainability Co., Ltd

2.2 Duration of Evaluation Study

Duration of the Study: August, 2014 – July, 2015

Duration of the Field Study: October 25 – November 7, 2014,
February 25 –March 7, 2015

2.3 Constraints during the Evaluation Study

For security reasons, site visits by external evaluators to two of the five target EPAs, namely, Khyber Pakhtunkhwa (KPK)-EPA and Balochistan-EPA, were not conducted. The surveys for collecting necessary information for evaluation of those two EPAs were conducted by questionnaires and interviews with EPA staff member in Islamabad or Karachi.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Pakistan

"The Ten Year Development Plan (2001)", Pakistan's Development Policy at the time of ex-ante evaluation, positioned the environmental sector as a priority area, listed a goal consisting of twelve items, and summarized the degree of achievement of each item. "Mid Term Development Framework (MTDF) (2005-2010)" announced as a mid-term development goal aimed at satisfying both environmental protection and economic growth and emphasized the importance of the environmental sector by listing a target goal consisting of fifteen items. In 2001, Pakistan formulated a "National Environmental Action plan (NEAP)" aimed at strengthening actions for protecting public sanitation policy, promoting sustainable living environments, improving the environment for people's living, and supporting measures for poverty eradication. In 2005, Pakistan also formulated a "National Environmental Policy" providing guidelines on efficient environmental management and engagements in environmental issues for the federal government, provincial governments, capital territory, and local governments. In this way, Pakistan took a step forward at the time of the ex-ante evaluation by mapping out a series of environmental sector strategies to respond to increasing environmental pollution.

"The 10th Five Year Development Plan (2010-2015) Approach Paper" issued after the MTDF also introduced "Environmental conservation and countermeasures for climate change" as one of 14 its pillars. The plan prioritized the strategies for the environmental sector and specified needs linked to the provision of safe water and appropriate public health, institutional capacity building, and knowledge management in the environmental sector. The plan proposed a concrete strategy, including the establishment of an effective monitoring system and the formulation and execution of national environmental standards on air and water. NEAP, the National Environmental Plan, and other policy initiatives shown at the time of ex-ante evaluation were still in effect at the time of project completion.

As mentioned above, development policy in Pakistan consistently assigned the environment sector to an important position in both project planning and completion stages by emphasizing the importance of countermeasures for environmental conservation and climate change towards the realization of sustainable development. Thus, this project, an initiative aimed at strengthening Pakistan's environmental

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

monitoring capacity for air and water through monitoring activities based on the national standard at Pak-EPA and the Provincial EPAs, is consistent with the development policies of Pakistan.

3.1.2 Relevance to the Development Needs of Pakistan

In Pakistan, air and water pollution is accelerated by the increase in population and the effect of automobile emissions as well as wastewater discharge from domestic and industrial sources. As of the ex-ante evaluation, lack of nationwide environmental monitoring networks and personnel were issues for proper environmental administration. Given these situations, the Japanese Government supported the "EMS Project," a grant aid project to establish a nationwide environmental monitoring system in Pakistan by building a laboratory and installing monitoring equipment. Yet technical assistance was required for the more effective use of the laboratory and equipment as of that time, as the monitoring and analysis capacities of Pak-EPA and the Provincial EPAs were still insufficient. Though specific data were not available at the time of project completion, air and water pollution still posed serious health risks and were designated as issues to be addressed in the future[3]. It is therefore important to understand the status of air and water pollution in Pakistan and establish a nationwide environmental monitoring system for tackling both at the ex-ante evaluation and project completion. As such, this project was consistent with Pakistan's development needs.

3.1.3 Relevance to Japan's ODA Policy

"The Japanese Country Assistance Strategy for Pakistan (2005)" placed the overall goal as "establishment and development of sustainable society" and listed the environmental sector as important cross-cutting issues. "Japanese ODA Charter (2003)" also showed sustainable development and environmental issues as important agendas.

3.1.4 Adequacy of Project Planning and Approach

In 2011, while the project was underway, the government of Pakistan decided to devolve some of its administration functions to provincial governments under the 18th amendment to the Constitution. Accordingly, the Ministry of Environment was dissolved in June 2011 and the responsibility for environmental administration was transferred to each Province. Project activities were not affected by this change but the budget allocation process of the Pakistan side was modified. The budget for the project activities initially released was based on the budget of the Ministry of Environment. After the responsibility for environmental administration devolved, each Provincial EPA

[3] Source: Pakistan Economy Survey 2013-14

was required to formulate and submit a budget report to its Provincial Government. The Provincial Government, in turn, authorized and allocated the budget. This modification affected the project cost covered by the Pakistan side and sustainability related for securing budget and staff after the project completion. However, this devolution was not assumed at all at the time of project planning and designing the project framework considered this was clearly seen as impossible as of the planning. Therefore, it can be judged that the project design was adequate at the project planning stage.

As stated above, this project has been highly relevant to Pakistan's development plan, which prioritizes environmental conservation and development needs for establishing a nationwide monitoring system to clearly grasp the state of pollution, and also to Japan's ODA policy, which positioned the environmental sector as a priority area. Therefore its relevance is high.

3.2 Effectiveness and Impact[4] (Rating: ②)

3.2.1 Effectiveness

3.2.1.1 Achievement of Project Purpose

Project Purpose:

Pak-EPA's and Provincial EPA's capacity of environmental monitoring on air and water is enhanced.

This project was composed five outputs: Pak-EPA and the Provincial EPAs are capable of formulating environmental monitoring plans (Output 1); the EPAs are capable of measuring parameters on air and water based on uniform methodologies for sampling measurements and analysis (Output 2); a laboratory management and QA/QC system in line with improved manuals and guidelines is established (Output 3); based on Outputs 1 to 3, the EPAs are capable of interpreting and evaluating monitoring data based on the internationally recognized environmental standards/NEQS (Output 4); and the EPAs are capable of compiling monitoring data and disseminating them to the Public (Output 5). The project purpose, namely, to enhance the capacity of Pak-EPA and the Provincial EPA to conduct environmental monitoring on air and water, is therefore attained (See Figure 1).

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

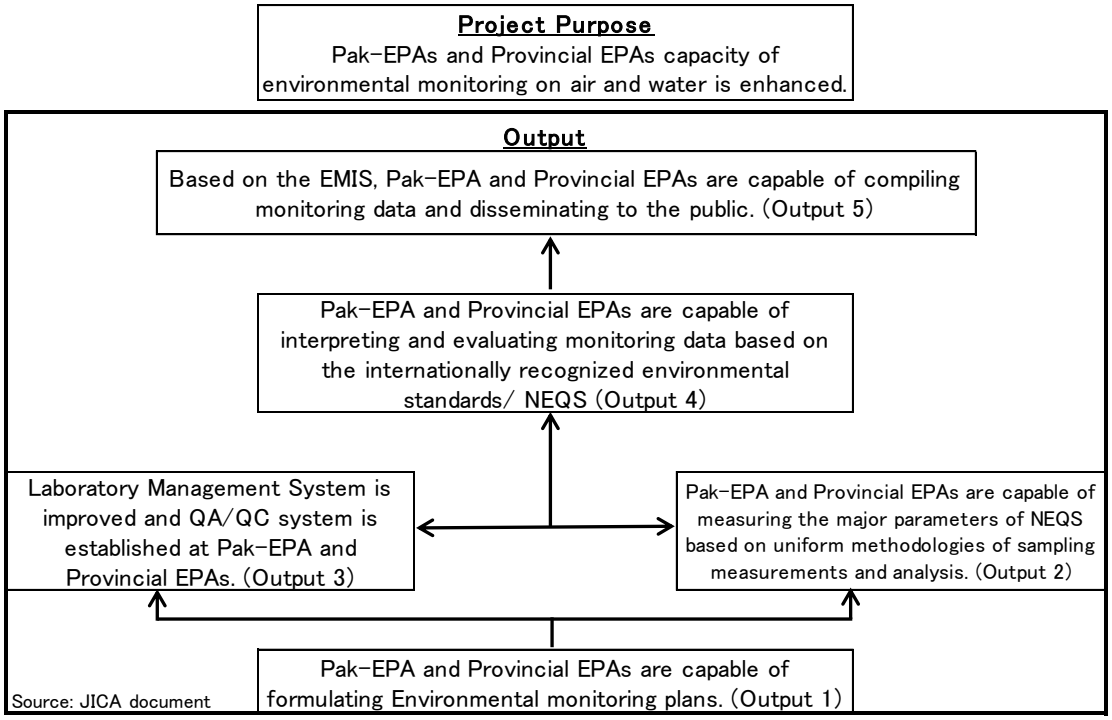


Figure 1 Output and Project Purpose

Table 1 lists the indicators of the project purpose and the achievement of each indicator as of the project completion.

Table 1 Achievement of Indicators for the Project Purpose

	Indicator[5]	Achievement of Indicator
Project Purpose	Indicator① Environmental monitoring reports including the interpretation and evaluation of the water and ambient air quality in the pilot areas are published by Pak-EPA and at least one of the provincial EPAs.	Indicator①：Achieved Water: Pak-EPA and the four Provincial EPAs developed water quality monitoring reports. Air : Pak-EPA and four Provincial EPAs developed air quality monitoring reports.
	Indicator② The monitoring results with appropriated significant digits required for NEQS are obtained by Pak-EPA.	Indicator② : Largely achieved In Pak-EPA and the four Provincial EPAs: Water: A certain level of significant digits were obtained, as a result. Air : A certain level of significant digits were obtained for half of the analytical equipment, as a result.
	Indicator③ QA/QC system in Pak-EPA and	Indicator③ : Achieved Each EPA conducted its activities in line

[5] At the time of the ex-ante evaluation, each indicator was targeted for each EPA. The Japanese Experts, however, were banned from visiting KPK and Balochistan EPAs after the project commenced due to the security reasons. The indicators for the EPAs were therefore modified to make them feasible. The changes are judged to have been reasonable under such circumstances.

	at least one of the provincial EPAs are initiated through development of regulation(s) and manual(s).	with the developed QA/QC system (including the developed manuals).

Source: Prepared based on the documents provided by JICA

Through the project activities, the capacity of Pak-EPA and the Provincial EPAs to environmentally monitor air and water largely improved. Before the project, the EPAs had no guidelines or manuals to follow. As such, they monitored different items within a scope of limited parameters that differed every time. Thanks to the project activities, the EPAs were able to measure and analyze data based on uniform rules and standards according to Standard Operation Procedures and managed to develop a monitoring report on air and water quality during the project period. The knowledge and experience gained helped to strengthen the capacity of the EPAs to implement monitoring activities. According to the documents provided by JICA, the general level of understanding among the trainees improved at the following rates after the project training courses were completed:

・Proficiency rating for air monitoring: Average 18%→34%[6]

・Rating of the staff's capacity for water monitoring : 2.3→3.9 (5 point scale)

The interview survey conducted in the terminal evaluation also confirmed that the EPA staff members interviewed recognized the enhanced capacity gained by the EPA technical staff during the project. At the same time, it was also mentioned that the level of staff knowledge and skills should be further enhanced to enable them to perform effective environmental monitoring by themselves.

3.2.1.2 Project Output

As shown in Figure 1, the expected outputs required for the achievement of the project's purpose were largely achieved at the time of project completion. Table 2 summarizes the achievements of each indicator set for each output.

Output 1 "Pak-EPA and provincial EPAs are capable of formulating environmental monitoring plans."

Through training and monitoring activities in practice, a guideline for overall environmental monitoring plan was prepared. Based on the guideline, all EPAs formulated environmental monitoring plans in pilot areas for both water and air. This indicates that the system, for formulating the environmental monitoring plans in line

[6] This result shows the level of understanding relative to a full understanding of 100%.

with the uniform guideline, was in place at each EPA.

Output 2 "Pak-EPA and Provincial EPAs are capable of measuring the major parameters of NEQS based on uniform methodologies of sampling measurements and analysis."

Under the project, the project team prepared maintenance management plans and manuals[7] for measuring equipment as well as Standard Operating Procedures which described the procedure of sample collection survey, measurement and analysis. The SOP enabled the EPAs to measure the major parameters in NEQS where they previously utilized a few limited parameters. This means that the EPAs, previously applied basic analysis, can now conduct more advanced measurements and analyses.

Output 3 "Laboratory Management System is improved and QA/QC system is established at Pak-EPA and Provincial EPAs."

Laboratory management manuals were developed utilizing the existing laboratory activities, and the QA/QC system was introduced to the EPAs. The system and manuals were not applied before the project. As such, the introduction of a unified laboratory management system with manuals and a QA/QC system in line with activity plans has helped improve the quality of laboratory activities.

Output 4 "Pak-EPA and Provincial EPAs are capable of interpreting and evaluating monitoring data based on the internationally recognized environmental standards/ NEQS."

As of the project completion, all of the EPAs had collected, interpreted, and evaluated the data by referring to the NEQS. Given that this was not done before the project, the capacity for interpreting and evaluating the monitored data was credibly improved compared to before the project. Environmental management plans in pilot areas were formulated based on the results of the analyses. Through the process of formulating the plan in pilot areas, the technical staff gained experience and improved their capabilities in formulating environmental management plans.

Output 5 "Based on the EMIS, Pak-EPA and Provincial EPAs are capable of compiling monitoring data and disseminating to the public"

By introducing the EMIS system, data of each provincial EPA could be automatically

[7] The monitoring activities under the project were conducted using analytical equipment provided through the EMS project. Since major equipment was inoperable at the start of the project due to a lack of proper maintenance, training in the operation and maintenance of that equipment was required to start the project activities.

transferred to the EMIS of Pak-EPA. This did much to strengthen the data management system of the EPAs in Pakistan. Following this system, necessary data to upgrade the website were prepared at each EPA. Furthermore, a report integrating the monitoring data of each EPA was compiled and opened to the public in libraries. This is considered an important output and was instrumental in the preparation of the report at the country level.

Table 2 Achievement of Output Indicators

Output 1: Pak-EPA and Provincial EPAs are capable of formulating environmental monitoring plans.	
Indicator ① Responsible person(s) for formulating environmental monitoring plan (air/water) are properly selected by Each Provincial EPA.	Achievement Responsible person(s) for formulating environmental monitoring plan were properly selected at each EPA. With the initiative of the responsible person, the plans were formulated.
Indicator ② A guideline of overall environmental monitoring plan is prepared by Pak-EPA.	Achievement Guidelines for environmental monitoring plans were prepared by Pak-EPA.
Indicator ③ Environmental monitoring plans in pilot areas are formulated as follows; (Ambient Air) (Emission (Air)) Pak-EPA, Punjab-EPA and Sindh-EPA. (Ambient Water) (Effluent (water)) All target EPA	Achievement Environmental monitoring plans (ambient air, emission air, ambient water and effluents water) at pilot areas were formulated in all EPAs.
Output 2: Pak-EPA and Provincial EPAs are capable of measuring the major parameters of NEQS based on uniform methodologies of sampling measurements and analysis.	
Indicator ① (Water) SOP for 30 parameters of NEQS / (Air-Ambient) SOP for 8 parameters / (Air-Emission) SOP for 15 particular parameters in NEQS defined by the Expert is developed	Achievement SOPs were developed as follows: SOP for Environmental Water Quality monitoring for all 32 parameters in NEQ SOP for measurement of ambient water for 8 parameters. SOP for measurement of Stationary Emission Gases for 15 parameters in NEQS.
Indicator ② Maintenance plans and manuals of the equipment are formulated and in place in association with Pak, Punjab, Sindh, KP and Balochistan- EPAs	Achievement Maintenance Plan/Manual was formulated which described maintenance/inspection procedures, maintenance plan and counter action and correction for equipment procured by grant aid project.
Indicator ③ Quality control records and log books of analysis are kept as follows; (Air Monitoring Stations) Pak and Punjab -EPA, (Analytical Equipment) Pak, Punjab and Singh-EPAs	Achievement Air monitoring stations: Quality control records were recorded and kept in maintenance sheets at stations at Pak and Punjab EPA though more precise control were needed. Analytical equipment: Use of log book, prepared under the project, started and kept at Pak-EPA, Punjab EPA, Sindh EPA

Indicator ④ (Water) The analytical results of QC samples are put into 20% range of QC sample in Pak, Punjab and Sindh-EPAs. (Air -Ambient) The difference of calibration factors of each air analyzer is less than 4 % at every calibration in Pak, Punjab and Sindh-EPAs. (Air-Emission) The difference of calibration factors of PG250 is less than 4 % in every measurement in Pak, Punjab and Sindh-EPAs.	Achievement Water: Certain accuracy of analysis[8] was secured by the result of the proficiency ratio at Pak, Punjab and Sindh EPAs. Air-Ambient: Calibration test were demonstrated at Pak, Punjab and Sindh-EPAs. Only 50% of air analyzers reached less than 4% in the difference of calibration factors due to the limited number of calibration per analyzer. Air-Emission: On average, 70% of mobile gas analyzer (PG250) reached less than 4% in the difference of calibration factors at Pak, Punjab and Sindh-EPAs.
Output 3: Laboratory Management System is improved and QA/QC system is established at Pak-EPA and Provincial EPAs.	
Indicator ① Laboratory management manual is prepared in each EPA	Achievement Laboratory management manual was prepared by utilizing the existing laboratory activities, 14 operation procedures and manuals.
Indicator ② Responsible person(s) for QA/QC is (are) properly selected on the work process chart by each EPA	Achievement Responsible persons for QA/QC were identified on the work process chart at each EPA, and laboratory management system was improved.
Indicator ③ QA/QC activity plans are prepared in each EPA.	Achievement QA/QC activity plans were prepared in each EPA during the project implementation.
Output 4: Pak-EPA and Provincial EPAs are capable of interpreting and evaluating monitoring data based on the internationally recognized environmental standards/ NEQS.	
Indicator ① Qualities of river waters and ambient air are evaluated based on the internationally recognized standards as follows; (Air Quality at Air Monitoring Station) All target EPAs (Water Quality at Pollution Source) Pak, Punjab, Sindh-EPAs (Water Quality) All target EPAs	Achievement Air Monitoring Station: Each EPA interpreted, evaluate monitoring data and formulate the reports for management plan. Capacity for interpreting and evaluating monitoring data was increased. Water (Pollution Source, environment): Evaluated monitoring data was described in the provincial monitoring report. Data were evaluated based on Japanese standard since NEQS for ambient water had not been finalized yet though the draft was available.
Indicator ② Pollution sources and pollution loadings are presumed based on the environmental monitoring data as follows; (Air Quality at Air Monitoring Station) (Water Quality) All target EPAs	Achievement Air (Monitoring Station): Pollution loadings were presumed based on the monitoring data at each EPA. Water: Pollution load was calculated based on the monitoring data. Pollution source inventories were identified except

[8] The average of variance for the analytical results of the QC samples was less than 20% for Ni (Nickel), Ag (Silver) and Fe (iron) (Pak-EPA) less than 20% for COD (chemical oxygen demand), TSS (total suspended solids), and TDS (total dissolved solids) (Punjab EPA) and less than 20% TSS and TDS (Sindh EPA.)

	Balochistan EPA during the project implementation.
Indicator ③ : Conceptual environmental management plan(s) are proposed for some pilot area as follows; (Air Quality at Air Monitoring Station) Pak, Punjab, Sindh-EPAs (Water Quality) All target EPAs	Achievement "Report on water quality monitoring and management plan" and "Air Quality Monitoring Report" in pilot area were developed in each EPA.
Output 5: Based on the EMIS, Pak-EPA and Provincial EPAs are capable of compiling monitoring data and disseminating to the public.	
Indicator ① Environmental Monitoring Information System is in place in Pak-EPA.	Achievement Air Monitoring Information Network was revised and EMIS was developed in Pak-EPA.
Indicator ② Websites are properly updated in Pak-EPA and Punjab-EPA.	Achievement Pak-EPA uploaded the monitoring data, which was shared by each provincial EPA, at the website.It was authorized by the Provincial Government to upload the data in Punjab EPA.
Indicator ③ Environmental monitoring report in at least one of the pilot areas is published at least once.	Achievement Monitoring data in pilot area were organized and ready to open to public. Environmental monitoring report of each province was developed and integrated to one report.

Source: Documents provided by JICA and Interviews to each EPA.

As described, the project largely achieved its purpose.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

Overall Goal

Environmental monitoring systems are in place at Pak-EPA and Provincial EPAs

EPA staff members have maintained their capacity for environmental monitoring since the project was completed. On the other hand, some of the EPAs had difficulty securing maintenance costs for analytical equipment provided under the EMS project and the cost of consumables and spare parts for conducting adequate activities during the a certain period between project completion and the ex-post evaluation (see Table 3: Achievement of Overall Goal, Indicator ①). The changes in the budget allocation process and staff recruitment linked to the devolution of administrative functions (unforeseen in the planning stages) largely affected the difficulties in securing budget.

Under the initial plans, the necessary budget for monitoring activities after project completion was to be allocated by the federal government. Later, however, pursuant to the devolution of administrative functions in 2011, Pak-EPA and the Provincial EPAs

were required to procure funds from the provincial governments (Refer to 3.1.4. Adequacy of Project Planning and Approach in Relevance for detail). Following this change, each Provincial EPA proposed a budget to its provincial government, whereupon Punjab-EPA and KPK-EPA secured budgets. No enough budget for monitoring activities was approved in Balochistan, but the Balochistan EPA nonetheless managed to secure funds by partly drawing from its non-development (general) budget and receiving support from Non-Governmental Organizations, etc. Meanwhile, the major monitoring activities of some of the EPAs were discontinued due to budget restrictions during the certain period between project completion and the ex-post evaluation. Pak-EPA, for example, partially conducted monitoring activities for water but not for air since both fixed and mobile monitoring stations could not be operated. The EMIS installed at the Central Laboratory for Environmental Analysis and Networking in Pak-EPA was also partly inoperable, and data collected at the Provincial EPAs were not transferred[9]. Sindh EPA has outsourced the monitoring on water, which is required for the environmental tribunal cases, and ceased other monitoring activities. Monitoring plans have been formulated accordingly, but the securing a budget and regularly preparing environmental monitoring report was clearly limited at the time of the ex-post evaluation. This means that the project has achieved its overall goal in the sense that an environmental monitoring system is in place to a certain degree, but the functionality of the system is still limited.

Table 3　Achievement of Overall Goal

<table>
<tr><th>Overall Goal</th><th>Indicator</th><th>Achievement</th></tr>
<tr><td rowspan="2">Environmental monitoring systems are in place at Pak-EPA and Provincial EPAs.</td><td>Indicator ①
Each EPA can secure the budget for environmental monitoring.</td><td>Securing the needed budget
<table>
<tr><th>EPA / Year</th><th>Pak</th><th>Punjab</th><th>Sindh</th><th>KPK</th><th>Balochistan</th></tr>
<tr><td>2012/2013</td><td>×</td><td>○</td><td>×</td><td>○</td><td>△</td></tr>
<tr><td>2013/2014</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
</table>
Note: ○ Budget was secured、× Budget was not fully secured.
See “Sustainability” for the amount.
Source: Questionnaires responses and interview survey</td></tr>
<tr><td>Indicator ②
Each EPA formulates environmental monitoring plans by themselves.</td><td>Formulating Environmental Monitoring Plans
<table>
<tr><th>Pak</th><th>Punjab</th><th>Sindh</th><th>KPK</th><th>Balochistan</th></tr>
<tr><td>△ (Only water)</td><td>○</td><td>×</td><td>○</td><td>○</td></tr>
</table>
Source: Questionnaires responses and interview survey</td></tr>
</table>

[9] One explanation for the inoperable condition of the EMIS is a lack of technical staff who can operate the EMIS. A second factor has been budget constraints. Furthermore, electricity supply was cut off at Pak-EPA when the staff worked at temporary offices due to an office move in January 2014. Power cuts were frequent even after the move, which made it very difficult to procure a stable power supply for the equipment. (Based on interviews with staff members of Pak-EPA.)

	Indicator ③ Pak-EPA and provincial EPAs publish environmental monitoring report	Developing Environmental Monitoring Reports Pak: △ (Only water); Punjab: ○; Sindh: △ (Only water); KPK: ○; Balochistan: ○ Source: Questionnaires responses and interview survey

3.2.2.2 Other Impacts

① Impacts on the Natural Environment

Based on the results of interviews with the EPAs, the project did not exert any environmental impact. The ex-ante evaluation addressed concerns about the disposal of heavy metals and organic solvent used for analysis. However, it was confirmed during the site survey that these substances were properly dealt with under the QC/QA system.

② Land Acquisition and Resettlement

There was no resettlement of residents or site acquisition during the project, according to the interview surveys to implementing agencies which was conducted in ex-post evaluation.

③ Other impacts

・Improvement of data submitted to Environmental Tribunals

As described in "Effectiveness", the quality of the monitoring system has been improved through the implementation of the project, which inevitably has facilitated the provision of more reliable environmental data to the Environmental tribunal. In addition, by utilizing the equipment provided by the grant aid project, the EPAs are now capable of analyzing a full set of parameters in air monitoring, which has contributed to the preparation of the "Pakistan Clean Air Program."

・Sharing the Enhanced Capacity within the EPAs

In total, 102[10] staff members were trained during the project and knowledge and experiences were shared within each EPA after the project completion[11]. The EPA laboratories also received interns from universities and graduate schools students to teach them about monitoring activities. Thus, enhanced capacity under the project has indirectly helped to increase the capacity of EPA staff who was not involved the training and EPA staff at regional offices and students from

[10] Pak-EPA (11), Punjab EPA (31), Sindh EPA (18), KPK-EPA (23), Balochistan –EPA (9). Please refer to 3.4.2 Sustainability: Organizational Aspects.

[11] In total, 39 staff members (3 from Pak-EPA, 5 from Punjab EPA, 21 from Sindh EPA, 4 from KPK-EPA and 6 from Balochistan EPA) were trained during the interim between project completion and the ex-post evaluation. This number includes not only staff members from Provincial EPAs , but also staff members working at the laboratories of the regional EPAs.

universities and graduate schools.

As mentioned above, the project purpose, the strengthening of capacity for the implementation of monitoring activities, has been achieved through project activities. The processes of budget allocation and staff recruitment were changed, however, as a consequence of the devolution of environmental administrative functions from the Federal government to Provincial governments. This change was not foreseen during the planning stage. Some EPAs have been unable to conduct major monitoring activities because of difficulties in securing budget. While the technical capacity has been enhanced at those EPAs, their activities have not been fully functional. In short, the shortcomings in the function of the system have precluded achievement of the overall goal, while the system itself has been institutionalized to some extent. The effectiveness and impact of the project is fair.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Table 4 Summary of Project Input

Inputs	Plan	Actual
(1) Experts	6 Long-Term	13 Long-Term (109.46 MM*) - Team Leader/Monitoring Planning - Water Monitoring A/B/C - Air Monitoring A/B - QC/QA - Data Communication - Project Coordinator
(2) Trainees received	4 Counterparts / year	12 Counterparts in total
(3) Equipment	-	Maintenance and repairment cost of equipment, Replacement of spare and other consumable items (Approximately 15.9 million yen)
(4) Operation Cost	-	Approximately 18 million yen
Japanese side Total Project Cost	360 million yen in total	450 million yen in total
Pakistan side Operational	Rupee (Rs.) 86.08 million	(Rs.) 47.7 million Approximately 41 million yen[13]

Expenses	Approximately 116 million yen[12]	

* MM stands for man month.

3.3.1.1 Elements of Inputs

According to the interview surveys of each EPA staff member, the number of dispatched experts and their expertise were appropriate. Though the number of dispatched long-term experts increased from the initially planned 6 to 13, a few experts in monitoring and project coordinators were dispatched and shared the tasks. Thus, the total number of inputs was achieved as planned. Furthermore, Japanese experts were prohibited from visiting KPK and Balochistan EPAs for security reasons after the project began. At those two EPAs, staff members participated in training conducted at Islamabad and Karachi. Both EPAs stated, however, that training and practice with the equipment installed on-site would have been preferable. Thus, it may be worthwhile to examine training methods to enable training at each EPA's laboratory, for example, by dispatching the trained EPA staff from other EPAs when Japanese experts are unable to visit the sites.

As for the assignment of counterparts on the Pakistan side, counterparts were not necessarily sufficient in number. It was partially because Pakistan government did not allow to employ new staff as government officials for a certain period. Therefore, the total number of EPA staff was also generally limited. According to the interview surveys of Japanese consultants, the project had to be conducted with the assigned number of staff under these situations.

3.3.1.2 Project Cost

The actual cost for the Japanese portion was 360 million yen, which was higher than the original plan of 450 million yen (125 % of the original plan). The expenditure was affected by unexpected causes such as increased maintenance costs for the equipment provided by the EMS project, budget diversion to rescue operations after floods and rehabilitation from earthquake damage, and the devolution of the Ministry of Environment functions. These situations compelled the Japanese side to cover part of the expenses that were initially to be borne by the Pakistan side. According to the Japanese experts, project activities would have come to a standstill if the Japanese side had decided not to cover parts of the Pakistan side's burden (because some of the equipment would have been inoperable). This extra expense was therefore considered

[13] Exchange rate during project implementation (February 2009 ～February 2012): 1Rs. = 0.86 yen.
[12] Exchange rate at the time of the ex-ante evaluation (August, 2012): 1 Rupee (Rs.) = 1.35 yen.

unavoidable.

3.3.1.3 Period of Cooperation

The project was implemented from February 2009 to February 2012 which was as planned with no extension.

Although the project period was within the period, the project cost exceeded the plan and Japanese side covered part of Pakistan portion. It is because of natural disasters and the devolution of the organizations in Pakistan. 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

The priority environmental issues for economic growth and development was still in place at the time of the ex-post evaluation. "Pakistan Vision 2025," the Development policy at the time of the ex-post evaluation (formulated in 2014), also put priority on the environmental sector. The policy set "energy, food, and water security" as one of the seven pillars to support development and stressed the importance of environmental protection for sustainable economic growth and development.

Furthermore, each EPA has worked to formulate a "Provincial Environmental Act" since the devolution to the Provincial governments in 2011. The progress of each province is summarized below.

-Pak-EPA: In the process of approving the new act
-Punjab EPA: Approved（2012）
- Sindh EPA: Approved（2014）
-KPK-EPA: Approved（2014）
-Balochistan : Approved（2013）

As explained in "Relevance," Pakistan has been consistent to show the policies to promote the measures for environmental pollution control for the last two decades. Even after environmental policies and budgets devolved to the Provincial EPAs, each Province has worked to formulate and approve its own act. Thus, the sustainability of project effects from policy and institutional aspects can be confirmed.

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

(1) Coordination among EPAs

During the project implementation, the Pakistan government announced an 18th

amendment to its Constitution and devolved a part of administrative functions from federal government to provincial government. In line with the devolution, the Ministry of Environment was dissolved in June 2011. Accordingly, the responsibility and budget for environmental administration were transferred to each Province. As a result, the administrative structure shifted from an umbrella form in which Pak-EPA was a subsidiary organization under the Ministry of Environment and allocated/ assigned budget /staff to the Provincial EPAs to a modified form in which each Provincial EPA ensured its own budget and staff. Then the regulating authority of Pak-EPA changed to the Ministry of Disaster Management and the Provincial EPAs for the Provincial governments. Therefor there is no administration linkage between Pak-EPA and the Provincial EPAs, the EPAs have largely stopped coordinating and communicating since the project completion. The EPAs were initially expected to continue their periodical meetings to discuss the progress of securing budget, the regularization of project staff, the status of monitoring implementation, issues for operation, and data sharing, those meetings have not progressed since the project completion. The interview surveys conducted during the ex-post evaluation show that each EPA hopes to establish a forum for sharing issues and experiences, so improvement is expected.

(2) EPA staff members for the monitoring activities

The number of staff members engaged in monitoring activities and the numbers of staff members trained under the project and currently working at the EPAs are shown in Tables 5 and 6, respectively.

Table 5　Number of EPA Staff Members at the Time of the Ex-post Evaluation

(Unit: Number)

	Pak	Punjab	Sindh	KPK	Balochistan
Number of EPA Staff in Total	62	200	97	85	145
Number of Staff Engaged Monitoring Activities	6	19	42	17	15
Deficiency in the Number of Staff Members for Monitoring	4	Sufficient	Sufficient	Sufficient	Sufficient

Note: The number of EPA staff in Total includes all supporting staff as well. The number of staff members engaged in monitoring activities includes staff members who are working at regional offices positioned beneath the EPAs organizationally

Source：Interview surveys of EPA staff

Table 6 Numbers of Staff Members Trained under the Project and Trained Staff Members Working in the EPAs

(Unit: number)

	Pak	Punjab	Sindh	KPK	Balochistan
Trained Permanent EPA Staff	8	29	18	17	10
Retained Trained Permanent EPA Staff	6	19	13	14	9
Trained Project Staff	11	5	5	3	-note
Retained Trained Project Staff in the EPAs	0	0	1	0	-note
Staff trained by other staff who were trained under the project	16	5	21	4	6

Note: Balochistan EPA did not accept project staff assigned by the Federal government and employed local persons for the project with its own budget.
Source: Interview surveys to EPA staffs

At the time of the ex-post evaluation, a lack of the staff member for monitoring activities was confirmed in Pak-EPA. Under the project, permanent staff working at the EPAs and project staff employed for the project for a fixed term (project staff) took the training. The project staff members were selected by the federal government and dispatched to the Provincial EPAs as of the commencement of the project. In the planning stage, it was assumed that the project staff would be regularized as permanent staff by the Federal government and ultimately employed in the Provincial governments. This scheme could not be applied after the devolution of the administrative functions to the provincial governments. Thus, most of the project staff members were not retained at EPA after the project completion. Each EPA has made its best effort to re-employ the project staff. However, the recruitment process of the provincial governments basically takes a long time, so in some cases the staff found other jobs while waiting. Pakistan also stopped recruiting new staff for a certain period due to the tight fiscal situation. As a consequence, it was very difficult to regularize the project staff to permanent staff as planned. On the other hand, the recruitment exam and staff selection at the commencement of the project were conducted in Islamabad without the involvement of the provincial governments. As such, the strong regional roots and identification characteristic of Pakistanis probably dissuaded project staff from staying on at the EPA as permanent staff. There is clearly a need to examine feasible ideas for the selection methods to be used for sustainably recruiting project staff.

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

The trained technical staff of the EPAs reached a certain level through their

experiences in formulating monitoring plans, collecting samples, analyzing and compiling data, preparing reports, and maintaining the equipment for the analysis under the project. The interview surveys clearly showed that the staff members engaged in the project and the EPA staff members they trained have largely retained their technical capacity in each EPA. Manuals for the maintenance of analysis equipment prepared under the project have been placed at laboratories and mobile stations and utilized in a timely fashion; hence no major issues to do with technical capacity have arisen.

One concern, the expensive costs for maintenance of the analytical equipment, spare parts, and consumables, was common at all EPAs and hindered efforts to obtain the necessary equipment, etc. in sufficient numbers (Please see "3.4.4 Financial Aspects of the Implementing Agency for the Sustainability of Project Effects" for details).

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

(1) Budget for monitoring activity

As explained in "Impact," securing the budget is a must for the monitoring system of the EPA to function. The monitoring budget was approved for all of the EPAs in the fiscal year of 2013/2014, including those that lacked budget after project completion. Thus, the situation shows a trend toward improvement (Table 7).

Difficulties for securing budget after the project completion were also largely rooted in the devolution of administrative functions in 2011. The project initially planned had an umbrella structure in which project budget was allocated from the Non-development budget[14] of federal government to Pak-EPA and then further allocated by Pak-EPA to the Provincial EPAs. This structure was dismantled after the devolution. Under the new structure, each EPA was required to propose and secure budget to its provincial government. The EPAs, however, were confronted with a situation they had not foreseen in the planning stages and were still in the process of securing budget for environmental monitoring. More time was therefore needed for obtaining approval from the provincial governments, which made it more difficult to ensure their budgets. Eventually, at the time of the ex-post evaluation after devolution of administrative functions, the system settled into place and the transition period started to converge. Furthermore, the budgets at each EPA have been approved, hence improved prospects can be seen.

[14] In Pakistan, budget for each ministry is composed of two types, namely non development budget and PC-1 which is development budget.

Table 7 Non Development Budget and Monitoring Budget of Pak-EPA and the Provincial EPAs

(Unit : Pakistan Rupee (Rs.) Million)

	Non Development Budget		Monitoring Budget [Note 1]			Other / Future Prospect
	2013/2014	2014/2015	2012/2013	2013/2014	2014/2015	
Pak	21.2	36.8	0.2	0.2	5.3	Utilization of a part of the PC-1[Note 2] budget is planned.
Sindh	135.7	137.5	0	0	30.0	Rs.140 million of the PC-1 budget for 3 years has been confirmed.
Punjab	10.5	15.3	3.75	17.5	28.5	The PC-1 budget up to 2015/16 was confirmed.
KPK	-	-	-	Utilize non development budget	0.3	Rs. 3 million has been expensed for repairing fixed air monitoring stations.
Balochistan	169.2	210.6	Collaborate with NGO	1.5	Utilize non development budget	Proposed and confirmed Rs.2 million for 2014/15. Waiting for disbursement.

Note 1 : The monitoring budget includes the entire cost related to laboratories activities, including maintenance costs for analytical equipment and costs for spare parts and consumables.

Note 2 : The Development Budget is allocated based on project proposals. The Ministry budget of Pakistan is composed of the Non-development Budget and Development Budget based on the project, excluding research.

Note 3: The amount in this table is the information confirmed at February 2015 by the evaluation team.

Source: Questionnaire responses and interview survey

(2) Maintenance budget for analytical equipment

Pak-EPA and Sindh EPA have not operated the equipment for a certain period since project completion. However, their budgets for 2014/2015 were finally approved and confirmed during ex-post evaluation, and both EPAs have requested maintenance agents to enable them to resume operation[15]. The estimates from the agents were Rs. 13.7 million for Pak-EPA and Rs. 20 million for Sindh EPA. These amounts were 2.5 times the annual monitoring budget for Pak-EPA and more than 60% of the annual operating budget of Sindh EPA, respectively. These costs are being negotiated, as all of the EPAs have been advised that high costs for maintenance, spare parts, and consumables for equipment will be a major determinant of their ability to continue the monitoring activities in the future. When examining the operating cost for equipment, the project needed to make maintenance plans to clarify the necessary cost[16], secure appropriate procurement roots for necessary consumables and spare parts, and consider ways to keep cost lower such as longer-term (e.g., 5-year) service contracts with the agents. In addition, only one agent in Pakistan deals in maintenance and repair for

[15] Maintenance is required for re-operation because the equipment has not been operated for a long period.

[16] The necessary maintenance costs for the project were estimated based on the same conditions during the project implementation, where no taxes were imposed. A huge difference in the actual cost appears when tax is imposed. Therefore, the tax rate and inflation rate should both be factored into the estimates for the feasible and real cost.

analytical equipment. This monopolistic situation leads to longer response times and higher costs.

Some minor problems have been observed in terms of organizational and financial aspect of the implementing agencies. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was conducted with the aim of enhancing the capacity of the Pak - EPA and the Provincial EPAs to conduct environmental monitoring on air and water in Pakistan. The purpose of this project was consistent with Pakistan's development policy and needs, which prioritized the environmental protection due to the issue of increasing the pollution, as well as Japanese assistance policy. Thus, its relevance is high. Thanks to the project, Pak-EPA and Provincial EPAs now have enhanced capacities to formulate monitoring plans and are capable of collecting and analyzing data based on a uniform Standard of Procedure which was not existed before the project. A Quality Assurance and QA/QC system for laboratory activities was introduced in the process, and the capacity to analyze and evaluate data in line with internationally recognized standards was gained. On the other hand, the budget allocation and staff recruitment process were both changed broadly as a consequence of the devolution of the ministries responsible for environment from the Federal to Provincial government. Due to these changes, major monitoring activities were limited at some of the EPAs where budget for monitoring activities was not secured. While the environmental monitoring system was developed, these limitations in monitoring have prevented the system from reaching full functionality in practice. Thus, the effectiveness and impact of the project are fair. While the project period was within the plan, the project cost exceed the plan, thus its efficiency is fair. As for sustainability, coordination among the EPAs was sometimes lacking, and low retention rate of staff employed by the project in terms of institutional aspect as well as expensive maintenance cost and spare parts and consumable cost in terms of financial aspect were raised as EPA's concerns in terms of financial aspect. Thus its sustainability is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

・Continued efforts for securing the sustainability

In order to sustain the project effects, it will be essential to secure a sufficient budget

for monitoring activities and an appropriate number of technical staff persons with sufficient competencies. Since project completion, each EPA has had difficulties in securing budget and regularizing the project staff because the Provincial EPAs were in a process of devolution. For the future, EPAs will need to continue their efforts to secure budget and technical staff in the following ways.

- Regularizing the project staff

  EPAs were recruiting technical staff for monitoring activities during the ex-post evaluation survey. Staff persons must be employed in sufficient numbers and have sufficient skills. At the time of ex-post evaluation, only one project staff member with enhanced capacity was working at the EPAs. To become a permanent staff of a Provincial EPA, the hiring must take place via the provincial government recruitment system. However, active steps to acquire project staff, for example, by recommending project staff to apply via the Provincial recruitment system, are required for the effective and efficient utilization of the acquired capacity.

- Securing the budget for monitoring activity and thorough preparation

  After the project completion, some EPAs had not secured sufficient budget and were forced to discontinue certain activities for a certain period. At the time of project completion, the budget had been approved at all of the EPA. EPAs need to continue their efforts to secure budget. At the same time, it is recommended to allocate the budget for the laboratory and monitoring activities, not only from non-development budget as well as a part of PC-1 (project budget).

・Strengthening coordination among the EPAs

After the devolution of the federal government functions to the Provinces, coordination and communication between Pak-EPAs and the Provincial EPAs were lost. However, ongoing and regular follow-up among EPAs is effective for collaboration to formulate integrated reports and sharing information on maintenance, which ultimately improve the future environmental monitoring system and quality of maintenance. In the future, Pak-EPA and the Provincial EPAs must cooperate and hold periodical follow-up meetings.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

・Considerations for the cost of spare parts, consumables and maintenance

Expensive costs for spare parts, consumables and maintenance are a major concern for all of the EPAs. The current situation, with only one agent who can deal with maintenance and repair in Pakistan, has delayed maintenance response times and driven up costs for the EPAs. This situation should be avoided by any means possible for similar type of project in future. Prices for genuine spare parts and consumables for major analytical equipment are high from the outset. It would have been important in the planning stage during the project, or at least before project termination, to examine how to procure them in appropriate quantities with proper maintenance to maintain sustainability. Some of the equipment used in the project was provided by a grant aid EMS project. Thus, the project had to share information with the implementing agency during the project to create a detailed maintenance plan and maintenance budget to carry forward after project completion. Another useful option is to conclude service contracts with agents for longer periods (around 5 years) to keep the price at predictable and tolerable levels in the future.

・Project plan and implementation that contribute to efficient and effective equipment operation

The aim of the project was to strengthen the EPAs capacity to conduct monitoring activity using analytical equipment provided by the grant aid EMS Project. Some analytical equipment, however, was inoperable when the project started. Additional time and cost for maintenance were therefore needed. It would be helpful to consider strategic ways for implementing the project to avoid these circumstances, for example, by implementing a grant aid project that provides equipment and a technical assistance project that supports the effective utilization of equipment simultaneously or continuously.

・Sustainable project staff recruitment in Pakistan

The project staff members employed during the project period were paid with funds from the PC-1 (project) budget allocated to the development project. In Pakistan, a land of strong regional identities, people are often reluctant to accept permanent employment in a province away from home. In the interest of sustainability, the involvement of provincial government and selection of staff locally would be essential.