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Evaluation Reports

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Republic of Moldova

FY2021 Ex-Post Evaluation Report of Japanese ODA Loan

“The Project for Improvement of Medical Care Service”

External Evaluator: Hisae Takahashi, Global Group 21 Japan, Inc.

0. Summary

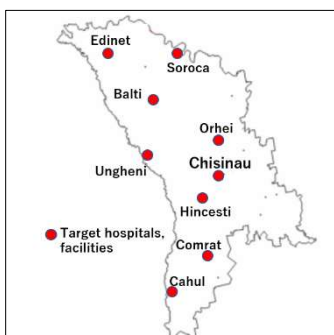
The Project was implemented with aims to improve and streamline the medical care and public health service by introducing new medical and laboratory equipment into tertiary and secondary hospitals¹ and other facilities in Moldova, thereby contributing to the improvement of the medical care service for the citizens.

Its purpose is in line with Moldova’s development policy and development needs at the time of appraisal and ex-post evaluation. It was also confirmed that the Project was in line with the international framework at the time of appraisal in terms of the consistency with the Japan’s aid policy; synergy effect and coordination with the Technical Cooperation Project conducted by the Japan International Cooperation Agency (JICA), and with the assistance by other development partner organizations; and the Sustainable Development Goals (SDGs). Therefore, its relevance and coherence are high. The Project costs exceeded the plan, and the Project period largely exceeded the plan due to the delay of the facility renovation for installation of the equipment and other reasons. Therefore, efficiency of the Project is moderately low. Approximately 70% of the set targets for the number of treatments and tests were generally achieved in the target facilities. Medical services using the procured equipment have contributed to provide early diagnosis, timely treatment, reduced patient burden, and also quality of medical care services with comfort for healthcare workers. Improvements in the quality of testing at the Centers of Public Health (CSPs) have also been reported. The impact in terms of contribution to improved medical care services across the country and to the recovery of patients with novel coronavirus infection (COVID-19) was also confirmed. Therefore, effectiveness and impacts of the Project are high. No issues have been observed in the policy/system, institutional/organizational, and technical aspects of the operation and maintenance of the Project. However, some minor issues have been observed in the financial aspect and the current status of operation and maintenance. Therefore, sustainability of the project effects is moderately low.

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

¹ Health services in Moldova are broadly divided into primary level (outpatient only), secondary level with hospitalization, and core tertiary level.

1. Project Description



Project Locations



X-ray Procured for the Mother and Child Institute

1.1 Background

After the Republic of Moldova (Moldova) became independent from the former Soviet Union in 1991, the financial condition of the health sector was under the financial pressure because the government was obliged to cover all medical cost and also because an excessive number of hospitals were established, thus it became necessary to reform the system of medical services. Under such situation, thanks to the sector reform conducted through cooperation of the World Bank (WB), the number of hospitals was reduced by approximately 80% from 335 (1998) to 73 (2012), and the medical expenditure was reduced by 40% (1991-1998)². Meanwhile, in Moldova, medical and relevant expenditure accounted for 11.7% (2010)³ against Gross Domestic Product, which had already reached the level of advanced countries, and transition of the disease structure was in progress toward that of advanced countries centring on non-communicable diseases. Also, rapid aging of the society was foreseen in the future due to the demographic changes. Therefore, it was needed to integrate and concentrate hospitals in order to further improve efficiency of medical services mainly of secondary and tertiary care and to improve the medical quality of those core hospitals. Concerning the latter, the urgent issue was updating deteriorated equipment as well as procurement of new equipment, given that the medical personnel had already acquired a certain level of medical technology. Against this backdrop, the Government of Moldova requested a Finance and Investment Cooperation to procure medical and laboratory equipment in the core hospitals in the capital city of Chisinau and the other facilities to Japan in 2012, and a loan agreement for the Project was signed in 2013.

1.2 Project Outline

The objective of this Project is to improve and streamline the medical care and public health service by introducing new medical and laboratory equipment into tertiary and secondary hospitals and other facilities in Moldova, thereby contributing to the improvement of the medical

² Source: Ex-ante evaluation

³ Source: World Development Indicators

care service for the citizens.

Loan Approved Amount/ Disbursed Amount	5,926 million yen/5,698 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	June 2013/June 2013	
Terms and Conditions	Interest Rate	0.1% (except for consulting services) 0.01% (Consulting service)
	Repayment Period (Grace Period)	30 years 10 years)
	Conditions for Procurement	Tied (Special Terms for Economic Partnership (STEP))
Borrower/Executing Agency	The Government of the Republic of Moldova/Ministry of Health	
Project Completion	July 2018	
Target Area	City of Chisinau and others	
Main Contractors (Over 1 billion yen)	- Kanematsu Corporation (Japan) - Marubeni Protechs Corporation (Japan)	
Main Consultant(s) (Over 100 million yen)	- Fujita Planning Co., Ltd. (Japan)	
Related Studies	- Feasibility Study (2009)	
Related Projects	<p>[Technical Cooperation]</p> <ul style="list-style-type: none"> - The Project for Improving Medical Device Management (2015-2017) - Country-focused Training on Improving the Oncological Services for Cancer Patients (2020-2023) <p>[Grant Aid]</p> <ul style="list-style-type: none"> - The Project for Improvement of Medical Equipment for Mother and Child Republican Hospital (1998) - The Project for Improvement of Maternal and Child Health Care System in the Second Level Hospitals (2000) <p>[WB]</p> <ul style="list-style-type: none"> - Health Services and Social Assistance Project (2007-2013) <p>[European Union]</p> <ul style="list-style-type: none"> - An assistance to the Regional Public Health Centers (2008-2012) - Sector Policy Support Programme Health (2009-2013) - Co-financing of the construction of the Republican Clinical Hospital's surgery block <p>[Swiss Agency for Development and Cooperation]</p> <ul style="list-style-type: none"> - Procurement of medical equipment to the Mother and Child Institute 	

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Global Group 21 Japan, Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October, 2021–November, 2022

Duration of the Field Study: February-March and August, 2022 (conducted by the local assistant)

2.3 Constraints during the Evaluation Study

Due to the global pandemic of COVID-19, the external evaluator did not travel to Moldova, but conducted interviews with the executing agency, the field inspection of the equipment at the target facilities of the Project, and interviews with the medical staffs and others through the local assistants. The collected information and data were carefully examined, and evaluation analysis and judgment were conducted by the evaluator. In addition, acceptance of refugees in Moldova due to the Russian invasion of Ukraine in February 2022 increased the workload of the executing agency, the Ministry of Health (MoH), and medical staff at target facilities, making it difficult to spend time answering questionnaires and conducting interviews during site visits, which in turn placed certain constraints on information collection.

3. Results of the Evaluation (Overall Rating: B⁴)

3.1 Relevance/Coherence (Rating: ③⁵)

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Moldova

At the time of the appraisal of the Project, Moldova's development policy, The *Moldova 2020* (2012), stated on the health sector that improving the efficiency of the health system would contribute to increase productivity, promote social inclusion and reduce poverty, and that the health of the population would affect economic development and social prosperity⁶. The sector plan at the time, the *National Health Policy 2007-2021* (2007), set 13 goals, including health promotion and disease prevention, strengthening the health of infants, young and elderly people, overcoming non-communicable chronic diseases and others. The *Healthcare System Development Strategy 2008-2017* was presented as an implementation policy to achieve its goals and to assess progress on nine indicators, including population and basic health indicators, equitable access to medical services, financial sources for medical care, etc. Furthermore, to incorporate the above policy and strategy into an action plan for sector reform, the *Policy Roadmap for Moldova (2011)*, which showed plans for the functional reorganization, consolidation, and development of general and specialized hospitals in the capital city, was developed.

⁴ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁵ ④: Very High, ③: High, ②: Moderately Low, ①: Low

⁶ Source: *Moldova 2020, National Development Strategy: 7 solutions for economic growth and poverty reduction*

At the time of the ex-post evaluation, the *Moldova 2030* (2018)⁷ was formulated, stating reduction of morbidity of non-communicable diseases in the health sector and setting goals to reduce mortality from cardiovascular diseases by 13% and to reduce the infant mortality rate to 8.6 per 1,000. The *National Health Policy 2014-2020* (2013), which is the sector plan at the time of the ex-post evaluation, aims to improve the health of the population and reduce inequalities, with key areas such as health system governance, securing financial sources for medicines and medical equipment and the provision of medical services and public health. In addition, the 10 CSPs were established to strengthen laboratory networks and management at the regional level to enhance responses to public health emergencies in line with the policy⁸.

As mentioned above, at both times of the appraisal and ex-post evaluation, the purpose of the Project is in line with the Government's development policy for the country.

3.1.1.2 Consistency with the Development Needs of Moldova

At the time of the appraisal of the Project, the country was shifting to a disease structure centred on non-communicable diseases, and the aging of the population was expected to continue rapidly due to demographic changes, making it a challenge to improve the level of medical care at the core hospitals. On the other hand, the development of medical facilities and equipment has stalled due to a lack of funds and many facilities have no choice but to use the equipment which come from more than 20 years old after installation. In addition, there were concerns about the risks posed to health by pesticide residues in the country, where there are many agricultural workers, and also there was a need to strengthen the testing systems required to identify health risks from hazardous environmental substances from industrialisation and to formulate countermeasures. The National Centers of Public Health (CNSP) and CSPs, which played this role, also had aging equipment, and it was a challenge to improve the equipment and strengthen activities using them. The target hospitals equipped with equipment under the Project were positioned as the top referral hospitals in each field in Moldova and were therefore high priority targets for support in the country, where improving core hospitals was an issue.

At the time of the ex-post evaluation, equipment utilization is very high except for some equipment, and core hospitals in all sectors have a strong need for regularly updating equipment to provide necessary healthcare services efficiently. In addition, many items of outdated equipment are still used in the CNSP and CSPs, thus the need for updating equipment continues to be high, as the types and methods of examination are constantly evolving, and new normative documents and standards are emerging⁹.

Based on the above, at the time of planning and ex-post evaluation, the development needs to

⁷ Source: *National Development Strategy (2018)*

⁸ Source: Questionnaire answers

⁹ Source: Questionnaire answers

enhance medical and laboratory equipment remains high, thus the Project was in line with this need.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of the appraisal, the *Rolling Plan for the Republic of Moldova* (2012) had positioned the social sector as the priority area for assistance and Japan was working on improvement of medical care services as one of the priority issues. As the implementation of the Project was in line with this policy, the Project was found to be consistent with Japan's ODA policy.

3.1.2.2 Internal Coherence

Prior to the implementation of the Project, JICA procured medical equipment through conducting "The Project for Improvement of Medical Equipment for Mother and Child Republican Hospital" (1998)¹⁰ and "The Project for Improvement of Maternal and Child Health Care System in the Second Level Hospitals" (2000) under its grant aid program¹¹. Although the relevance of the two projects is limited to the Institute of Mother and Child (MCI), the MCI states that its experience in implementing equipment procurement and the provision of Japanese equipment enabled the smooth implementation of the Project and led to the request to the Japanese Government for cooperation. In addition, with the aim of improving equipment maintenance and management capacity and clinical skills in the target hospitals and facilities, support was planned through Technical Cooperation Project and "The Project for Improving Medical Device Management (PIMDM)" (2015-2017) was implemented. Through the implementation of the Project, Departments/Sections of Biomedical Engineering (D/SBME) were newly established in the target hospitals. According to the medical staffs at the target hospitals, the establishment of the D/SBMEs has significantly improved their capacity to manage medical equipment, and they are able to carry out maintenance of medical equipment in-house at the time of ex-post evaluation, whereas previously this was outsourced. The implementation of both projects, which supported the procurement of equipment (ODA loan) and the strengthening of equipment maintenance and management capacity (Technical Cooperation Project), contributed to the situation where equipment procured under the Project has been utilized and operated under appropriate maintenance and management.

3.1.2.3 External Coherence

A surgical block was constructed at the target facility, the Republican Clinical Hospital (RCH),

¹⁰ Procurement of mother and child medical care equipment to the hospital, which was predecessor of the project's target hospital, the MCI.

¹¹ Procurement of mother and child healthcare equipment to the eleven second level hospitals across the country.

with support from the WB and others, and the Project was planned to take charge of the procurement of equipment. Interviews with the RCH indicated that the provision of medical services using the equipment procured in top-quality facilities built with the support of the WB has led to providing efficient service to patients. In addition, the EU, Austria, and others also supported the procurement of medical equipment in other target facilities. Therefore, coordination was made during the detailed design, such as excluding some equipment planned in the Project to avoid duplication. Although no consistency with international frameworks was pointed out in the documents as of the appraisal or by the executing agency, the Project was implemented with the goal of strengthening and increasing the efficiency of the medical service system and contributing to the improvement of medical services in Moldova. It is therefore consistent with “SDG Goal 3: Ensure healthy lives and promote well-being for all at all ages.”

As mentioned above, implementation of the Project is in line with Moldova’s development policy and development needs, and there are no issues with the Project plan and approach. It was also confirmed that the Project is in line with Japan’s ODA policy, synergizes with JICA’s Grant Aid and Technical Cooperation projects, and is in line with the cooperation and coordination with the WB, EU, other assistance, and international frameworks. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

In the Project, medical and laboratory equipment were procured, and consultancy services were conducted at the five core hospitals in each sector, the CNSP and CSPs. The planned and actual outputs of this Project are shown in Table1.

Table 1 Planned and Actual Output¹²

Target hospitals/facilities	Plan	Actual
RCH ^{Note1}	Operation microscope, C-arm with angiography, Equipment for neurosurgical operation theater	Deleted: Equipment for neurosurgical operation theater, C-arm with angiography Added: Equipment for operation theater and ICU
MCI ^{Note2}	Computed Tomography (CT), Anesthesia machine, X-ray mammography, Surgical endoscope, Endoscopic electrocautery	Deleted: CT, Anesthesia machine, Endoscopic electrocautery Added: Equipment and others for Central Sterile Supply Department (CSSD), operation theater and pathological prosecution room
Emergency Medicine Institute (EMI) ^{Note3}	CT, MRI, Angiography, Surgical endoscope	Added: CSSD equipment, mobile X-ray, Neuronavigation System
Oncologic Institute (OI) ^{Note4}	CT, MRI, Surgical endoscope, FISH Hybridizator, Anesthesia machine	Deleted: MRI, Surgical endoscope Added: CT (1), Ambulance, Genetic analyzer, Otoscope
Municipal Clinical Hospital “Sf. Treime” (ST) ^{Note5}	CT, MRI, Angiography	Deleted: MRI Added: Equipment relating to operation theater, ICU and laboratory, and for CSSD
All target hospitals	Infusion pumps, monitors, etc.	As planned
CNSP, CSPs ^{Note6}	Liquid Chromatography, Genetic analyzer, Safety cabinet	As planned
Consulting services	Support for bidding works, briefing sessions and evaluation; Support for contract negotiations; Supervision of equipment delivery and installation; Coordination and implementation of training; Support for inspection after installation of equipment; Support for development of maintenance and management plans; Support for PSR and PCR preparation; Technical advice and coordination support for overall project operation	As planned

Source: Ex-ante evaluation, documents provided by JICA and the Project consultant, questionnaire answers

Note 1: The RCH is the top referral hospital in Moldova providing advanced surgical care and main speciality area is treatment of cardiovascular disease.

Note 2: The MCI took over the management of the Republican Clinical Hospital for Children and provides the whole set of medical care from pregnancy and childbirth to pediatric care as a core hospital in the country.

¹² In this Project, 89 types of equipment were procured for the RCH, 63 for the MCI, 24 for the EMI, 62 for the OI, 44 for the ST, 52 for the National Central Public Health Centre and 23 for the Regional Public Health Centre. Due to the wide variety of equipment types and quantities, this ex-post evaluation focused on understanding the major equipment types and those that are highly relevant to the effectiveness.

Note 3: The EMI specializes in emergency medical care that requires advanced treatment and in the treatment of cerebrovascular diseases and surgery under the microscope, and is the only hospital that can deal with multiple trauma and severe burn injury in Moldova.

Note 4: The OI is the top referral hospitals in the field of inspection, diagnosis and treatment of cancer, and public research facilities in the field of oncology.

Note 5: The ST is the largest municipal hospital in the capital. It is offering medical service in multiple specialized departments and receiving the patients referred from all over the country.

Note 6: The CNSP is responsible for policy formulation and implementation. The CSPs are in charge of activities for health promotion through the examination. In 2017, they were integrated in the National Agency for Public Health.

During the detailed design, some changes were made to the equipment to be procured. The reasons for the changes were, as described below,¹³ mainly to adjust to the priorities in each target facility and to avoid duplication of support from other donors, and thus the changes were taken as appropriate. No changes were made to the major equipment after the detailed design.

[Reasons for changes in procured equipment]

1) RCH

The type of equipment to be procured has changed based on coordination with the project supported by Austria. Moreover, under the changes, the hospital covered the cost of locally available furniture, appliances, personal computers, etc.

2) OI

The clinical effects and priorities for equipment were reviewed in the hospital, and equipment was re-selected for deletion and addition.

3) EMI

Equipment for sterilization section was added to provide a higher level of sterilization of the surgical instruments procured under the Project.

4) MCI

CT was added considering the clinical effect. Moreover, equipment that could be procured with the budget of the MoH was excluded from the scope, while genetic diagnostic equipment and otoscopes were added instead.

5) ST

Equipment to be deleted or added was selected based on a review of the clinical effects and priorities in the hospital.

6) CNSP and CSPs

Since additional equipment was procured with the support of EU, duplicate equipment was excluded from the Project.

In addition to the changes mentioned above, the facilities for installing three types of equipment

¹³ Source: Detailed design survey report and questionnaire answers

were also changed. A neuronavigator¹⁴ and electroencephalograph (EGG) were shifted from the RCH to the Institute of Neurology and Neurosurgery, which was not the target facility of the Project, to increase the utilization rate of the equipment. Furthermore, in the OI, the endoscope washers/disinfectors were shifted to the RCH, MCI, EMI and ST since the facilities where it was initially planned to install the equipment could not be established due to budget shortfalls, thus it was not expected to fully utilize the equipment.

The consulting service was also implemented as planned. Equipment-specific trainings on Operation and Maintenance(O&M) were provided for some items of equipment in “Coordination and implementation of training” in addition to operational explanations at the time of installation. Equipment and duration were as follows: CT, MRI and pediatric laparoscopy training (1 week each), angiography equipment training (3 weeks), real-time PCR equipment training (3 days), training for liquid chromatography and gas chromatography (4 days each), and all were conducted at the target facilities in Chisinau. Interviews with each facility indicated that the training content was appropriate and effective in the O&M of the equipment, although some respondents mentioned that it would have been more effective if the training had been conducted again a few months after the equipment had been in use. In the “Technical advice and coordination support for overall Project operation,” support for the overall implementation and operation was mainly provided. Given the very limited manpower of the MoH, the fact that this was the first ODA loan project in Moldova, and the relatively large monetary scale of the Project, the coordination support provided by the consultant team of Japan, which included liaison with the JICA France office that had jurisdiction over the Project at the time and support for the preparation of documents for the payment, etc, was effective in ensuring the smooth implementation of the Project.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total cost of the Project was planned to be 6,651 million yen (ODA loan: 5,926 million yen). The actual project cost was 7,451 million yen (112% of the plan), slightly exceeding the plan. As shown in Table 2, while the cost covered by the Japanese portion was within the plan, the one covered by the Moldovan side exceeded the plan significantly because the scale of the facility renovation required for the installation of precision equipment was larger than planned and took longer time. The increase in the amount for the construction of the facility was an unavoidable response, as it was necessary to install the equipment in the proper place.

¹⁴ Imaging equipment to show the three-dimensional location of lesions and surrounding brain tissue during neurosurgery.

Table 2 Planned and Actual Project Costs

(Unit: million yen)

	Plan			Actual		
	Total	ODA loan	Moldovan funds	Total	ODA loan	Moldovan funds
Equipment procurement, installation	5,348	5,3408	0	5,575	5,575	0
Facility construction, renovation	332	0	332	1,729	0	1,729
Consulting service	128	128	0	124	124	0
Price escalation	227	227	0	0	0	0
Contingency	280	223	57	0	0	0
Interest during construction	12	0	12	16	0	16
Commitment charge	11	0	11	8	0	8
Administration cost	313	0	313	0	0	0
Taxes	0	0	0	0	0	0
Total	6,651	5,926	725	7,451	5,698	1,753

Source: Documents provided by JICA and questionnaire answers

Exchange rate: 1 lei = 6.37 yen (As of the appraisal in December 2012), 1 lei = 6.64 yen (Actual: average rate during the project implementation period)

3.2.2.2 Project Period

The Project period¹⁵ was planned to be 29 months, from June 2013 to October 2015, as opposed to an actual 60 months, from June 2013 to May 2018, which significantly exceeded the plan (207% of the plan). Procurement of equipment was completed in March 2016, however, delays occurred as the relevant facilities could not be renovated as planned due to budgetary shortfalls on the Moldovan side¹⁶. Specifically, the renovation works of the Colon Cancer Screening Center at the OI were delayed, and the handover took place in December 2017. Moreover, the equipment remained underutilized due to the absence of doctors who could use the equipment; thus the Project was completed in May 2018 when this equipment was partially put into operation. It should be noted that at the stage of the Project formulation, it was confirmed with the MoH and the Ministry of Finance that the budget for facility development at each hospital had been secured, and no problems were identified. On the other hand, as already mentioned (refer to the Project costs), the renovation of the facilities required for the installation of equipment was more serious and extensive than planned, leading to budget shortfalls¹⁷. In addition to budget shortfalls, the replacement of the director of the target hospital, which delayed the decision-making on the facility renovation due to the deployment of substitute personnel, also contributed to the slow progress of the Project. Furthermore, in Moldova, single-company tenders are not approved, which has led to delays in the renovation works including the sterilization section due

¹⁵ The Project period is defined as the month the loan agreement is signed to the month the equipment is put into operation.

¹⁶ Source: Questionnaire answers from the Project consultant

¹⁷ Source: Document provided by JICA, questionnaire answers from the Project consultant

to unsuccessful tenders caused by insufficient number of bidders¹⁸.

In light of the above, the Project cost slightly exceeded the plan and the Project period significantly exceeded the plan. Therefore, efficiency of the Project is moderately low.

3.3 Effectiveness and Impacts¹⁹ (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The purpose of the Project is to strengthen and improve the efficiency of medical services and the testing systems by introducing the equipment to the target facilities, and the indicators listed in Table 3 had been set. On the other hand, in 2019, after the Project completion, the MoH submitted the change of the operation and effect indicators for the following reasons²⁰: 1) Equipment planned to be procured at the time of appraisal was excluded as a result of the detailed design, 2) The indicators were not appropriate due to lack of uniformity in counting the number of cases treated by endoscopy, 3) There are restrictions on the high cost services (e.g. catheterization for cardiovascular diseases) covered by the National Health Insurance, and the number of treatments that can be carried out at each facility depends on these restrictions, and 4) A part of the roles related to the indicators of the CNSP and CSPs transferred to the other organization due to the reform. In the ex-post evaluation, the achievement of the indicators set at the time of the appraisal is confirmed. Meanwhile, for indicators which have not achieved the target, alternative indicators were confirmed as a reference, if the reason for indicators not reaching targets corresponds to one of the reasons for change listed above, or more appropriate indicators were proposed. The analysis also took into account the actual results for 2019 and 2021, since it was assumed that the data would be affected due to movement restrictions in the country and the impact on normal operations associated with the response to COVID-19 in 2020 (two years after Project completion) when the target values were to be confirmed.

¹⁸ Source: Questionnaire answers from the Project consultant

¹⁹ When providing the sub-rating, Effectiveness and Impacts are to be considered together.

²⁰ JICA responded that it was difficult to change the indicators after the Project was completed since those changes needed to be discussed and agreed upon when events occur during Project implementation, but they would be used as a reference when conducting the ex-post evaluation.

Table 3 Operation and Effect Indicators of the Project

	Baseline value	Target value	Actual value				
	2011		2017	2018	2019	2020	2021
		2 Years After Completion		Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
① Average number of days of hospitalization for patients with endoscope interventions							
MCI	5.4	4.0	4.0	4.0	4.0	4.0	4.0
EMI	4.0	3.5	3.6	3.8	3.8	3.5	3.5
OI ^{Note1}	-	3.5	-				
ST	5.2	4.0	3.8	3.6	3.4	3.0	2.8
② Number of patients with ischemic heart disease treated by endovascular interventions							
EMI ^{Note2}	0	1,000			-		
<i>(Alternative indicator) Number of patients with cerebro-vascular diseases and peripheral vascular diseases treated by endovascular interventions</i>	0	350	40	310	370	255	370
ST	0	500	112	182	233	279	789
③ Number of CT tests							
MCI	0	2,500	1,288	1,288	1,709	1,513	2,485
EMI	7,434	10,000	7,353	10,022	10,197	9,814	16,378
OI ^{Note3}	453	4,500	-				
ST	766	2,000	2,932	3,565	3,703	3,767	6,029
④ Number of MRI tests							
MCI ^{Note3}	0	2,000	-				
EMI	0	2,000	2,143	1,004	1,842	1,039	1,961
ST ^{Note3}	0	2,000	-				
⑤ Number of angiography tests							
RCH ^{Note3}	400	1,000	-				
EMI	0	1,200	203	N.A	N.A	N.A	N.A
ST	0	750	566	800	830	717	906
⑥ Number of endoscopic interventions							
MCI	4,500	6,800	395	3,701	3,756	2,695	3,557
<i>(Alternative indicator) Number of the interventional endoscopies including: Laparoscopies, Hysteroscopies, Bronchoscopies, Gastroscopies</i>	429	1,100	395	3,712	3,862	2,744	3,779
EMI	2,333	5,800	3,959	5,328	3,653	2,217	3,110
OI	8,011	10,000	810	1,713	1,932	971	986
<i>(Alternative indicator) Number of mammography and colonoscopy screening investigation</i>	N.A.	5,800	4,824	5,668	6,301	4,619	5,555
ST	1,054	4,000	1,757	6,528	6,956	6,052	7,388
⑦ Number of microscopic interventions							
RCH	0	150	3,005	2,525	3,050	1,624	2,776
⑧ Number of tests at the CNSP and CSPs							
Bacteriological tests	296,269	330,000	248,540	226,396	198,796	116,715	130,755

Serological tests	273,437	305,000	106,984	67,808	12,298	7,813	44,030
Parasitological tests	332,817	380,000	280,126	209,047	191,666	148,876	155,222
Sanitary bacteriological tests	412,606	470,000	253,147	159,193	147,442	126,099	164,690
Sanitary hygienic tests	368,778	420,000	197,277	139,155	148,417	134,416	158,828
Molecular biological tests	5,791	6,900	10,997	7,814	7,681	236,342	247,403
Radiological tests	3,593	4,100	1,626	6,503	9,150	7,405	7,969
<i>(Alternative indicator) Number of implemented methods</i>	60	54	—	—	—	—	183
<i>(Alternative indicator) Number of implemented parameter</i>	130	140	—	—	—	—	—

Source: Documents provided by JICA, questionnaire answers

Note1: As oncology patients have complex systemic diseases and receive multilateral treatment, this indicator is not appropriate for the OI and is therefore excluded from the evaluation.

Note 2: The EMI is not subcontracted by the National Health Insurance for the delivery of treatment service for the cardiac patients and treatment is not provided to these patients, therefore this indicator is excluded.

Note 3: The planned equipment (CT, MRI, angiography equipment) was deleted during detailed design and therefore excluded from the evaluation.

In Table 3, indicators that achieved the target are shown in boldface²¹. More than 70% of the operation and effect indicators set for the target facilities (number of treatments and tests) have generally achieved the target values²², thus it can be said that the equipment procured has contributed to an increase in the number of tests and the improvement of medical care services in the target hospitals. The achievement of each indicator is as follows.

① Average number of days of hospitalization for patients with endoscope interventions

The performance of the three hospitals other than the OI has met the target.

② Number of patients with ischemic heart disease treated by endovascular interventions

The actual performance achieved about 60% of the target value in 2020, but the number of cases performed exceeded the target by 2021 at the ST. The number of patients with cerebrovascular diseases and peripheral vascular diseases treated by endovascular interventions was set as an alternative indicator, since the EMI does not provide treatment for cardiac patients as the National Health Insurance is not applied. The target values were proposed by the MoH as highly feasible figures, hence it is difficult to analyze the exact status of achievement as the validity cannot be ascertained. The EMI did not have angiography equipment and the treatment itself was not provided at the time of the appraisal, however, procurement of equipment has made examinations possible. The situation was that a certain number of treatments were identified at the time of the ex-post evaluation, meaning that the

²¹ As the response to COVID-19 is likely to have affected the usual number of treatments and tests in 2020, indicators whose performance in 2020 was below the target were also checked for performance in 2019 or 2021.

²² Of the eight indicators (number of treatments and tests) set, six indicators have basically met their targets: ① Average number of days of hospitalization for patients with endoscope intervention, ② Number of patients with ischemic heart disease treated by endovascular interventions, ③ Number of CT tests, ④ Number of MRI tests, ⑤ Number of angiography tests and ⑦ Number of microscopic interventions.

hospital is contributing to the improvement of healthcare services of this hospital.

③Number of CT tests

Although the performance of the MCI was slightly below the target, the number of tests performed at the EMI and ST exceeded the target.

④Number of MRI tests

At the MCI, the only hospital where MRI was installed, the number of tests was limited in 2018 due to a temporary breakdown and in 2020 due to COVID-19, but those in 2019 and 2021 both almost achieved the target.

⑤Number of angiography tests

Target number of the tests was achieved at the ST. The achievement of the EMI could not be confirmed because information was not provided due to the reason that ⑤Number of angiography tests is included in the alternative indicator for indicator ② (see below).

⑥Number of endoscopic interventions

Targets were achieved at the ST. In the EMI, the achievement in 2020 was about 60%, however, since it was almost achieved in 2018 and there was an increase in 2021, this may have been the result of temporary equipment breakdowns and COVID-19. The data for the MCI and OI were lower than the target values because the baseline values included all endoscopic treatments, whereas the actual figures are limited to the number of treatments using the equipment procured by the Project. The alternative indicators, “*Number of the interventional endoscopies including: Laparoscopies, Hysteroscopies, Bronchoscopies, Gastroscopies*” (MCI) and “*Number of mammography and colonoscopy screening investigation*” (OI), were submitted by the MCI and OI as the scope of the indicators was not clear. “*Number of the interventional endoscopies including Laparoscopies, Hysteroscopies, Bronchoscopies, Gastroscopes*” performed at the MCI significantly exceeded the target. Although the OI only achieved 80% in 2020 when it was affected by COVID-19, the target was almost achieved in 2021, thus sufficient outcomes are considered to have been achieved.

⑦Number of microscopic interventions

The number of interventions performed at the targeted RCH significantly exceeded the target.

⑧Number of tests at the CNSP and CSPs

Out of the seven types of tests, the numbers of tests, except for two types (molecular biology and radiology), were below the target. The above two types of tests increased because the studies for viral hepatitis and SARS-CoV-2 were carried out with the support of the World

Health Organization (WHO)²³. The number of tests was below target due to the consolidation of public health-related organizations, with the tasks related to food hygiene as well being transferred to the newly created National Food Safety Agency, which is responsible for related tasks. At the time of the ex-post evaluation, the CNSP and CSPs mainly carried out laboratory services on hygiene inspections of some food products, environmental hygiene inspections and commissioned research²⁴. The CNSP suggested as alternative indicators, the number of test methods and measurable parameters made possible by the procurement of examination equipment. Information on all 10 CSPs was not available, however, according to the officials at the CNSP, approximately 183 test methods have been introduced after the Project was implemented. In addition, according to medical staffs²⁵ at the two CSPs where site visits were conducted, the numbers of test methods or parameters that can be measured have not increased by the procurement of the equipment, but the newly installed equipment has contributed to improve the accuracy and efficiency of the examinations (see qualitative effects for details).

3.3.1.2 Qualitative Effects (Other Effects)

Thanks to the implementation of the Project, the qualitative effects were confirmed in the targeted facilities through use of the procured equipment, such as the provision of advanced medical services, early diagnosis and timely treatment, reduced patient burden and contribution to quality health services. According to the target hospitals, modern and sophisticated medical equipment such as CT, angiography equipment, radiography equipment and endoscopes enable early diagnosis and timely provision of treatment. For example, the mammography has many more qualitative images, helping identification of anatomical structures and microcalcifications, differential diagnosis of malignant and benign mammary glands and early detection of breast cancer. The introduction of X-ray has also enabled high-resolution examinations and reduced patient burden (irradiation dose). Furthermore, medical staffs commented that the updating and upgrading of medical equipment contributes to providing quality medical care services comfortably for not only patients, but also medical workers. Despite the limited number of responses, when patients were interviewed at the ST, they were all satisfied with the high standard of medical services they received at the hospital and indicated that the medical services at the target facility had improved compared with how they were before²⁶.

²³ Source: Questionnaire answers

²⁴ Source: Questionnaire answers

²⁵ Site visits to the CSPs in Hincesti and Orhei were conducted in August 2022 by the local assistant.

²⁶ The three respondents were each patient who had received medical services using equipment procured by the Project (“stenting vessels surgery”, “endoscopy medical services” and “thrombus extraction performed by angiography”).

The CNSP and CSPs are also able to implement tests more quickly and accurately by using the procured examination equipment. For example, it was reported that the use of a vortex mixer²⁷ minimised the impact of human error, and that the installation of a thermostatic bath²⁸ significantly reduced the melting time of culture media used in the laboratory and improved the efficiency of the staff's working hours.



(Photo: left) CT



(Photo: center) Mammography



(Photo: right) Vortex mixer

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Improvement of health care services in Moldova

The Project was assumed to contribute to the improvement of medical care services for people in Moldova by strengthening and improving the efficiency of the medical care service supply system in the target facilities, and to clarify the division of roles among hospitals.

The targeted facilities are the top referral hospitals in each field in Moldova, thus it can be said that the improvements in the medical services of these hospitals have an impact on the country's overall medical care services. The latest equipment provided by the Project contributed to the development of a system whereby patients not only from the region, but also from all parts of the country, can receive advanced medical services. In addition, the numbers of sophisticated equipment and the range of medical services have increased, enabling early diagnosis and the provision of high accuracy and treatment strategies, resulting in reduced complications and mortality. Moreover, the equipment procured complies with the standards required in the EU, and the use of modernised equipment also helps to reduce the workload and burden on medical staffs. The installation of advanced examination equipment at the CNSP and CSPs has also enabled tests to be conducted in line with EU standards, improved the accuracy of tests and significantly extended the nomenclature²⁹ of laboratory examination³⁰.

²⁷ Experimental apparatus for stirring the contents of a test tube by swirling the bottom of the tube at high speed.

²⁸ Artificially created environments that facilitate the growth of cells and micro-organisms.

²⁹ Nomenclature is a rule on how to name chemical and other substances, enabling systematic naming that captures the unique characteristics of a thing and allows phylogenetic taxonomic recognition.

³⁰ Questionnaire answers

(2) Clarification of the division of roles among hospitals

Although sufficient responses could not be obtained from the executing agency and target facilities, according to the ST, the number of referrals (referral and transport) to other hospitals has decreased and, conversely, the number of referrals from other hospitals to the ST has increased, as the ST has expanded the range and improved the quality of medical services. It can be said that the increased range of treatments that can be performed, and improved medical care services, have increased the number of cases that can be handled within the hospital.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

This Project was classified as Category B on the *JICA Guidelines for Environmental and Social Considerations* (April 2010), as it had minimal undesirable effects on the environment. Medical waste is regularly monitored at each facility in accordance with an environmental monitoring mechanism under the supervision of local authorities. Moreover, it has been confirmed that no negative impacts have occurred till now because of the implementation of the Project³¹.

2) Resettlement and Land Acquisition

The Project involved the installation of equipment on an existing site, and no land acquisition or resettlement was planned. It was confirmed through the documents provided by JICA and questionnaire answers that neither resettlement nor land acquisition had occurred.

3) Gender Equality and Marginalized People

No specific and direct initiatives from the perspectives of gender and marginalized people were articulated at the time of the appraisal, and no relevant impact occurred during the implementation and after the completion of the Project³².

4) Social Systems and Norms, Human Well-being and Human Rights

The establishment of Departments of Biomedical Engineering through the Technical Cooperation, with the installation of medical equipment in the Project, has increased the understanding of the importance of medical equipment management at the medical facilities in Moldova and influenced important changes to the national decree on medical equipment (No. 102). The decree specifies the introduction of regular laboratory inspections of medical equipment, which had not previously been conducted.³³

³¹ Questionnaire answers

³² Questionnaire answers

³³ Documents provided by JICA, questionnaire answers

5) Unintended Positive/Negative Impacts

Contribution to COVID-19 countermeasures

Equipment such as ventilators, patient monitors and diagnostic imaging equipment (mobile X-ray) procured under the Project was used in responding to COVID-19 at the target facilities. The use of this equipment to diagnose lung conditions and initiate necessary treatment in a timely manner has contributed significantly to reducing causal complications of patients. The ST, which was designated as a hospital to respond to COVID-19, had an extraordinary flow of patients in critical condition in need of respiratory therapy at the time and they were able to save more lives with this equipment.



Photo: Patient monitor (front) and Ventilator (left back) (ST)

Provision of medical services to displaced people from Ukraine

All the target facilities have constantly received displaced patients from Ukraine, especially many elderly people, women, and children. The OI, which has assigned 10 staffs and provides medical services for Ukrainians, has seen more than 300 displaced Ukrainians as patients, who received various tests, treatments, and operations. At the MCI, 57 displaced persons were treated and examined when the site visit was conducted. Other target facilities have similarly received many displaced people from Ukraine and reported that mainly X-rays, anesthesia, endoscopes, ventilators, analyzers, patient monitors, infusion pumps, etc., were utilized and contributed to the examinations and treatments.

From the above, it can be said that the Project has generally increased the number of tests and treatments required as planned and contributed to the improvement of medical care services in the target facilities. The provision of advanced healthcare services also contributes to reducing the burden on patients and enhances the comfort of medical staffs in providing quality medical care services, and it is also reported that the accuracy and efficiency of testing capabilities in the CNSP/CSPs have been improved. Patients are also highly satisfied with the services, and the target facilities are the top referral hospitals in each area, thus the improvement of medical care services in those facilities has an impact on the improvement of medical care services in Moldova as a whole. The equipment was also used as essential equipment to respond to COVID-19 and provide medical services to displaced people from Ukraine, confirming the impact of the equipment in contributing to large numbers of patients. This project has mostly achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

The National Agency for Public Health (NAPH) was established by MoH Order No. 184 (March 2016). With the establishment of the NAPH, the CNSP and CSPs were integrated into the NAPH, and in 2017, their major functions were also handed over to the NAPH. While testing for food hygiene and HIV testing has been transferred to newly established organizations and hospitals, other testing and food testing commissioned by other organizations continues to be conducted and equipment is operated and maintained by the NAPH and CSPs.

3.4.2 Institutional/Organizational Aspect

Prior to the implementation of the Project, though the equipment was operated and maintained by each facility, many hospitals contracted with private equipment maintenance companies and received regular maintenance services for advanced equipment including CT and MRI. After the implementation of the Project, the D/SBMEs have been established in each facility through the implementation of the PIMDM and have maintained and managed the equipment, thus not outsourcing it to external parties. In the CNSP and CSPs, maintenance and management were still outsourced at the time of the ex-post evaluation.

The number of the O&M staff at each target facility is shown in Table 5. The number of staff involved in the O&M has increased at each facility due to the increase in equipment and the internalization of maintenance and management tasks, however staff shortages were reported at several facilities. For example, additional Biomedical Engineers (BMEs)³⁴ assigned in the D/SBMEs are needed as they sometimes have too much work maintaining medical equipment according to the manuals, which was not done in the past. Moreover, engineers are not assigned in the CSPs after their integration into the NAPH, thus the need for such a position was mentioned by the CSPs visited.

Table 5 Number of the O&M Staff at Each Target Facility

	As of the appraisal ^{Note1}	As of the ex-post evaluation			Insufficiency of the staff number
		Total	Engineers and others	BME	
RCH	2	11	4	7	Yes
MCI	9 (5)	14	4	10	
EMI	5 (1)	19	9	10	
OI	3	12	7	5	Yes
ST	1	11	3	7	
NAPH	2 - 3	3	-	3	Yes
Each CSP	2 - 3	-	-	-	Yes

Source: Documents provided by JICA, questionnaire answers

Note 1: Numbers in brackets indicate BMEs.

³⁴ Specialized and required to complete the Biomedical Engineer course at the Technical University of Moldova.

Each facility has a system whereby if problems of maintenance arise that cannot be dealt with in the hospital, they contact their own supplier to request repairs or action. In the NAPH, engineers conduct the maintenance of simple equipment, while the maintenance of precision equipment is outsourced to contracted external suppliers, as in the system in place as of the appraisal.

3.4.3 Technical Aspect

- Technical capacity required for the O&M

At CSPs where engineers are not assigned and maintenance of equipment is outsourced, a lack of staff with appropriate technical skills was reported as an issue. No problems were reported in the hospitals regarding the technical skills on medical staffs and BMEs required for the O&M of the equipment. At the OI, there is equipment that is not being used according to its intended purpose due to the absence of doctors who can perform bone marrow transplants utilizing stem cell freezing equipment. At the time of the appraisal, there was a doctor who received training in Romania and Germany, and was able to utilise the equipment, but he passed away and there were no doctors available thereafter, and the equipment has remained in operation as a refrigeration facility ever since. According to the OI, it is planned that hematologists and doctors undergoing short-term training will be able to perform bone marrow transplants³⁵.

- Contribution through the trainings in the Project and the support from the Technical Cooperation

The target facilities had opportunities for participating in the O&M and clinical trainings through equipment-specific training under the Project and support from the Technical Cooperation, PIMDM. In addition, D/SBMEs have also been established, hence equipment maintenance, which was outsourced before the Project, can currently be conducted internally. The D/SBMEs established in each target facility operate in line with MoH Order No. 262 *Regarding the establishment of D/SBMEs within pilot institutions* (2016). Medical equipment procured under the Project is also maintained in accordance with manufacturers' recommendations, which has also improved confidence in the quality of the equipment for medical staffs using the equipment. According to the medical staffs in the target facilities, the presence of BMEs in the Department contributes to the prompt resolution of medical equipment faults, the proper planning of maintenance procedures and the securing of necessary budget, and is essential for the sustainable and effective use of equipment, including the implementation of preventive maintenance and management³⁶. In each target facility, it would have been difficult to properly maintain and manage the procured equipment internally without the establishment of D/SBMEs responsible for maintenance and management, thus the PIMDM has made a significant contribution.

³⁵ Documents provide by JICA, questionnaire answers

³⁶ Source: PCR, questionnaire answers, hearing to the Project consultant

- Use of manuals and availability of spare parts, etc.

In all target facilities, maintenance manuals for procured equipment are used on site as required. At the OI, it was confirmed that the manuals that do not contain detailed information including structural drawings and electronic schematics necessary for maintenance are also maintained by using information sources on the web. Spare parts and consumables are available, though parts for some items of equipment (endoscopes and others) that are very expensive and time-consuming to obtain were identified as challenges. In addition, maintenance services in the CNSP and CSPs are contracted through a tender process, which means that it takes time to make repairs and obtain parts. Therefore, it is explained that a certain warranty and repair period should be provided when procurement is contracted.

3.4.4 Financial Aspect

Each facility has allocated budget for the O&M of equipment. Financial resources of hospitals are budgeted approximately 85% by the MoH, 5% by medical fees (payment for medical services), and others³⁷. Although there were no income and expenditure problems in the two hospitals where the information could be confirmed (see Table 6), half of the target facilities reported budget shortfalls (see Table 7). There are many consumables and spare parts for medical equipment which require expensive parts and repairs, thus possible maintenance is carried out within budgetary limits in hospitals where budgets are insufficient (the NAPH outsources maintenance within its budget). The cases have shown that the facilities with insufficient budgets are unable to conduct adequate repair work on medical equipment. It is reported that cost of maintenance and management of endoscopes, which are used frequently, is particularly expensive.

Table 6 Income and Expenditure of the Target Hospitals

(Unit: million Moldovan Lei)

	2019			2020		
	Income	Expenditure	Balance	Income	Expenditure	Balance
RCH	530	477	53	583	556	27
ST	209	205	4	292	302	-10 ^{Note}

Source: Questionnaire answer

Note: The ST experienced a deficit in 2020 due to the impact of COVID-19 but returned to normal profitability in 2021.

Table 7 The O&M Cost of each Target Hospital

(Unit: million Moldovan Lei)

	2017	2018	2019	2020	Insufficiency of budget
RCH	3,760	5,864	6,179	8,307	
MCI	10,345	2,694	N/A	N/A	N/A
EMI	2,522	3,510	5,767	3,908	
OI	4,812	5,583	1,410	4,726	

³⁷ Based on information from the RCH, as detailed financial information, including budget breakdown, was only available from the RCH.

ST	506	1,900	1,456	2,536	Yes
NAPH	581	393			Yes

Source: Documents provided by JICA, questionnaire answers

3.4.5 Environmental and Social Aspect

No negative environmental and social impacts were assumed at the time of appraisal, and it has been confirmed by the executing agency that there are no possible negative environmental and social impacts in the future.

3.4.6 Preventative Measures to Risks

- Communication among stakeholders

It was pointed out that close coordination was required since the MoH was not familiar with the procedures specific to ODA loan, etc. as this was the first ODA loan project in Moldova, and since the detailed design which was conducted as Technical Cooperation for ODA loan and procurement of consulting services for implementation of the Project would proceed simultaneously³⁸. Although the Project was the first ODA loan project in Moldova, it proceeded relatively smoothly in fact, as the MoH had extensive experience in implementing EU-supported projects and the support for logistics and coordination tasks among the stakeholders were provided through the consulting service. In addition, the same consulting company was responsible for detailed design and consultancy support, therefore there were no obstacles or problems with handover or coordination systems³⁹.

- Securing basic infrastructure for equipment installation

When procuring equipment, it was a prerequisite that the necessary buildings for installation and use of equipment, as well as electricity, water and medical gas supplies, are secured. Therefore, it was pointed out as of the appraisal to keep the following points in mind: to examine the consistency of the equipment and the underlying infrastructure, and to ensure that any necessary renovation would be carried out in advance. As described in Efficiency (2) Project Inputs ② Project Period, as the main reasons for delay, the OI reported cases where the construction of facilities necessary for the installation and use of some equipment was not completed and the equipment was transferred to other facilities at the time of completion, resulting in only partial utilization of some equipment. In the other hospitals, the basic infrastructure was developed as planned and equipment was procured and put to use without any problems.

3.4.7 Status of Operation and Maintenance

The maintenance status of the equipment procured under the Project is generally good, both in

³⁸ Source: Documents provided by JICA

³⁹ Source: Questionnaire answers and hearing to the Project consultant

terms of utilization and maintenance⁴⁰. Maintenance of equipment is also carried out in accordance with the plan, and records were also confirmed during the site visit. On the other hand, cases were reported where frequently used items of equipment such as endoscopes and ventilators were difficult to repair or required new purchases due to the high cost of parts and maintenance. As challenges, it was pointed out that some equipment had to be sent abroad for repair as there were no agents in Moldova, budgets were not available, and the equipment could not be used during the long repair periods.

Table 8 Major Equipment which is Damaged and Planned Response

Hospital	Equipment	Current condition	Plan for response
RCH	Anesthesia machine	Using a working anesthesia machine.	Needed spare will be procured this year.
	ESR iSED analyzer ⁴¹	No difficulties thanks to using alternate analysis methods.	The devices will be replaced this year.
MCI	Ophthalmic microsurgical system	Given the fact that operations of this type are planned and not urgent, there are no serious cases or difficulties in providing medical services due to absence of this equipment.	As there are no agents in Moldova, making it necessary to obtain from Romania, additional costs are required for engineer's travel, work and the necessary spare parts.
	Endoscope	There are some malfunctions in some part of the equipment due to intensive use. Thus, due to the limited frequency of use, the number of patients treated per day is limited.	The defect has not been removed as it can only be repaired at repair laboratories in Germany and the parts are costly.
EMI	Video colonoscope	One of the two devices is non-functional due to a damaged part (by intensive use), thus only the other one is in use.	Maintenance is carried out annually, but depending on the complexity of the fault, repairs take time.
	X-ray C-arm	One of the two devices is non-functional.	Currently in the process of contracting repair services.
OI	Video colonoscope	It has reduced the number of interventions and increased waiting times.	The repair cost is expensive, at around 50% of the equipment cost. It is planned to procure new devices.
	Ventilator	Damages of magnet valve and using other devices.	The repair cost is economically inefficient, thus there is no plan to repair it.
	Ventilator	Deterioration due to intensive use and using other devices.	Requires the intervention of an authorized company. Maintenance is planned in 2023.

⁴⁰ Source: Questionnaire answer and site visit conducted by the local assistant

⁴¹ Equipment for analyzing abnormalities in blood components and the degree of inflammation by ESR (erythrocyte sedimentation rate).

	Digital mammogram	The other mammography unit is in use.	As spare parts are very expensive, it is planned to purchase them through another project's budget.
	Stem cell freezing unit	Not in use due to the absence of a facility for installation and a capable doctor	See 3.4.3 Technical Aspect
ST	Pulmonary ventilator	Damage of several parts	In the process of repair
	Infusion pump	Disconnection due to cable deterioration	In the process of repair
	Blood gas analyzer	Damage to interaction with the sensors	In the process of repair
NAPH	Rotary evaporator	Malfunction of pump	It is included in procurement plan of medical equipment for 2022
	Alpha, Beta and Gamma Counting Spectrometry	Failure of the detector	Not yet responded as the agent is not located in the country.

Source: Questionnaire answers and confirmation during the site visits

As mentioned above, no issues have been observed in the policy/system, institutional/organizational, and technical aspects. However, some minor issues have been observed in the financial aspect including the current status of O&M and they are not expected to be resolved. Therefore, sustainability of the project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented with aims to improve and streamline the medical care and public health service by introducing new medical and laboratory equipment into tertiary and secondary hospitals and other facilities in Moldova, thereby contributing to the improvement of the medical care service for the citizens.

Its purpose is in line with Moldova's development policy and development needs at the time of appraisal and ex-post evaluation. It was also confirmed that the Project was in line with the international framework at the time of appraisal in terms of the consistency with the Japan's aid policy; synergy effect and coordination with the Technical Cooperation Project conducted by the JICA, and with the assistance by other development partner organizations; and the SDGs. Therefore, its relevance and coherence are high. The Project costs exceeded the plan, and the Project period largely exceeded the plan due to the delay of the facility renovation for installation of the equipment and other reasons. Therefore, efficiency of the Project is moderately low. Approximately 70% of the set targets for the number of treatments and tests were generally achieved in the target facilities. Medical services using the procured equipment have contributed

to provide early diagnosis, timely treatment, reduced patient burden, and also quality of medical care services with comfort for healthcare workers. Improvements in the quality of testing at the CSPs have also been reported. The impact in terms of contribution to improved medical care services across the country and to the recovery of patients with COVID-19 was also confirmed. Therefore, effectiveness and impacts of the Project are high. No issues have been observed in the policy/system, institutional/organizational, and technical aspects of the operation and maintenance of the Project. However, some minor issues have been observed in the financial aspect and the current status of operation and maintenance. Therefore, sustainability of the Project effects is moderately low.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

• Re-examine the maintenance plans for the frequently used equipment

Equipment is generally in good condition and has been mostly utilized without problems, however, some frequently used items of equipment, such as endoscopes and mammography, are expensive to maintain and are a burden on hospitals. Although preventive maintenance of the equipment is conducted by the D/SBMEs, maintenance costs can be higher if the equipment is used more frequently than expected. Moreover, if it takes time to order the necessary parts or repairs, the equipment will not be available during that time. In addition to general preventive maintenance and maintenance plans, the D/SBMEs at each hospital should consider additional costs and replacement cycles of parts required for the frequently used equipment to further enhance the effective use of equipment.

• Responses to the shortage of BME numbers

Several target facilities reported shortages of the staff to ensure proper O&M of equipment. The number of staff at each facility has increased with the increase in equipment, but there is overwork, particularly due to a shortage of engineers and BMEs. The target facilities that are understaffed should notify the MoH with a clear indication of the number of understaffed staff, their overtime hours and workload, and the MoH should consider and respond to necessary increases to reduce the burden on BMEs and support the appropriate maintenance and use of appropriate equipment.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Ensure the preconditions of procurement needed for the proper use of equipment

In this Project, it was planned to prepare the necessary facilities for installation on the

Moldovan side. The Project was delayed because the facilities could not be constructed due to a lack of budget as there was a demand to renovate the facilities beyond the estimation at the implementation stage, although this had been fully examined at the time of the appraisal. In addition, it was confirmed that there is equipment which has not been properly used at the time of the ex-post evaluation because the installation facility was not prepared. For this equipment, the absence of doctors who could handle the equipment was another factor why the equipment was not being used properly. When procuring precision equipment, the conditions under which the equipment will be fully utilized should be clarified in advance, and Project stakeholders should provide monitoring support from the Project formation stage to ensure that the conditions are met; and it is desirable to install the equipment only after the conditions for installation (securing the installation site and assigning several doctors who can utilize the equipment) are met, to prevent equipment from being unused.

5. Non-Score Criteria

5.1. Performance

5.1.1 Objective Perspective

- Smooth implementation of Project through support (consulting services) for overall operations

This Project was Moldova's first ODA loan project. In addition, since the executing agency, the MoH, had limited staff, extensive support was provided by the consultancy team as part of the consultancy services, including liaison with the JICA France office and assistance for preparing the payment documents. Generous follow-up, including a support for the preparation of procedurally necessary documents to be submitted to JICA, liaison and coordination work and payment-related documents, also enabled proper communication between the MoH and the Japanese side, which is considered to have contributed to the smooth progress of the Project.

5.1.2 Subjective Perspectives (retrospective)

(1) Detailed analysis (contribution to the healthcare sector through synergies with the related cooperation projects) policy

Prior to implementation of the Project, Japan has implemented support for the development of maternal and child health care and medical equipment (see 3.1.2.2 Internal Coherence) through grant aid projects, medical and health-related task-specific training, etc. in the healthcare in Moldova. The Project was implemented as the first ODA loan project in Moldova for further expanding their impact of those activities in healthcare sector. Furthermore, around the same time as the Project, the PIMDM for the appropriate O&M of medical equipment and the establishment of a management system was implemented as the Technical Cooperation Project, and the linkages have continued even after the Project was completed and are contributing to the improvement of medical and public health services in the country. In this part, the complementary and synergistic

effects of these series of supports on the effectiveness and impact as well as sustainability of the Project are analyzed from the subjective perspectives. Specifically, the following four points are described: the situation as of the Project formulation; how the Project overcame obstacles and achieved outcomes, including the linkage with the Technical Cooperation Project; who responded and how when unexpected changes in circumstances occurred; and the outcomes achieved as a result⁴².

(2) Situation at the time of the appraisal of the Project

At the time of the appraisal, in Moldova, the further reform and streamlining of the medical care service delivery system was needed to avoid the increase of medical care expenditure to a sustainable level, while promoting the health sector reform. While basic health indicators were improving, the number of patients with heart disease, brain disease and non-communicable diseases was increasing due to the aging of the population and changing lifestyles, with non-communicable diseases being the main cause of death (2011)⁴³. For non-communicable diseases, treatment based on accurate diagnosis using advanced medical equipment is the key to combating these diseases, therefore this was considered a priority issue for health policy. In addition, a large part of this equipment has been used from the Soviet Union era, and more than 80% of the existing medical equipment was obsolete; and the lack of equipment was hindering proper diagnosis and surgical procedures. At that time, medical equipment management was a new concept in Moldova; the D/SBMEs were established in the MoH in 2012, by the department in charge of medicines doubling as the medical equipment department, and several staff were assigned to this department. However, experience of the staff in the maintenance of medical equipment was limited, as the situation was such that pharmaceutical staff were also responsible for equipment maintenance. Thus, the Moldovan side understood that the existing capacity of medical equipment management system was not sufficient, and it would also need to strengthen its capacity to ensure the sustainability of the equipment when procuring new equipment⁴⁴.

(3) From Grant Aid to the formation of ODA loan Project, and the link with Technical Cooperation Project

In the facilities where medical equipment for mother and child health care was procured through grant aid, it was confirmed that the equipment had been used properly for more than 10

⁴² When conducting this study, it was not possible to conduct the originally planned interviews with officials from the MoH in Moldova because the person in charge of the Project was retired from the MoH, and other Ministry officials were busy with COVID-19 and dealing with displaced persons from Ukraine. For this purpose, an analysis was made based on the sources including the interviews conducted with medical personnel at the target facilities and project consultants for the Grant Aid Project and Technical Cooperation Project, and the content of interviews with JICA officials by JICA's Evaluation Department.

⁴³ Source: Documents provided by JICA

⁴⁴ Source: Hearing to the Project consultant

years, while the durability of the equipment was estimated to be around five years. On the Moldovan side, the experience of using Japanese equipment procured through grant aid has led to an understanding of the high performance of the equipment, thus a request for Japanese equipment was raised. Accordingly, to respond to the strong need for advanced medical equipment, the utilization of the equipment after the implementation of the project, and the reputation and trust in Japanese medical equipment, based on past grant aid experience, led to a request from the Government of Moldova to Japan for the ODA loan Project under STEP in 2012 with the aim of procuring insufficient and new equipment. In fact, medical staffs at the MCI, where medical equipment for maternal and child health care was procured through the grant aid, stated that the success of the grant project (the use and contribution of the equipment at the MCI) led to the implementation of this Project. Subsequently, the Project was implemented by scaling up with the use of the experiences gained from the grant aid project, and as a project to introduce new and advanced medical equipment for tertiary and secondary medical facilities.

The Project was formulated only to procure equipment. On the other hand, at the time, the target hospital outsourced the maintenance of its main equipment, which was expensive and time-consuming. Therefore, the Technical Cooperation Project, PIMDM, was implemented at the same time the equipment was installed under the Project, with the aim of establishing a system for the maintenance and management of medical equipment for the facilities where the equipment was procured. Thanks to the implementation of the PIMDM, D/SBMEs were established in the five target facilities of the Project, and BMEs were assigned accordingly. Their roles and standard operating procedures were prepared by the PIMDM and described in the guidelines and include the introduction of records of cases of repairs and responses to medical equipment, the introduction of planned preventive maintenance and user training, etc., all of which are essential to ensure the sustainability of the equipment procured under the Project. In the D/SBMEs, the devices for testing medical equipment were installed, enabling regular testing of equipment performance, thus the quality of internal equipment maintenance has also improved. Accordingly, after the implementation of the Project, medical equipment maintenance, which had previously been outsourced, was conducted in-house in the target hospitals, and the D/SBMEs and BMEs have become indispensable for the efficient and effective use of equipment. Medical staffs in all target hospitals indicated in interviews that the presence of BMEs has made a significant contribution to the quick resolution of medical equipment failures, the proper planning and implementation of maintenance procedures, and securing of the budget needed to do so.



Photo: BMEs inspecting medical equipment with doctors. (One BME in the front right and two in the back). Source: Website of the target hospital (RCH)

(4) Unexpected changes in circumstances and responses

According to the Project consultant and the medical staffs at the target facilities, without the establishment of the D/SBMEs and the presence of BMEs in the department, it would have been difficult to properly operate and maintain the procured equipment. At the time of the ex-post evaluation, BME, which is increasing its importance in each institution, is a position with a short history in Moldova. A department in this field was established at the Technical University of Moldova in the late 2000s, and the first graduates were produced in 2010. At the time of the start of the Project, the number of graduates from the Department was limited to around 100, and the recognition and status of the BME was low, therefore most graduates from the Department were working in other jobs and this situation was a major challenge to securing BMEs.

The MoH, which had a limited number of staff, also specialized in policy-making work, leaving treatment and services to each medical facility, and had limited involvement in services such as maintenance of medical equipment. The medical equipment was managed concurrently by the staff in charge of medicine, but their experience in maintaining medical equipment was also limited due to the structure whereby the department that handled medicines oversaw equipment. In a situation where the importance of maintenance and management was increasing, the recognition was low and recruitment and employment of the necessary personnel did not progress, the experts engaged in the Project and PIMDM requested the participation of the Deputy Minister of the MoH in the training in Japan organized by the PIMDM and conveyed the importance of medical equipment management through his participation in the training. This resulted in the assignment of a BME in charge of medical equipment at the MoH after his return. The placement of personnel with knowledge of medical equipment and its maintenance in key posts in the MoH, where personnel in charge of medicines were only previously available, has helped to share the importance of equipment maintenance and management, and has led to the establishment of a system for the maintenance and management of medical equipment at the five target facilities. This was the starting point for the development of a medical equipment management system⁴⁵.

(5) Resulted outcome

In the target medical facilities of the Project, the medical equipment procured has contributed to provide quality medical services. For example, the reduction of “the number of days of hospitalization for patients with endoscope intervention” (the operation and effect indicator set at the time of the appraisal), the provision of early diagnosis and timely treatment using modern and high-performance medical equipment (CT, angiography equipment, X-ray equipment, endoscopes, etc.), and the implementation of high-resolution tests by introducing X-ray equipment all help to reduce the burden on patients. The use of the sophisticated equipment also helped reduce the burden and workload of medical staff.

⁴⁵ Source: Hearing to the Project consultant

The PIMDM, which was implemented at the time of the installation of equipment in the Project, contributed to the efficient and effective use of the equipment, which is one of the synergy effects between the two projects. As noted by the medical staffs in the target facilities, medical equipment is properly maintained (according to manufacturers' recommendations) by D/SBMEs established through PIMDM support, and preventive maintenance and repair work is carried out promptly and regularly after Project completion. Considering the maintenance and management systems in each target facility and the understanding about the maintenance in Moldova at the time of formulation, it would have been difficult to ensure that the medical equipment procured would continue to be used effectively without the activities of the D/SBMEs. According to the MoH and medical staffs in the target hospitals, through the outcomes achieved in the target facilities, there is now a better understanding of the maintenance and management of medical equipment not only in the target facilities, but also in other medical facilities. In response to these changes, the MoH plans to identify and analyze the training needs of technical staffs in charge of medical equipment at medical facilities nationwide with the support of JICA in the future, in order to further strengthen the maintenance of medical equipment in regions as well⁴⁶.

5.2 Additionality

None

⁴⁶ From July 2022, JICA has launched a Technical Cooperation project, "Strengthening the Capacity of Medical Equipment Maintenance and Management," which supports the development of medical equipment management guidelines and the establishment of training programs for BMEs.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
<u>Major equipment</u>		
RCH	Operation microscope, C-arm with angiography, Equipment for neurosurgical operation theatre	Deleted: Equipment for neurosurgical operation theater, C-arm with angiography Added: Equipment for operation theater and ICU
MCI	CT, Anesthesia machine, X-ray mammography, Surgical endoscope, Endoscopic electrocautery	Deleted: CT, Anesthesia machine, Endoscopic electrocautery Added: Equipment and others for CSSD, operation theater and pathological prosecution room
EMI	CT, MRI, Angiography, Surgical endoscope	Added: CSSD equipment, mobile X-ray, Neuronavigation System
OI	CT, MRI, surgical endoscope, FISH Hybridizator, Anesthesia machine	Deleted: MRI, Surgical endoscope Added: CT (1), Ambulance, Genetic analyzer, Oscope
ST	CT, MRI, Angiography	Deleted: MRI Added: Equipment relating to operation theater, ICU and laboratory, and for CSSD
All target hospitals	Infusion pumps, monitors, etc.	As planned
CNSP and CSPs	Liquid Chromatography, Genetic analyzer, Safety Cabinet	As planned
<u>Consulting services</u>	1) Support for bidding works, briefing sessions and evaluation 2) Support for contract negotiations 3) Supervision of equipment delivery and installation 4) Coordination and implementation of training 5) Support for inspection after installation of equipment 6) Support for development of maintenance and management plans 7) Support for PSR and PCR preparation 8) Technical advice and coordination support for overall project operation	As planned
2. Project Period	June 2013-October 2015 (29 months)	June 2013-May 2018 (60 months)
3. Project Cost		
Amount Paid in Foreign Currency	5,907 million yen	5,722 million yen
Amount Paid in Local Currency	744 million yen (116 million Moldovan Lei)	1,729 million yen (260 million Moldovan Lei)
Total	6,651 million yen	7,451 million yen
ODA Loan Portion	5,907 million yen	5,698 million yen
Exchange Rate	1 Moldovan Lei = 6.37 yen (As of December 2012)	1 Moldovan Lei = 6.64 yen ((Average rate: June 2013-May 2018)
4. Final Disbursement	July 2018	

United Mexican States

FY2021 Ex-post Evaluation Report of Technical Cooperation Project

“The Project for Diversity Assessment and Development of Sustainable Use of Mexican Genetic Resources (SATREPS)”

External Evaluator: Hajime Sonoda, Global Group 21 Japan, Inc.

0. Summary

“The Project for Diversity Assessment and Development of Sustainable Use of Mexican Genetic Resources (SATREPS)” (hereinafter referred to as “the Project”) was implemented with the development of capacity for conservation, assessment, and sustainable use of Mexican genetic resources as the overall goal, and (A) establishment of stable conservation system and improved germplasm management system of the National Center for Genetic Resources (hereinafter referred to as “CNRG”) through the evaluation of genetic diversity and the establishment of conservation methods, and (B) development of CNRG policy for exchanging genetic resources as project purposes. The Project was consistent with Mexico’s development plans and needs both at the time of planning and at the time of completion, and the plan and the approach of the Project were appropriate. The Project is consistent with Japan’s ODA Policy at the time of planning, as well as synergistic with other JICA projects. Therefore, its relevance and coherence are high. The project purposes have been achieved on the whole through the strengthening of the genebank function for stable conservation and management of plant genetic resources at CNRG, and the exchange of genetic resources within and across countries through procedures based on international rules. As for the overall goal, it was confirmed that the expected results of the Project are being realized as CNRG is fulfilling its role as a central institution for promoting the conservation and sustainable use of Mexican genetic resources. Therefore, the effectiveness and impact of the project are high. The efficiency of the Project is high, as the outputs were realized as planned, and both the project period and the project cost were within the plan. There are no problems in the policy/system, institutional/organization aspect, or technical aspect related to the sustainability of the Project, but from a financial point of view, there are some problems in securing the research budget, and the sustainability of the effects achieved by the Project is moderately low. Based on the above, the Project is evaluated to be satisfactory.

1. Project Description



Project Location



Exterior view of CNRG

1.1 Background

Genetic resources are one of the strategic resources of our time, and their legal treatment is discussed in various international treaties. In the Nagoya Protocol to the Convention on Biological Diversity¹, the greatest challenge was to realize one of the objectives of the Convention, “access to genetic resources and the fair and equitable sharing of benefits arising from their utilization” (ABS: Access and Benefit-Sharing). Mexico is the fifth largest country in the world with diverse genetic resources, and there are many plant genetic resources of Mexican origin that are of global importance. The Mexican government has set forth its commitment to the conservation and protection of genetic resources in its *National Development Plan (2007-2012)*. CNRG was established in May 2011, with support of JICA’s technical cooperation (a dispatch of science and technology research fellows), as an operation base to encompass the conservation, protection, and sustainable use of genetic resources, including domestic animal, plant, and microorganism resources under the umbrella of the National Forestry, Agriculture and Livestock Research Institute (hereinafter referred to as “INIFAP”) of the Ministry of Agriculture and Rural Development.

Against this backdrop, the Mexican government requested Japan’s cooperation to strengthen the genebank function of CNRG, which conserves and manages genetic resources², and to establish policies for the domestic and international exchange of genetic resources. The Project

¹ The Convention on Biological Diversity (CBD), which entered into force in May 1993, is a treaty aimed at the conservation of biological diversity, the sustainable use of the components of biological diversity, and the fair and equitable sharing of benefits arising from the utilization of genetic resources. The Nagoya Protocol (official name: The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity) is an international instrument that establishes procedures to ensure the steady implementation of the ABS. It was adopted at the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity held in Nagoya, Aichi, Japan, in 2010.

² A genebank is a system for collecting and preserving a variety of genetic resources, such as seeds of wild and cultivated plants, sperm and eggs of wild and domesticated animals, and microorganisms, for use as agricultural products and medicines, as well as for the conservation of biodiversity, or a specialized institution and facility for this purpose.

was implemented from August 2013 to August 2018, as the Science and Technology Research Partnership for Sustainable Development (SATREPS).

1.2 Project Outline

Overall Goal	Capacity for conservation, assessment and sustainable use of Mexican genetic resources is developed.	
Project Purpose	A. Stable conservation system and improved germplasm management system of CNRG are established through the evaluation of genetic diversity and establishment of conservation methods, focusing on six target species. ³ B. CNRG policy for exchanging genetic resources is developed.	
Outputs	Output 1	Genetic diversity of the six target species is evaluated, and basis of sustainable utilization of the germplasm is established in CNRG.
	Output 2	Long-term conservation methods are established for target species.
	Output 3	Strategies for Access and Benefit Sharing (ABS) of genetic resources are defined in CNRG.
Total cost (Japanese Side)	325 million yen	
Period of Cooperation	August 2013-August 2018	
Target Area	Tepatitlán, Jalisco: National Center for Genetic Resources (CNRG)	
Implementing Agency	National Research Institute of Forestry, Agriculture and Livestock (INIFAP), Ministry of Agriculture and Rural Development	
Other Relevant Agencies/ Organizations	None	
Organization in Japan	University of Tsukuba, National Agriculture and Food Research Organization (NARO) (National Institute of Agrobiological Sciences during the cooperation period, integrated with NARO in 2018)	
Related Projects	“Scientific and Technical Research Fellowship: Building a Foundation for Sustainable Use of Mexican Genetic Resources” (JICA, July 2010-July 2012); training of CNRG researchers in Japan under the “Japan-Mexico Strategic Global Partnership Training Program” (JICA, Plant Genetic Resources, 2011-2012); third country training “Genebank Management” (JICA, 2017-2021).	

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

Two project purposes were established for this project that share the same overall goal. At the time of the terminal evaluation, the level of achievement of the three outputs is satisfactory. Project purpose A. is expected to be achieved and Project purpose B. has already been achieved.

³ The six target species for the Project are avocado, chayote, nopal, cacao, amaranth, and husk tomato.

1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation (including other impacts)

The overall goal of the Project is likely to be achieved three to five years after completion. In addition, CNRG has strengthened its relationships with national institutions and has established new relationships with regional and global partners through the Project. It is expected that such partnerships will be strengthened in the future.

1.3.3 Recommendations from the Terminal Evaluation

(1) Recommendations until the completion of the Project

It is necessary to complete some unfinished activities by the completion of the Project to ensure the achievement of the project purposes and outputs.

(2) Recommendations for post-project period

- Management and operational stabilization of CNRG as a core institution for genetic resources
- CNRG to become a center of national action for the conservation and use of biodiversity in Mexico
- Securing financial resources to continue CNRG's research activities
- Securing financial resources for the operation of the genebank
- Promoting teamwork in CNRG's laboratories
- Continued collaboration between CNRG and relevant Japanese institutions

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda (Global Group 21 Japan, Inc.)

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2021 - November 2022

Duration of the Field Study: March (by a local assistant), June 2022

2.3 Constraints during the Evaluation Study

Due to the pandemic of COVID-19, the first field survey was conducted through a local assistant. Information and data collected through interviews with the implementing agencies were carefully reviewed by the evaluator, and evaluation analysis and judgment were made considering the results of the second field survey.

3. Results of the Evaluation (Overall Rating: B⁴)

3.1 Relevance/Coherence (Rating: ③⁵)

3.1.1 Relevance (③)

3.1.1.1 Consistency with Development Plan of Mexico

At the time of planning (2013), the Mexican government, which places great importance on efforts to conserve and protect genetic resources, established “National Genetic Resources System (SINARGEN)”, an institutional framework that encompasses the conservation, protection, and sustainable use of genetic resources, including domestic animal, plant, and microbial resources. As part of this initiative, INIFAP established with its own funds CNRG in Tepatitlán, Jalisco, which will serve as the base of activities for SINARGEN. At the time of project completion (2018), among the goals of *Mexico’s National Development Plan (2013-2018)*, “Strategy 4.10.4 Promote sustainable use of the country’s natural resources” for “Prosperous Mexico” emphasizes the protection, conservation and utilization of genetic resources. Based on the above, the Project is consistent with Mexico’s development policies both at the time of planning and at the time of completion.

3.1.1.2 Consistency with Development Needs of Mexico

In Mexico, research on genetic diversity and conservation has been limited to major crops (wheat, maize, etc.) due to aging conservation facilities and lack of their management. At the time of planning, research on the conservation and management of region-specific genetic resources was limited, and there was an urgent need for research on the conservation and sustainable use of some tropical species for which long-term conservation is difficult. Through the Project, CNRG researchers gained appropriate practical experience in the conservation and management of genetic resources, however, it was still necessary to continue to acquire and accumulate specialized knowledge and skills in the conservation and management of genetic resources, and to enhance the genebank function of CNRG. Therefore, this Project is consistent with Mexico’s development needs both at the time of planning and at the time of completion.

3.1.2 Coherence (③)

3.1.2.1 Consistency with Japan’s ODA Policy

At the time of planning, Japan’s ODA policy was assisting Mexico to achieving an inclusive nation by promoting sustainable economic growth and spreading the benefits of economic development to the entire society. The Project corresponded to the cooperation program “Capacity Building for Climate Change Response (Promotion of Science and Technology Cooperation)” under the priority area of assistance “Global Environmental Issues” and the development issue

⁴ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁵ ④: Very High ③: High, ②: Moderately Low, ①: Low

“Strengthening Response to Global Climate Change” as stated in the Japanese government’s (Ministry of Foreign Affairs) Project Development Plan, and aimed at capacity building in the field of biodiversity through science and technology cooperation.

On the other hand, the Japan-Mexico Partnership Program (JMPP) was signed in 2003, with the aim of further strengthening bilateral technical cooperation and promoting economic and social development in other developing countries through triangular cooperation. The Project was expected to support the improvement of Mexico’s ability to respond to the above-mentioned global issues, and to disseminate and expand the results of such cooperation to third countries, including those in Latin America, through the JMPP’s initiatives and others.

Based on the above, the Project is consistent with Japan’s ODA policy at the time of planning.

3.1.2.2 Internal Coherence

By the time of the planning of the Project, the dispatch of long-term experts to CNRG through the “Scientific and Technical Research Fellowship: Building a Foundation for Sustainable Use of Mexican Genetic Resources (July 2010 – July 2012)” and the training of Mexican researchers in Japan through the “Japan-Mexico Strategic Global Partnership Training Program” (Plant Genetic Resources; January 2011, January 2012, and January 2013) provided CNRG with basic research systems and technologies of Japan for the management and utilization of genetic resources. The Japanese institutions involved in these collaborations became the collaborating institutions of the Project. This prior cooperation by JICA placed a basis for the implementation of the Project. After the start of the Project, JICA, the Mexican Agency for International Development Cooperation, and CNRG conducted a third country training program on genebank management for Latin American countries from 2017 to 2021, with a total of about 150 participants including online participation. This has strengthened the network of regional experts on genetic resources, which has led to an increase in the impact of the Project. Based on the above, the internal consistency of the Project is high, as there are other JICA projects that have specific synergistic effects with the Project.

3.1.2.3 External Coherence

As described in “1.1 Background”, the Project is consistent with international frameworks for the conservation and use of genetic resources, including the Convention on Biological Diversity and the Nagoya Protocol, and the Mexican government continues to develop the legal framework for its smooth implementation (see Sustainability for details). Regarding Goal 2 “Zero Hunger” of the SDGs adopted in 2015, Mexico’s *National Development Plan (2019-2024)* outlines measures to conserve biodiversity, improve such crops as sugarcane and coffee, and conserve, protect, restore, and utilize ecosystems and biodiversity. Conservation and utilization of genetic resources by CNRG is part of the activities for this purpose. Thus, the Project is consistent with

the international framework for the conservation and utilization of genetic resources and is also consistent with the Mexican government's commitment to the SDGs.

Based on the above, its relevance and coherence are high.

3.2 Effectiveness and Impact⁶ (Rating: ③)

3.2.1 Effectiveness

CNRG had been promoting the collection and conservation of plant and animal genetic resources as the central institution for ex situ conservation of genetic resources in Mexico. The Project aims to strengthen the genebank function of CNRG for sustainable conservation and management of plant genetic resources (Project Purpose A) through research on genetic diversity assessment and long-term conservation methods for genetic resources (Outputs 1 and 2). The Project also aimed to support the management of the international use of Mexican genetic resources in CNRG (Project Purpose B) through the establishment of examples for the transfer of genetic resources both domestically and internationally in accordance with international rules (Outputs 3).

3.2.1.1 Achievement of Outputs

CNRG, Tsukuba University, and National Institute of Agrobiological Sciences (now National Agriculture and Food Research Organization) conducted joint research mainly on six plant species (avocado, chayote, nopal, cacao, amaranth, and husk tomato) that are food crops native to Mexico and have regional and international economic value, but whose research has lagged due to their specific reproductive characteristics.

(1) Evaluation of genetic diversity and development of information infrastructure (Output 1)

The genetic diversity of the six target plant species conserved at CNRG and the national agricultural experiment stations of INIFAP was evaluated through the development of genetic markers, and the selection process of core collections of representative varieties/lines was carried out.⁷ Core collections for avocado and cacao were selected by project completion. As for avocado, after genetic marker evaluation of the genetic characteristics of each of the 319 lines conserved in CNRG, 36 lines were selected, covering about 80% of the different genetic characteristics of all 319 avocado lines. On the other hand, a database for the management of genetic resources of plants, animals, and microorganisms was established to meet the needs of CNRG and has been

⁶ When providing the sub-rating, Effectiveness and Impacts are to be considered together.

⁷ A genetic marker is the genetic characteristics (genotype) of an individual organism, or the DNA sequence unique to the individual organism that serves as the marker of the line. A core collection is a set of representative varieties/lines selected from conserved genetic resources. By selecting core collections, it is possible to efficiently conserve diverse genetic resources with genetically duplicated collections eliminated.

put into operation for CNRG researchers. In addition, a long-term maintenance plan for genetic resources in CNRG was discussed, and a maintenance program was developed reflecting this plan.

As a result, Output 1, “Genetic diversity of the six target species is evaluated, and basis of sustainable utilization of the germplasm is established in CNRG” was achieved in general by the end of the Project. According to interviews with the counterparts and the experts on Output 1, other important achievements are: the establishment of the working group has strengthened the cooperative and complementary relationship among researchers, and research has been conducted in a more systematic and organized manner; bioinformatics,⁸ a new specialized field in the assessment of genetic diversity, was introduced; important research equipment was acquired; etc.



DNA sequencers provided by the Project Next-generation DNA sequencers purchased by CNRG

(2) Development of long-term preservation methods for genetic resources (Output 2)

Aiming at stable and long-term preservation of genetic resources at CNRG, investigation was made on growth-suppressed and ultra-low temperature preservation methods for plants with hard-to-store seeds that are susceptible to dryness and low temperature. A simple cryopreservation method was developed using aluminum cryo-plates (cooling plates) and ultra-low temperature preservation techniques was established using cultured stem tops of chayote, potato, cacao, vanilla, etc., as materials. In addition, long-term preservation of amaranth, husk tomato, and nopal with orthodox seeds that can be preserved under dry and low-temperature conditions was conducted according to a newly developed manual.

As a result of the above, Output 2, “Long-term conservation methods are established for target species” was achieved by the end of the Project. According to interviews with the counterparts and the experts on Output 2, the Project’s important achievements include the mastery of growth-suppressed preservation (in vitro preservation) methods and ultra-low temperature preservation

⁸ It is an interdisciplinary field that combines various disciplines such as biology, computer science, information technology, mathematics, and statistics, and uses computers to analyze various information of living organisms such as genetic information.

methods for plant genetic resources to the point where they can be applied to various plant species, the storage of germplasm of important plant species at CNRG, and the strengthening of networks with domestic and foreign researchers.



Orthodox seeds stored in cold dry storage

Potatoes stored in growth-suppressed conditions



Cryopreservation using aluminum cooling plates (left and middle)

Cryopreservation chamber (right)

(3) Study of strategies for ABS (Output 3)

Based on the discussion of ABS (opportunities for the acquisition of genetic resources and the fair and equitable sharing of benefits arising from their utilization) in the Project, drafts of a guidance and a document of academic discipline on genetic research were prepared. However, these documents were not completed and published due to the ongoing debate on ABS among a wide range of stakeholders in Mexico. On the other hand, a model of the contractual format required for the transfer of genetic resources in accordance with international rules was developed, and this was used in the transfer of chayote genetic resources from Mexico to Japan for research purposes. Based on these experiences, the director of CNRG became a member of the ABS-related committee of the Mexican government and made recommendations on the national

strategy for promoting the use of genetic resources in Mexico and the development of the ABS-related procedures.

As a result of the above, Outputs 3, “Strategy for Access and Benefit Sharing (ABS) of genetic resources in CNRG is developed” was partially achieved by the completion of the Project. According to interviews with the counterparts and experts on Output 3, an important achievement was the realization of the transfer of chayote to Japan, which was publicized as a Mexican case on the Convention on Biological Diversity and the Nagoya Protocol.

3.2.1.2 Achievement of Project Purpose

Table 1: Achievement of Project Purpose

Project Purpose A: Stable conservation system and improved germplasm management system of CNRG are established through the evaluation of genetic diversity and establishment of conservation methods, focusing on six target species.	
<u>Indicator:</u> Plant genetic resources are introduced and conserved in CNRG according to the manual for conservation and management of plant genetic resources, and the information is made publicly available.	<u>Achievements:</u> A manual for ultra-low temperature preservation of genetic resources was prepared and distributed nationally and internationally. The orthodox seed conservation manual was completed three months after the project completion. A database of over 4,000 registrations of genetic resources of crops, forest trees, livestock, and microorganisms was maintained in CNRG’s genebank and made publicly available within CNRG’s offices.
Project Purpose B: CNRG policy for exchanging genetic resources is developed.	
<u>Indicators:</u> Genetic resources are exchanged nationally and internationally following the policies developed by the Project.	<u>Achievements:</u> The project prepared a contract form for the transfer of nopal from a domestic university and the transfer of chayote from a domestic research institute to CNRG. The transfer of chayote from Mexico to Japan was completed according to internationally agreed-upon procedures.

(1) Establishment of a stable conservation and management system for plant genetic resources (Project Purpose A)

Output 1 and Output 2 strengthened the function of the genebank of CNRG which stores and manages genetic resources. Although some manuals were not completed until three months after the completion of the Project, and the database was made available only within CNRG, the high level of achievement of Output 1 and Output 2 indicates that Project Purpose A was mostly achieved.

(2) Development of policies for the exchange of genetic resources (Project Purpose B)

Based on the policy developed in the Project, the domestic and international exchanges of genetic resources have been realized. However, with regard to Output 3, discussions by a wide

range of domestic stakeholders of genetic resources are still ongoing, and, although not within the scope of the Project, the development of a legal system for the exchange of genetic resources has not yet been realized. Based on the partial achievement of Output 3, it is judged that Project Purpose B has been generally achieved.

Based on the above, it is judged that the Project mostly achieved its purpose.

3.2.2 Impacts

3.2.2.1 Continuation of Activities after Completion of the Project

Due to the pandemic of COVID-19, the employment of research assistants, field research, exchanges with other institutions, etc., were restricted for about two years after March 2020, and the working hours at CNRG were limited, which stagnated research activities. However, the activities initiated under the Project have been continued as follows.

(1) Collection, evaluation, and conservation of genetic resources

Regarding the collection, evaluation, and conservation of genetic resources, after the completion of the Project, activities have continued mainly with plant species that have been adequately funded as research projects. According to CNRG, although the species targeted by the Project are those endemic to Mexico and for which research has lagged behind and their importance has not changed, commercially popular species such as bean, maize, and agave (an ingredient in tequila) are more likely to receive research funding.

Additional collection and long-term conservation of genetic resources are underway for chayote, amaranth, and vanilla among the plant species addressed by the Project, but the core collection is not yet complete. Research on physiological characteristics, biochemical properties, and seed preservation methods is underway in nopal. For avocados, research is ongoing to develop and improve long-term preservation methods. For other plant species, the following activities have been conducted to utilize the technologies and methods developed in the project.

- A research project to advance the creation and conservation of core collections by evaluating genetic resources for legumes is underway with a timeline of 2019-2023. Using the knowledge and technology gained through the Project, newly acquired bioinformatics has been applied, as well as morphological and biochemical characterization. The results will contribute to the nutritional utilization and promotion of legume breeding.
- In 2014, a project was initiated by the National Forestry Commission (CONAFOR) to collect, evaluate, and store forest tree genetic resources nationwide, where the technology developed in the Project was used. Diversity assessment using genetic markers was conducted for pine, douglas fir, and other forest species, and the Project's technology was used for the long-term

preservation of pine, mahogany, etc.

In addition, a project for the evaluation and long-term conservation has been implemented for ex situ conservation of genetic resources of wild maize and bean species. Technologies for evaluation and conservation in the Project were also applied to garlic and agave.

The new technologies obtained by CNRG through the Project are also linked to the provision of new services needed by private companies and government agencies. For example, technologies to evaluate genetic diversity will be used to assess whether appropriate genetic diversity is being maintained for animal and plant breeding, and to analyze factors that contribute to population declines in nature. On the other hand, as specific plant growth suppression and cryopreservation procedures need to be developed for each species, CNRG can develop and provide the procedures necessary for private seed companies and others in introducing new species. Furthermore, although not directly related to the results of the Project, the training for CNRG's animal and fish-related researchers in Japan through the Project contributed to the provision of services such as sperm evaluation and cryopreservation that private companies require.

(2) Utilization of the genebank

The number of genetic resources stored in CNRG's genebank is continuously increasing after the completion of the Project by accepting genetic resources sent from the experimental stations of INIFAP, the National Commission for Knowledge and Use of Biodiversity (CONABIO) of the Mexican government⁹, international institutions and universities that store Mexican genetic resources, and others. The genetic resources conserved by CNRG as of June 2022 are shown in Table 2.

⁹ It had been decided that all genetic resources collected by CONABIO in the field of agrobiodiversity, which is being implemented through a public call starting in 2019, in a project aimed at "securing the future of global agriculture in the face of climate change by conserving the genetic diversity of traditional agroecosystems in Mexico," will be stored in CNRG. According to CNRG, this has led to an increase in the storage of genetic resources in its genebank, as well as an increase in inquiries from other institutions to CNRG regarding genetic resources.

Table 2: Genetic Resources Conserved in CNRG's Genebank

	Number of conserved genetic resources
Orthodox seeds (dried and low temperature store)	Crops: 26,296 lines Forage crops: 1,249 lines Forest trees: 1,975 lines
Recalcitrant seeds (cryopreservation)	Crops: 223 lines (2,367 specimens) Forest tree: 58 lines (580 specimens)
Botanical garden	Crops: 154 lines Forest trees: 474 lines
Others	DNA: 29,519 specimens Sperm of domestic animals / aquatic organisms: 24,697 specimens Embryo: 138 specimens Oocyte: 1,549 specimens Microorganisms: 491 lines (1,519 specimens)

Source: Prepared from materials provided by CNRG

In the forest tree sector, there was a large collection of genetic resources in the project by CONAFOR mentioned above. In addition, an agreement between the National Seed Inspection and Certification Service (SNICS) and CNRG, which was being prepared at the time of the ex-post evaluation, will require SNICS certified seed dealers to store 1 kg of seed at CNRG. Also in the animal sector, genetic resources from breeders' associations and other organizations are accepted. Many seeds have been stored at INIFAP facilities around the country since the 1950s, but these genetic resources have not been integrated into CNRG's genebank yet. It is planned that INIFAP will finish verifying the information on these seeds and registering them in CNRG's database by 2023, and then the all the genetic resources stored by INIFAP will be integrated into CNRG's genebank. On the other hand, since the completion of the Project, genetic resources from CNRG's genebank have been provided several times to other INIFAP experimental stations and domestic universities for research purposes.

Thus, CNRG's genebank will continue to be utilized after the completion of the Project and further development is expected in the future. For now, CNRG is focusing on the collection of domestic genetic resources and not yet on their distribution. However, to accelerate the collection of genetic resources in CNRG's genebank, it is necessary to disseminate correct information about its role and further strengthen the trust relationship with relevant parties in Mexico.¹⁰

¹⁰ According to CNRG, the transfer of chayote genetic resources to Japan under the Project gave rise to the misconception that CNRG was giving away Mexican genetic resources to a foreign country. In reality, the chayote was transferred not from CNRG, but from a domestic producer organization, and the transfer was based on international rules for ABS. There is also a misconception that once a genetic resource is deposited with CNRG, the person responsible for its original management would not be free to use them. In reality, CNRG is a place for safe long-term



Seeds of 590 lines of amaranth received from other facilities of INIFAP (left and middle)
Seed sorting operation (right)

(3) Access to genetic resources and benefit sharing (ABS)

The Ministry of Agriculture and Rural Development established the Sectoral Committee on Genetic Resources for Food and Agriculture in 2020 with the objective of coordinating stakeholders who stand on the side of producers regarding the conservation of genetic resources, the equitable distribution of benefits from their sustainable use, and of consolidating their opinions and reflecting them in Mexican government policies. The director of INIFAP is a permanent member of the Committee, and the Director of CNRG participates in its meetings on his behalf. There are four subcommittees: Agriculture, Fisheries, Livestock, and Invertebrates and Microbes, and CNRG is the chair of the Invertebrates and Microbes subcommittee. CNRG researchers contribute through the work of each subcommittee.

In order to develop a legal framework for the smooth implementation of the Convention on Biological Diversity and the Nagoya Protocol, the Inter-Sectoral Working Group established by the Ministry of Environment, as the focal point of the Convention, has been collecting opinions, paying due attention to the protection of the rights of indigenous peoples and people of African descent, in line with the current administration's policy. INIFAP contributes by participating in the working group as the representative of the production sector, and CNRG contributes by always attending its meetings.¹¹

storage and backup of the owner's genetic resources and does not transfer them to others without a transfer agreement based on the consent of the original custodian. CNRG is working to clear up these misunderstandings through various national conferences and events on genetic resources and through individual meetings with relevant institutions.

¹¹ In the past, the collection of genetic resources for research required only the consent of the local government, but under the current administration, the consent of a number of indigenous groups is required in addition. This is very time consuming and there is a risk that researchers will skip the procedure. Under the current administration's policy, the Inter-Sectoral Working Group is aiming for an approach that emphasizes the human rights of indigenous peoples and prioritizes the protection of genetic resources. On the other hand, the production sector, such as the Ministry of Agriculture and Rural Development, is concerned that excessive protection may hinder the utilization of genetic resources for breeding and other purposes, and the Sectoral Committee is gathering the opinions of the production

A report from the Japanese side on the use of the transfers of chayote to Japan for research purposes realized through the Project was submitted to the Ministry of the Environment and approved after evaluation. The website of the Secretariat of the Convention on Biological Diversity has registered six transfers of Mexican genetic resources under the Nagoya Protocol (five domestic transfers and one international transfer) that were realized after the chayote transfer; according to CNRG, there are several other transfers that are currently in preparation. For these transfers, the format for genetic resources transfer agreements prepared by the Project is being used.

(4) Genebank-related networks

Through JICA's 2017-2021 third-country training on genebank management, a network of more than 100 genebank experts in Latin America was established. The trainees have since continued to engage in technical discussions, publicize events, and share experiences through social networking sites. The network also contributed to facilitating the registration of information in the online genetic resources database of The Tropical Agricultural Research and Higher Education Center (CATIE). In addition, trainees participated in a project for the conservation of Mesoamerican wild cereals conducted by the Darwin Initiative of the UK, and some of the project's training was also conducted at CNRG.

3.2.2.2 Achievement of Overall Goal

As mentioned above, CNRG is fulfilling its role as a central institution for promoting the conservation and sustainable use of Mexican genetic resources, and it is judged that the Overall Goal "Capacity for conservation, assessment and sustainable use of Mexican genetic resources is developed" has been achieved.¹² After the completion of the Project, activities to maintain and strengthen each Output of the Project have continued, indicating that the Project has played an important role in strengthening CNRG's genebank function and has contributed to the achievement of the Overall Goal.

3.2.2.3 Other Positive and Negative Impacts

At the time of planning, it was stated that the Project would promote researches for the conservation and appropriate use of genetic resources and that there was little risk of negative environmental and social impacts. According to CNRG, the Project is a collaborative research on genetic resources and has no notable direct impacts on the natural environment, resettlement and land acquisition, gender, vulnerable groups and human rights, social systems, norms, and people's

sector before entering negotiations. The Inter-Sectoral Working Group has not yet released the relevant bills to the public by the time of the ex-post evaluation.

¹² No specific indicators have been established to determine the level of achievement of the Overall Goal.

well-being.

It is expected that the Project will emphasize ABS considerations for indigenous species in Mexico, thereby ensuring that indigenous and local people who provide genetic resources of indigenous species will receive appropriate benefits. In addition, it is expected that research results by CNRG based on the Project, or research results using genetic resources stored at CNRG, will be utilized in the agricultural sector through the improvement of varieties in the agriculture, livestock, and forestry sectors.

As a result of the implementation of the Project, the Project Purposes of “Stable conservation system and improved germplasm management system of CNRG are established through the evaluation of genetic diversity and establishment of conservation methods, focusing on six target species” and “CNRG policy for exchanging genetic resources is developed” were achieved in general. As for the Overall Goal, it was confirmed that CNRG is fulfilling its role as a central institution for promoting the conservation and sustainable use of Mexican genetic resources, and the Project is showing results as planned. Therefore, the effectiveness and impacts of the Project are high.

3.3 Efficiency (Rating: ④)

3.3.1 Inputs

3.3.1.1 Inputs

The table below shows the planned and actual inputs to the Project from the Japanese and Mexican sides. In addition to the experts dispatched by the Japanese side, about 30 Japanese researchers were involved in the joint research at the partner institutions in Japan.

According to the terminal evaluation, inputs were adequate for both from Japan and Mexico. A total four joint coordination committee meetings were held for project management, and there were no particular communication problems in conducting the joint research through daily e-mails and videoconferences. According to the interviews with the experts and CNRG during the ex-post evaluation, the project management was appropriate and there were no major implementation issues. CNRG believes that the technology transfer was sufficiently conducted through visits, communication, and training in Japan by Japanese researchers.

Table 3: Planned and Actual Inputs

Input elements	Plan	Actual Results
(1) Dispatch of experts	Long-term experts: genebank management, plant genetic resources Short-term experts: plant genetic resources, tissue culture, ultra-low temperature preservation, information management Coordinator	2 long-term experts (60.9 person-months) 13 short-term experts (30.6 person-months) 2 coordinators (50.9 person-months)
(2) Trainees accepted	Trainees accepted	Total 49 (53.2 person-months)
(3) Equipment	Materials and equipment required for project activities	Analytical equipment, vehicles, etc. (10.7 million MEX)
(4) Operational cost	-	7.7 million MEX
Total project cost of the Japanese side	370 million yen	325 million yen
(5) Assignment of human resources of the Mexican side	Project director Project manager Researchers: orthodox seeds, tissue culture, molecular biology, animal genetic resources, microbial genetic resources, information management	Project director Project manager 55 researchers
(6) Office Environment	Office space, equipment space, etc.	Office space, equipment space, etc.
(7) Materials and equipment on the Mexican side	Materials and equipment required for research	Materials and equipment required for research (20.2 million MEX)
(8) Project cost burden on the Mexican side	Domestic travel and operating expenses	4.4 million MEX (domestic travel expenses, analytical instrument maintenance and management expenses, consumable supplies, etc.)

Source: Prepared from material provided by JICA (at the time of planning: ex-ante evaluation sheet, R/D; actual results: the terminal evaluation report)

Note: 1 MEX (Mexican peso) = 6.0 yen (November 2017)

3.3.1.2 Project Cost

The actual project cost of the Japanese side was 325 million yen (88% of the planned amount) against the planned 370 million yen, being the actual amount smaller than the planned amount. The Mexican side bore approximately MEX 24.6 million (equivalent to about 150 million yen), including purchase of research equipment, domestic travel expenses, consumables for analytical instruments, and maintenance costs. It should be noted that the experts pointed out that while research dealing with living organisms is prone to unexpected events, the lack of flexibility in the

JICA budget execution procedures made it difficult to respond.

3.3.1.3 Project Period

The project period for the Project was five years, from April 2013 to March 2018, as planned. According to the terminal evaluation, there were some delays but none of them were major delays, and the activities were implemented almost as planned. According to CNRG, researchers in other sections of INIFAP did not provide genetic resources of husk tomato as planned, which made it difficult to secure materials for research. In some cases, the security situation in the country affected access to genetic resources of the target species.

As described in “3.2.1.1 Achievement of Outputs,” the achievement level of the outputs is high.¹³ Since the project cost was within the plan and the project period was as planned, the efficiency of the project is judged to be very high.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

The National Development Plan (2019-2024) of the López Obrador administration, launched in December 2018, mentions, among other things, the guarantee of the right to adequate food of nutritious good quality and the conservation of agrobiodiversity and biodiversity in relation to genetic resources. The Mexican government’s commitment to CNRG can be confirmed by the fact that it constructed CNRG with its own funds and has made a reasonable financial contribution to the Project.¹⁴

As described in “3.2.2.1 (3) Access to Genetic Resources and Benefit-Sharing (ABS),” “the Ministry of Agriculture and Rural Development established in 2020 the Sectoral Committee on Genetic Resources for Food and Agriculture. Whereas the National Genetic Resources System established by the previous administration had no guaranteed financial resources¹⁵, the Sectoral Committee has a secretariat and secures government budget allocations based on law. There has been no change in Mexico’s policy regarding the Convention on Biological Diversity and the Nagoya Protocol, and discussions are continuing in the “Inter-Sectoral Working Group” to develop a legal system for genetic resources.¹⁶ On the other hand, Mexico is a signatory to the International Treaty on Plant Genetic Resources for Food and Agriculture, but has not yet ratified

¹³ Output 3 (Study of strategies for ABS) was only “partially achieved,” but this was due to external factors and not due to implementation problems. Given that Output 3 had fewer inputs than the other outputs, its impact on efficiency is considered minor.

¹⁴ The Minister of Agriculture and Rural Development, who attended the event marking the 10th anniversary of the establishment of CNRG (June 16-17, 2022), stated that he considers CNRG an important facility for national security.

¹⁵ See “3.1.1.1 Consistency with Development Plan of Mexico.”

¹⁶ See footnote 11 under “3.1.1.1 Consistency with Development Plan of Mexico.”

it.¹⁷

Based on the above, there are no issues with the sustainability of the Project in policy and system aspect.

3.4.2 Institutional/Organizational Aspect

The organizational structure of CNRG has not changed since the time of planning. As of April 2022, there are 31 staff members (including 15 researchers and 9 technicians), up from 29 at the time of planning. The average age of the staff is 40 years, and the average length of service in CNRG is 6 years and 5 months (6 employees have been with the organization for less than 3 years). According to CNRG, the salary level is lower than in the private sector, but similar to the general level in public institutions in Mexico, and there are not many transfers out. Vacancies are constantly being filled, and there are no particular challenges in the employment system nor in recruitment. In addition, according to the experts, the relative ease of obtaining continuous research funding is an incentive for researchers to stay.

CNRG maintains continuous collaboration with other research organizations of INIFAP, government agencies, and universities, and is also ready to work with the private sector through the Sectoral Committee and the Inter-Sectoral Working Group. Through its research projects, CNRG has also had cooperative relationships with government agencies such as the Ministry of Agriculture and Rural Development, the National Commission for Knowledge and Use of Biodiversity, and the National Forestry Commission, universities and research institutions, private companies (tequila, dairy products, organic fertilizers, etc.), and producer organizations (livestock producers, etc.). In addition, a network of genebank specialists from Latin American countries has been established through JICA's training in third countries.¹⁸ Relationships have also been maintained with cooperating institutions on the Japanese side, for example through a joint research conducted by CNRG staff studying in the doctoral program at the University of Tsukuba.

As described above, CNRG's organization structure, as well as its relationships with related domestic and foreign institutions, are stable, and there are no issues regarding the sustainability of the institutional/organizational aspect of the Project.

3.4.3 Technical Aspect

CNRG is accredited for international standards in quality management (ISO 9001-2008) and laboratory (ISO/IEC17025:2005). Eleven of CNRG's 15 researchers hold doctoral degrees and

¹⁷ While coordinating with rules of the Convention on Biological Diversity and the Nagoya Protocol, this treaty establishes the "system between many nations" based on the actual usage of plant genetic resources, and smoothly conducts the ABS in this field. According to CNRG, its ratification is being discussed in the Inter-Sectoral Working Group, and Mexico will first need to examine and organize its domestic genetic resources.

¹⁸ See "3.3.2.1 (4) Genebank-related networks."

two are enrolled in doctoral programs. The other two will start their doctoral studies by 2024. In addition, according to INIFAP policy, all the researchers and technicians of CNRG always participate in training in related fields.¹⁹

Of the 22 researchers and technicians assigned as counterparts from CNRG at the completion of the Project, 17 (77%) remained at the time of the ex-post evaluation. The manuals and other materials prepared by the Project are continuously used, and the techniques obtained through the Project are applied to other plant species. All the analytical instruments and other research equipment provided by the Project are in good working condition and are being used for research activities. Furthermore, according to the counterpart, “organized and systematic research activities through collaboration among researchers” based on the experience of joint work with the experts and training in Japan are continuing at the time of the ex-post evaluation.

Based on the above, the technical level of CNRG is high, and there are no issues with the sustainability of the technical aspects of the Project.

3.4.4 Financial Aspect

CNRG’s budget and expenditure for 2019-2021 are shown in Table 4. Due to the new administration’s policy of stricter control of government agencies’ expenditures, increased government spending due to COVID-19, and the economic downturn, all government agencies were required to return a quarter of their allocated budgets to the treasury in 2020. INIFAP made up for this with funds it had accumulated for facilities and equipment, and CNRG’s budgeted expenditures for 2020-2021 have been maintained at a level of approximately 27 million MEX. The Genebank operating budget for the collection, conservation, and distribution of genetic resources and the maintenance budget for research equipment are included in the fixed costs, and according to CNRG, a certain budget has been maintained.

Table 4: Budgeted Amounts and Expenditures of CNRG (in thousand MEX)

	2019	2020	2021
Budget	29,180	27,330	29,199
Expenditure	27,873	27,133	27,066
Fixed costs*	17,843	24,098	21,619
Research project**	10,030	3,038	5,447

Source: Prepared from materials provided by CNRG

Notes *2020 includes 4,528,000 MEX for the installation of solar power generation and storage facilities in case of power outages.

** Includes budgets for research projects by INIFAP, and budgets for research projects by other government agencies, private companies, etc., and income from the provision of services.

¹⁹ Examples of training provided by INIFAP and received by CNRG researchers include quality management systems, climate change, the International Convention for the Protection of New Varieties of Plants, ISO 19011:2018 management system audits, and intellectual property rights.

In this regard, research project budgets have decreased significantly since 2020. CNRG is allocated a multi-year research project budget by the INIFAP headquarters based on each researcher's application to the open call, which pays for salaries of research assistants (technicians), purchase of supplies and equipment for research, and travel expenses for field activities. However, due to fiscal austerity, there were no open calls for research projects in 2020 and 2021. The research project budget is a valuable source of funding for the introduction of the state-of-the-art analytical and informatics equipment, and its decline could lead to a stagnation of CNRG's technical capacity. CNRG hopes that the open call will resume in 2022, but as of June 2022, the outlook for this is uncertain. It should be noted that CNRG has been working to obtain research project budgets from other government agencies, private organizations, and other sources, including 36 million MEX from the National Forestry Commission. It has also provided services such as analysis and storage of genetic resources to external organizations, which resulted in revenues of approximately 1.3 million MEX in 2021.

Based on the above, the financial sustainability of the Project is partially challenged in terms of securing research project budgets.

3.4.5 Environmental and Social Aspect, Preventive Measures to Risks

There are no issues that need to be noted with regard to environmental, social, or other risks to the sustainability of the Project.

3.4.6 Status of Operation and Maintenance

The Project does not include the provision of large-scale facilities and equipment and is not applicable.

Based on the above, some minor issues have been observed in terms of the financial aspect, and the prospects for improvement is unclear. Therefore, sustainability of the Project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented with the development of capacity for conservation, assessment, and sustainable use of Mexican genetic resources as the overall goal, and (A) establishment of stable conservation system and improved germplasm management system of CNRG through the evaluation of genetic diversity and the establishment of conservation methods, and (B) development of CNRG policy for exchanging genetic resources as project purposes. The Project was consistent with Mexico's development plans and needs both at the time of planning and at the time of completion, and the plan and the approach of the Project were appropriate. The Project

is consistent with Japan's ODA Policy at the time of planning, as well as synergistic with other JICA projects. Therefore, its relevance and coherence are high. The project purposes have been achieved on the whole through the strengthening of the genebank function for stable conservation and management of plant genetic resources at CNRG, and the exchange of genetic resources within and across countries through procedures based on international rules. As for the overall goal, it was confirmed that the expected results of the Project are being realized as CNRG is fulfilling its role as a central institution for promoting the conservation and sustainable use of Mexican genetic resources. Therefore, the effectiveness and impact of the project are high. The efficiency of the Project is high, as the outputs were realized as planned, and both the project period and the project cost were within the plan. There are no problems in the policy/system, institutional/organization aspect, or technical aspect related to the sustainability of the Project, but from a financial point of view, there are some problems in securing the research budget, and the sustainability of the effects achieved by the Project is moderately low. Based on the above, the Project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

In order for CNRG to further develop and fulfill its mission based on the results of the Project in the future, INIFAP and CNRG need to address the following issues.

- Ensure an adequate research budget, by publicizing the role and capabilities of CNRG and actively seeking funds not only from government funds, but also from outside organizations interested in the conservation and utilization of genetic resources.
- While strengthening the trust relationship with relevant domestic institutions, promote the integration of other genebanks of INIFAP into CNRG's genebank, and promote further collection of genetic resources by accepting genetic resources from other domestic and foreign institutions.
- Enrich the database of CNRG's genebank, gradually expand the scope of information disclosure, and promote the use of genetic resources by transferring them domestically and internationally based on international rules to meet the needs of research, breeding, etc.
- Further expand collaboration with specialized institutions and researchers in Latin America by organizing international events and trainings on genetic resources to strengthen CNRG's role as a regional technical center.

4.2.2 Recommendations to JICA

JICA will encourage the implementation of the above recommendations by INIFAP and CNRG

and monitor their implementation.

4.3 Lessons Learned

Diversified and continuous research cooperation utilizing various schemes

CNRG was constructed by the Mexican government with its own budget, and its launch was preceded by a two-year of Scientific and Technical Research Fellowship and three batches of training of Mexican researchers in Japan under the “Japan-Mexico Strategic Global Partnership Training Program.” The Japanese institutions involved in these collaborations became cooperating institutions for the Project. In addition, after the start of the Project, a third country training program on genebank management for Latin American countries was held from 2017 to 2021. Such a high level of commitment on the Mexican side, a series of cooperation through the coordination of various JICA schemes against this background, and the continuous involvement of the Japanese cooperating institutions are considered to have led to the very high evaluation of the Project. Therefore, in research cooperation where there are specific cooperating agencies on the Japanese side, it is important to confirm the commitment of the partner country and to conduct multifaceted and continuous cooperation by utilizing various schemes.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective perspective (N/A)

5.1.2 Subjective perspective (retrospective) (N/A)

5.2 Additionality

None in particular.

END

Country Name

Kyrgyz Republic

< Project Name > The Project for Improvement of Equipment of The Manas International Airport



Project Site (source: JICA Project Report)



Air Navigation Facilities:, VHF Omni-directional Range (VOR) / Distance Measuring Equipment (DME) (source: JICA)



Inside of the VOR/DME (source: JICA)

I. Project Outline

Background

Air transport plays an extremely important role as a means of transport to support socio-economic activities for a landlocked country such as the Kyrgyz Republic. While four international airports and seven domestic airports are operational in the Kyrgyz Republic, the Manas International Airport (MIA) is its largest international airport, with a 4,200 m runway, located approximately 30 km northwest of the capital Bishkek. The airport was built in 1974 and modernized in 1996 under the Bishkek-Manas International Airport Modernization Project, financed through Japanese ODA loan, which included runway improvements and terminal building renovation. As of 2011, 232 international flights and 154 domestic flights per week operated. The number of passengers on international and domestic flights reached approximately 1.17 million and 510,000, respectively, in 2014. In particular, the number of passengers on international flights showed a high average annual growth rate of more than 15% over a six-year period from 2008 to 2014. With MIA accounting for about 60% of the country's air traffic and 43% of domestic traffic, the airport plays an important role as a gateway to other countries and a hub for domestic traffic. Since the number of flights on both international and domestic routes was expected to increase further in the future, there was an even greater need to ensure on-time operations and safety.

However, landing is often impossible during low visibility conditions such as the presence of dense fog, etc., especially in winter, and the aging of air navigation facilities could hinder safe operations. In addition, the ground support equipment for efficient airport operations was aging, and there were concerns about shortages because of aviation demand. Therefore, there was a need to improve air security equipment and ground support equipment at MIA.

Objectives of the Project

The project aims to ensure safe and efficient airport operations by improving maintenance of air navigation equipment and ground support equipment at MIA, thereby contributing to improving the safety and reliability of the airport and aircraft operations.

Contents of the Project

1. Project Site: Manas International Airport, Bishkek city, Kyrgyz Republic (Population: Approximately 5.66 million as of 2014).
2. Japanese side:

- (1) Procured Equipment: Air Navigation Facilities (Instrument Landing System : ILS¹, VHF Omni-directional Range: VOR / Distance Measuring Equipment: DME²) , Ground Support Equipment for Aircraft (Snow blower, Aircraft Tow Tractor, Belt loaders, etc.), Airport Firefighting Vehicle
- (2) Consulting Service: Detail Design, Supervision of Procurement (there was no soft component service.)
- 3. Kyrgyz Republic side:
Preparatory works for installation of the equipment including site preparation, removal of existing structures prior to installation of the equipment, supply of electric power

Implementation	E/N Date	October 26, 2015		
Schedule	G/A Date	October 26, 2015	Completion Date	May 30, 2018
Project Cost	G/A Grant Limit: : 1,630 million yen, Actual Grant Amount: 1,540 million yen			
Executing Agency	Ministry of Transport and Communications			
Contracted Agencies	Main Contractors: Airport Firefighting Vehicle / Ground Support Equipment: Ogawa Seiki			
	Air Navigation Facilities: NEC Enterprise Solutions, America EMEA			
	Main Consultants: Joint Venture of the Nippon Koei and the Japan Airport Consultants Agent: N/A			

II. Result of the Evaluation

Summary

1. This project intends to provide air navigation safety equipment and ground support equipment, etc., contributing to enhancing the safety and efficiency of the airport.
2. The objective is consistent with Kyrgyzstan's development policy, the country's need for improved air transport safety and efficient airport operations as effective development of the aviation sector ensures sustainable economic development, and Japan's aid policy. It is also consistent with other Japanese assistance and support from other donors and has high relevance and consistency. Clarified through the preceding Manas International Airport Modernization Project (L/A signed: 1996), the Airport Construction, Operation and Maintenance Planning Training (Training Program related ODA Loan: 2012) and Aviation Security country training in 2014, which provided opportunities to learn the state-of-the-art operation and management methods and aviation security systems of actual Japanese airports, etc., aligned the safety with operational needs. It also complements the support of other assistance agencies. In the ex-post evaluation, it was confirmed that operations during adverse weather conditions with low-level clouds and low visibility have improved and that ground support equipment and other equipment have been upgraded to prevent significant delays and accidents. Improvement in both incidence and duration of delays, common during the winter season, was confirmed, enhancing the safety and reliability of the airport and aircraft operations. In 2020, however, the occurrence of the COVID-19 pandemic significantly decreased aircraft operations, but from 2021 onwards, the number of scheduled flights has recovered and new routes have been developed to accommodate the increasing number of flights. Based on this information, the effectiveness and impact of the project is high. Although the project period was slightly longer than planned, the project costs are still within the plan and the efficiency of the project is high. As there are generally no problems with the operation and maintenance management system, technology, and finances, the sustainability of the project effect is high. In light of the above, this project is evaluated to be highly satisfactory.

Overall Rating ³	A	Relevance & Coherence	③ ⁴	Effectiveness & Impacts	③	Efficiency	③	Sustainability	③
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<Special Perspectives Considered in the Ex-Post Evaluation/Constraints of the Ex-post Evaluation>

¹ Radio equipment that displays the course of entry when an aircraft lands on a runway (Instrument Landing System: ILS) is a landing aid device that emits directional radio waves to an aircraft approaching for landing, indicating the exact direction of the runway, angle of approach process and position on the approach course. When landing by ILS, the runway sight distance (the maximum distance at which the pilot of an aircraft on the runway centre line can see the runway centre line lights, etc.) and the landing decision altitude (the height above the end of the runway at which the decision to land or go-around is made) are determined according to category. The higher the category number, the lower the landing decision altitude, which allows for landing in bad weather and at low visibility.

² A radio device that provides aircrafts with directional and distance information from an all-directional radio beacon station.

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ④: Very high, ③: High, ②: Moderately low, ①: Low

In January 2017, before the aircraft equipment provided under the project became operational, a cargo flight crashed near MIA due to poor visibility, killing all four crew members and 35 residents near the airport.

Due to the spread of COVID-19, local information necessary for evaluation was collected through remote surveys from Japan. Interviews with the implementing agency, MIA, and others conducted online by the evaluator.

1 Relevance/Coherence

< Consistency with the Development Policy of Kyrgyz Republic at the period of ex-ante evaluation >

Under the *Medium-Term Development Program for 2012–2014* (formulated in 2012), the Kyrgyz Government identified the urgent need to upgrade and modernize aviation security equipment, and under the *Civil Aviation Development Strategy for 2013–2020* (formulated in 2013), the government stated that effective development of the aviation sector would ensure sustainable economic development in Kyrgyzstan. The project is in line with these policies, as one of the objectives of the *Strategy for Aviation Development 2013–2020* is to improve air transport safety and strengthen airport security as a guarantee for the sustainability of Kyrgyzstan's economic development.

< Consistency with the Development Needs of Kyrgyz Republic at the period of ex-ante evaluation >

While aviation demand is expected to increase, the aviation security equipment is aging. As a result there are concerns about the impact on on-time and safety operations. The modernization of the equipment at MIA, the main airport, is an urgent issue for safety and efficient operation of the airport, and this project corresponds to these needs.

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

In the Country Assistance Plan for Kyrgyzstan (2012), the transport sector, including MIA under the project, is identified as one of the priority areas in the "Maintenance and improvement of transport infrastructure and mitigating regional disparities." Therefore, the project was in line with the policy of Japan towards the Kyrgyz Republic during the Ex-Ante Evaluation.

<Internal Coherence>

The Airport Construction, Operation and Maintenance Planning Training (Yen loan account training: 2012), as well as the 2014 national training, were highly appreciated by the implementing agencies for effectively bringing together various stakeholders, including the aviation administration, the maintenance and management of MIA, and the implementing agencies responsible for aviation safety, to gain knowledge on how to make the airport safer through the utilization of equipment to be developed under the project. As there are limited opportunities to receive direct on-site briefings on operating the latest airport safety equipment, the series of training, which provided opportunities to deepen the understanding of improving airport safety equipment, is considered to have had a synergistic effect on the maintenance and management of the equipment maintained under the project.

< External Coherence >

Before the project, the tarmac, runway, and control tower were constructed with assistance from USA. Subsequently, the provision of equipment under the project led to a comprehensive improvement in airport safety. The synergistic effect of the project is high, as the surrounding infrastructure (from the USA) and equipment (from Japan) have been developed. Furthermore, the International Civil Aviation Organization (ICAO) has provided technical assistance intermittently since 2017, targeting aviation safety and applying modernized equipment.⁵ The implementing agencies have coordinated and utilized the support of other donor agencies to ensure safe operations and efficient airport operations, and synergies with the project can be confirmed, so external consistency is high.

<Evaluation Result>

In light of the above, the relevance and coherence of the project are high⁶.

⁵ No Country Left Behind" success: a Significant Safety Concern resolved!. Retrieved February 2022, from ICAO website: https://www.icao.int/EURNAT/Pages/news_articles/NoCountryLeftBehind-success.aspx

⁶ Relevance: ④③②①, Coherence:④③②①

<Project logics for impact realization >

At the time of the Ex-Ante Evaluation, MIA played an important role as a gateway to other countries and as a hub for domestic transport, and the number of international and domestic flights was expected to increase, requiring the guarantee of on-time operations and safety. The project was implemented to improve the safety and reliability of aircraft operations (impact) by enhancing air navigation and ground support equipment (output) to ensure on-time operations and safety (outcome) to cope with the increased number of flights. Figure 1 summarizes the logistics of the project from its implementation to the development of its impact, as envisaged during planning.

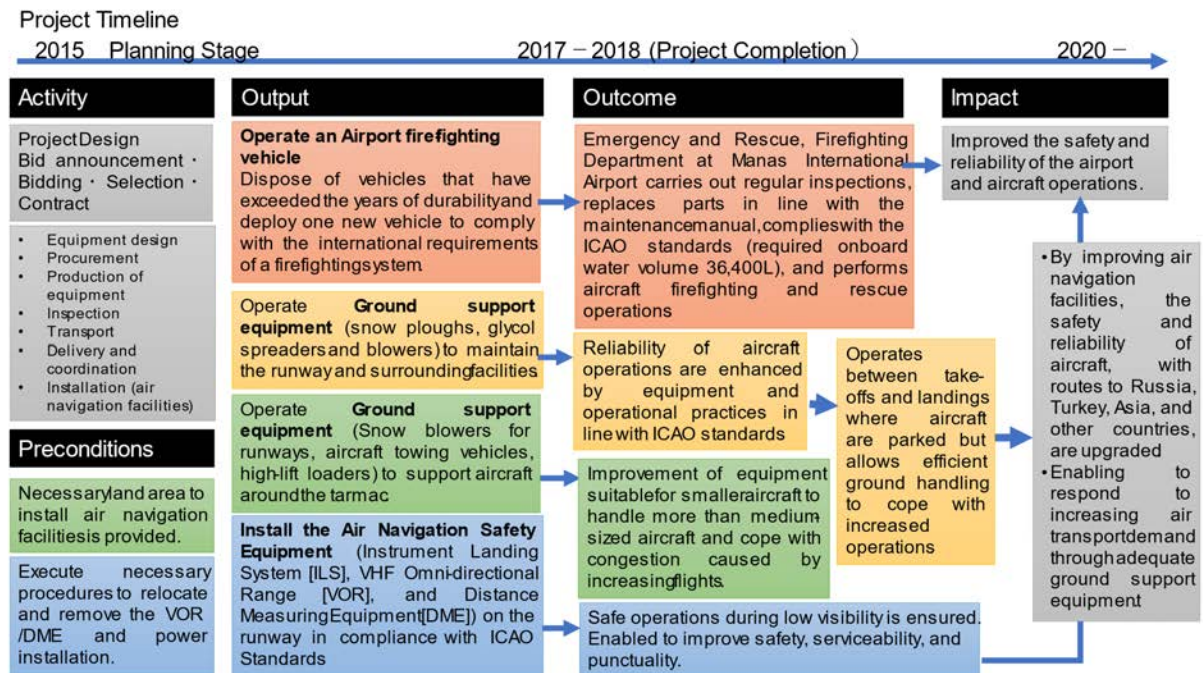


Figure 1 Logics of the Project

At the time of the project planning, due to the age of the air navigation equipment at MIA, there was a risk of problems with airport operations during inclement weather when clouds are at a low-level and low visibility occurs, often resulting in impossible landing, especially in the winter. Furthermore, the airport's firefighting vehicles were extremely dilapidated and did not meet ICAO standards.⁸

Upgrading air navigation equipment through the project and the ability to provide more accurate radio frequency operational support from a greater distance were expected to contribute to increased safety by expanding the range of weather conditions in which it is possible to land safely. In addition, new snow and glycol⁹ spreaders (snow ploughs) and blower vehicles were expected to reduce the time required for airport maintenance during snowfall, contributing to safety and efficiency in aircraft operations, as well as to the efficiency of airport operations. Furthermore, the provision of firefighting vehicles was expected to improve the firefighting system to meet international requirements. In the analysis of effectiveness in the ex-post evaluation, based on the above logic, the improvement of the visibility distance on the runways after 2018, when the aircraft under the project was put into operation, the status of the firefighting system meeting international requirements¹⁰ was checked and efficient operation of aircraft take-off and landing, safety, service rate, and on-time performance of the implementing agencies were verified. Concerning the impact, a questionnaire survey of airlines sought their views on meeting the increasing demand for aircraft operations and improving safety and reliability.

⁷ When providing the sub-rating, Effectiveness and Impacts are to be considered together.

⁸ ICAO specifies standards for the deployment of airport firefighting vehicles by airport category.

⁹ Chemicals that lower the freezing point of water and have a de-icing effect.

¹⁰ Refers to ICAO security standards. An airport's category for rescue and firefighting is determined by the maximum aircraft (aircraft length and fuselage width) normally used by that airport. The largest aircraft in service at MIA is a Boeing 747, which falls under category 9 according to ICAO security standards and, therefore, must meet the criteria accordingly.

<Effectiveness>

(1) Visibility distances on runways

The target visibility distance on the runway of more than 200 m was achieved with the equipment installed during the project. The project upgraded the air navigation equipment to enable instrument approaches and landings even when visibility is reduced by providing highly accurate aeronautical information. The ILS Category IIIA operation was achieved per the original target for the operational category¹¹ that uses it to approach and land on the intended runway. Being able to provide a more accurate radio frequency operational support has contributed to increased safety.

(2) Fire-fighting systems that meet international requirements

At the time of planning, MIA owned six fire engines, four of which were 13 years beyond their useful life and did not meet the ICAO security standards (36,400 L of water is required onboard) for aircraft firefighting and rescue. With the provision of one new fire engine under the project, the total onboard water volume of the three vehicles meets the ICAO security standards.

Table 1 Pre-post comparison of effectiveness indicators

Indicators	Baseline 2014	Target (2019) after completion	Actual (Responded by questionnaire in 2022)
Weather condition when aircrafts are able for landing. (Visible distance at runway)	More than 350 m (ILS Category II)	More than 200 m (ILS Category IIIA)	More than 200 m (ILS Category IIIA)
Percentage of landing / take off aircraft under the condition which satisfy international requirements on fire and rescue at MIA. (%)	0	100	100

Source: Questionnaire Survey and interview

Note: ILS Category II is a runway sight distance (the distance at which the pilot of an aircraft on the centerline of the runway can see the runway markings, runway lights or runway centerline lights) of 350 m or more and the decisive height (the approach limit height for a precision approach, at which point, if no visible markings necessary to continue the approach are seen, the aircraft must initiate a return approach) of 30 m or more but less than 60 m. The precision instrument approach and landing is an operation of not less than 30 m and not more than 60 m. Category III, on the other hand, refers to precision instrument approaches and landings where the runway sight distance is 200 m or more and the decisive height is less than 30 m or not set.

(3) MIA's flight delays in winter (indicative information)

In order to verify the efficient operations and reliability of the project at MIA, the status of delayed flights at the airport was reviewed and used as a reference to determine the effectiveness of the project. The changes in flight delays provided are shown in Table 2. The percentage of flights delayed during the winter season, when most departure delays occur due to weather conditions, in 2012 exceeded 7% but was below 5% in 2021. In the same season, the number of hours of delay per flight also decreased from 1.66 to 1.15. There has been an improvement in delay rates and delay times during the winter and throughout the year.¹² In light of this, it is estimated that “safer operations” and “more efficient airport operations” have been accomplished.

Table 2 Delayed Flights in MIA

	2012		2013		2019		2021	
	Number of flights departed (A)	Number of flights delayed due to weather conditions (B)	A	B	A	B	A	B
Number of flights departed in Winter (November–March)	2,084	149	2,677	153	3,248	162	2,092	102
Number of flights departed per year	5,336	160	7,049	174	8,416	177	5,792	115
Delay rate during winter (B÷A)		7.1%		5.7%		5.0%		4.9%
Delay time / flight during winter (unit: hour)		1.66		1.18		1.38		1.15
Annual delay rate (B÷A)		3.0%		2.5%		2.1%		2.0%
Annual delay time / flight (unit: hour)		1.62		1.27		1.43		1.05

Source: Evaluation Team based on the provided data by the MIA

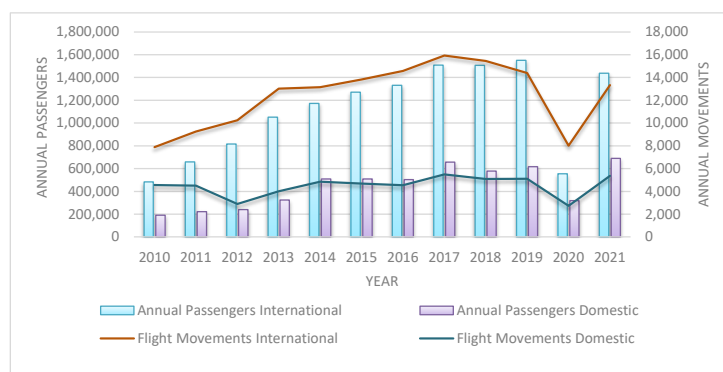
¹¹ ICAO's all-weather operations manual, classified as categories I, II, and III (A, B, and C).

¹² Note that 2020 was omitted from the comparison due to the extremely low number of flights taking off in the year (2,704) due to the spread of Covid-19 pandemic.

<Impacts>

The airlines serving in MIA were asked for opinions on the project's goals of (i) ensuring safe operations and (ii) efficient airport operations through a questionnaire, to which three airlines responded. The evaluation of operations and services of the airlines following the provision of equipment by the project is positive, with the ground equipment improving, staff being satisfied with the service they receive, no accidents or risk hazards, and no particular complaints from pilots or ground staff about the MIA. It is assumed that the airlines understand that ground handling has become more efficient with updated ground support equipment. It was also reported that the number of scheduled flights has consequently increased since the curbing of COVID-19 cases.

The annual number of passengers and aircraft take-offs and landings in MIA are shown in Figure 2. The annual number of passengers increased in 2019 after starting the operations of the equipment under the project, while the number of aircraft departures and arrivals decreased. Air Kyrgyzstan, an airline of the Kyrgyz Republic, gradually reduced its international flights in 2015 due to aircraft shortages, withdrew its license renewal in 2017, and ceased operations in 2018, together with domestic flights; while Air Bishkek, also from the Kyrgyz Republic, ceased operations in 2017. Similarly, Air Manas from the Kyrgyz Republic cancelled flights to Istanbul, Urumqi, Delhi, Moscow, and Tashkent and almost ceased operations in 2019. Thus, the decline in the number of aircraft arrivals and departures could be attributed to the fact that the domestic airlines of the Kyrgyz Republic suffered from financial difficulties at the time. On the other hand, as shown in Table 3, some foreign airlines increased the number of flights in 2019, and the passenger numbers did not decrease (as shown in Figure 2). Changes in flight destinations that may contribute to enhanced regional connectivity were observed in the increased number of flights to and from Russia, Kazakhstan, Turkey, the Middle East, and China (Table 3).



Source: JICA Evaluation Team based on the provided data by the MIA

Figure 2 MIA's flight movements and passengers

Table 3 Number of take-offs from MIA to main destinations per year

Destinations	2014	2015	2016	2017	2018	2019	2020	2021
Moscow (Russia)	1,331	1,602	1,626	1,844	1,626	1,588	375	461
Novosibirsk (Russia)	366	455	453	462	476	441	92	35
Istanbul (Turkey)	1,166	1,618	1,753	1,716	1,867	1,588	670	1,284
Almaty (Kazakhstan)	286	364	403	451	472	542	133	315
Tashkent (Uzbekistan)	153	169	135	107	218	182	69	162
Ulaanbaatar (Mongolia)	130	155	157	155	155	157	0	0
Dubai (United Arab Emirates)	173	216	206	263	388	397	125	384
Sharjah (United Arab Emirates)	0	124	150	200	0	85	31	75
Shanghai (China)	77	203	140	112	203	140	112	99

Source: JICA Evaluation Team based on the provided data by the MIA

The number of movements are considerably decreased due to Covid-19 pandemic but it is on the way to recovery. In addition, it is considered to have become possible to respond to the increase of the number of services.

<Other positive and negative impacts>

At the time of planning, the project was deemed to have minimal undesirable effects on the environment and was classified as Category C under the JICA Guidelines for Environmental and Social Considerations (2010). Resettlement or land acquisition were not necessary as the site for the equipment installation is within the airport compound.

<Evaluation Result>

Considering the evaluation above, the project has generally achieved the planned effects. The provided equipment is being used as planned, and the expected effects, such as contributing to safe operations and efficient airport management, are realized. Delays in aircraft take-off during the winter season, which was a concern, have improved. Regarding the impact of improving the safety and reliability of the airport and aircraft operations, in a questionnaire survey, airlines that regularly operate MIA also gave favorable evaluations regarding the operation of the airport. It was confirmed that the number of flights in service has increased. Furthermore, no undesirable social (including human rights and gender equality) or environmental impacts have been observed. Therefore, the effectiveness and impacts of the project are high.

3 Efficiency

<Output>

The outputs shown in Figure 1 materialized as planned. The Ministry of Transport and Communications (MOTC) was the implementing agency during the project, which carried out various supervision tasks since the opening of MIA, while the Department of Aviation was in charge of the overall project. Once the existing equipment was relocated to the spare runway, the airport safety equipment, VOR/DME was installed in phases around the runway. This process was devised by MIA under the direction of the Department of Aviation to minimize impacts of the runway closure on airport operations.

<Project cost>

The total project cost of this project was 1,540 million yen against the planned amount of 1,630 million yen, which was within the plan (95.4 % of the plan). The side of the Kyrgyz Republic assumed the cost of removing the existing equipment, which amounted to less than 1% of the total project cost. The share of the project cost by the Kyrgyz Republic increased significantly due to the phased installation of the equipment described above, but this is considered to be necessary.

<Project period>

The actual duration of the project was 28 months (December 2015–September 2016), while the planned duration was 26 months (August 2014–March 2018). The project period was 108% of the planned project period due to the delays in the tendering process and unforeseen delays in maritime transport from the Kyrgyz Republic side.

<Evaluation Result>

As described above, although the project cost was within the plan, the project period slightly exceeded. However, since the project was generally efficient with respect to outputs, the efficiency of the project is high.

4 Sustainability

< Policy and System>

The Aviation Development Strategy 2016–2020, promulgated in 2016, clearly states that the project includes the modernization of airport equipment, ground equipment, and firefighting vehicles. *The National Development Strategy (2019–2040)* also indicates the importance of modernizing the airport infrastructure of MIA to be one of the hub airports in Central Asia, which supports the project from a policy and institutional perspective.

< Institutional/Organizational Aspect>

Air traffic control and safety management equipment and air navigation equipment, VOR/DME, are owned, operated, and maintained by Kyrgyzstan Aeronavigation (KAN). The air navigation equipment, ILS, and other ground support equipment are

Table 4 Staff of the Operation and Maintenance in MIA

	2014	2022
Airport Terminal Maintenance Service Department	22	40
Ground Handling	80	109
Transport / Special Equipment	187	177
Emergency and Rescue, Fire-fighting Department	68	68
Operation and maintenance of ILS	-	15

Source: JICA Evaluation Team based on the provided data by MIA

owned, operated, and maintained by Manas International Airport Company. As shown in Table 4, the number of MIA staff has been increased and streamlined in line with the aviation demand and the need to introduce new aircraft, and KAN, which manages the VOR/DME, assigned 9 out of 48 full-time personnel with over 10 years of experience. MIA considers this structure to be sufficient for maintenance and management. The organizational structure of the implementing agency was well-established at the time of the ex-post evaluation and considered appropriate.

<Technical Aspect>

Seven participants from the MOTC and MIA participated in the Training on Airport Construction, Operation and Maintenance Planning (Yen loan account training) in 2013, before the project was launched, and visited Fukuoka and Narita airports. The implementing agencies recognized that the site visits contributed significantly to raising safety awareness. MIA provides professional and advanced training for employees engaged in airport operation according to training programs approved by the Civil Aviation Authority of the Kyrgyz Republic and in accordance with the requirements of national legislation and safety standards required for international airports, as well as the practices recommended by ICAO.¹³ In addition, according to reports and other information from MIA and ICAO, training sessions conducted intermittently by ICAO from 2017 to 2019, following the previously mentioned accident, are considered to have resulted in enhancing the awareness and competence of employees. MIA strengthened its efforts to improve technical capacity by establishing a new training department in April 2022. Based on the above, it is concluded that there are no particular problems with the technical aspects of the operation and maintenance of the project.

<Financial Aspect>

The financial situation at MIA from 2014 to 2020 is shown in Table 5. In 2020, the number of flights fell sharply due to COVID-19, resulting in extremely low profits because of the reduced revenues. However, the situation is recovering with the increasing number of flights according to the flight data in 2021, and the financial situation is deemed acceptable.

Table 5 Cashflow of the MIA

Unit: Million Kyrgyz Som

Fiscal Year	2014	2015	2016	2017	2018	2019	2020	2021
Total Revenue	2,589.5	3,372.6	4,162.3	4,202.7	4,331.8	4,739.9	2,479.1	6,826.7
Total Expenditure	2,028.8	2,092.6	2,352.3	2,607.1	2,791.2	2,845.8	2,419.6	3,070.3
- Human Resources	837.3	1,002.0	1,151.0	1,271.7	1,331.7	1,378.8	1,093.1	1,593.7
-Operation Cost (Fuel, etc.)	252.1	263.7	269.9	267.7	296.4	274.5	199.9	254.3
- Others	887.1	629.7	912.7	1002.7	1122.5	1120.9	1091.9	1,132.8
Profit	560.7	1,280.0	1,810.0	1,595.5	1,540.6	1,894.1	59.5	3,756.4
Non-operating financial income and expenditure	364.9	239.8	-58.3	377.5	354.7	165.8	666.8	207.2

Note: Fiscal Year is from April 1 to March 31.

Source: MIA

MIA considers modernizing the airport by adopting a public-private partnership (PPP) approach in the future. An agreement between the Ministry of Economy and Commerce and the International Finance Corporation (IFC) in October 2021 considers specific support details and a project pre-feasibility. A study has been accomplished, and the selection of an operating company is under consideration. The ownership and management structure of the maintenance equipment under the PPP scheme will be discussed upon finalizing the operating structure.

Given this information, it can be concluded that the financial situation is generally good, despite the significant effects of the COVID-19 pandemic, and the budget requirement for maintenance and management has been secured. No major problem will be expected.

¹³ Менеджмент ОАО "МAM" прошёл обучение по курсу "Система управления безопасностью полетов поставщиков обслуживания" - Международный аэропорт "Манас." (2022). Retrieved May 2022, from www.airport.kg website: <http://www.airport.kg/press-center/news/986>

<Current Status of Operation and Maintenance>

The operational status of the equipment maintained under the project is good. The equipment is without any problems, and the necessary budget for maintenance has been secured. At the time of the equipment arrival, the supplier explained thoroughly the operation method and manuals on each equipment. The level of technology is appropriate and without particular issues. Four years have passed since the initial use of the equipment in 2018, but appropriate preventive maintenance has been completed in accordance with the manuals. To date, no spare parts have been needed other than those originally serviced. Regarding the air safety equipment (ILS and VOR/DME), alarm problems caused by insects occurred when the equipment was initially installed but was resolved after inspection by the Japanese supplier. This was done within the equipment warranty period, but the aftercare service was carried out without delay, which is commendable.

<Evaluation Result>

As described above, there are no problems in the policy systems, institutional/organizational aspects, technology, finance, and operation and maintenance status. Therefore, the sustainability of the project effects is high.

III. Recommendations & Lessons Learned

- Recommendations to Executing Agency ; None
- Recommendations to JICA

The importance of aviation safety was learned in detail through the training sessions in Japan, which was highly appreciated. Moreover, the effectiveness would be further enhanced if a more strategic collaboration was designed during the Ex-Ante Assessment.

- Lessons Learned

MIA officials have participated in the Airport Construction, Operation and Maintenance Planning Training in 2012, the Aviation Safety training (country focus training) in 2014, and the Aviation Safety Seminar (group training) in 2017 and 2019 after the procurement of the project. The content of these training courses, which included site visits to Japanese airports, was highly valued for being practical and enabling participants to learn the actual operational conditions of aircraft. The group training sessions also received high marks for the opportunity to interact with experts from other countries. As technology related to airport equipment and safety progresses quickly, a high level of interest was expressed regarding regular technical exchanges with the Japanese side. Therefore, it is considered important to invite relevant personnel to the group training in the aviation sector.

IV. Non-Score Criteria

- Adaptation/contribution Evaluation from an objective perspective

Agreements on technical assistance for airport safety were signed between ICAO and the Kyrgyz Government before the project and after 2018 when the project upgraded the equipment. Europe, the USA, Turkey, and other countries provide technical assistance on airport personnel safety on an ongoing basis. These contribute to the safety of MIA and are therefore considered to be an indirect contribution to the project objectives.

- Additionality N/A



Fire fighting Vehicle
(source: JICA)



Belt Loader Vehicle
(source: JICA)



Snow blowers for runways
(source: JICA)

Republic of Tajikistan

FY2021 Ex-Post Evaluation Report of
Japanese Grant Aid Project

“The Project for Improvement of Dushanbe International Airport (Phase 1) (Phase 2)”

External Evaluator: Hisae Takahashi, Global Group 21 Japan, Inc.

0. Summary

The Project was implemented with the aim to improve safety of aircraft operations and passenger and cargo handling capacity by upgrading air navigation safety equipment and improving cargo handling facilities at Dushanbe International Airport (DIA), thereby contributing to the facilitation of logistics flow.

Its purpose is in line with Tajikistan’s development policy at the time of planning and the ex-post evaluation, which has emphasized the importance of air transportation and development of airport facilities, and development needs to improve safety and facilities at the airport, which plays an important role in air transportation. Although there was no specific collaboration or coordination with projects or assistance other than from the Japan International Cooperation Agency (JICA), it was confirmed that the Project was in line with Japan’s aid policy, which has emphasized the development of transport infrastructure, and with Goal 9 of the Sustainable Development Goals (SDGs), as well as with technical cooperation projects aimed at improving the operational capacity of air navigation services. Therefore, its relevance and coherence are high. The Project costs exceeded the plan, and the Project period largely exceeded the plan due to unsuccessful tenders and delays in tax exemptions. Therefore, efficiency of the Project is moderately low. The installation of air navigation safety equipment under the Project has improved the safety and reliability of aircraft operations by enabling appropriate aircraft arrivals and departures. At the cargo terminal, it has become possible to streamline cargo handling operations and handle perishable and medical goods that require temperature control, thereby contributing an impact such as receiving emergency relief supplies in the wake of the new coronavirus infection (COVID-19). On the other hand, with the opening of land routes with Uzbekistan and air services limited due to COVID-19 and the situation in Ukraine, international cargo handling volume has decreased compared to before the Project, resulting in substantially lower volumes than planned. As mentioned above, this Project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the Project are moderately low. No issues have been observed in the policy/system, institutional/organizational, technical, financial, environmental, and social aspects, including the current status of operation and maintenance. Therefore, sustainability of the Project effects is very high.

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

1. Project Description



Project Location



Inside of the Cargo Terminal

1.1 Background

DIA, located in the capital of Tajikistan, was expected to play a role in inter-regional trade and as a hub for such trade, taking advantage of its location where Afghanistan was only about three hours away by road. As the number of passengers at the airport increased at an annual rate of 15-18% between 2009 and 2013, the volume of air cargo was also expected to increase sharply from 3,258 tons in 2013 due to an increase in passenger flights and large cargo flights.¹

However, the Instrument Landing System (ILS) to guide aircraft onto the runway was installed only for one direction at DIA. With this condition, the flights were frequently cancelled or delayed due to heavy fog, and the installation of air navigation safety equipment was an urgent issue. In addition, the cargo terminal, which had been constructed 50 years ago, had become severely dilapidated and lack of equipment made temperature control and handling of large cargo difficult. Against this backdrop, a Grant Aid project to upgrade air safety navigation equipment and improve the cargo terminal was requested from the Government of Japan to improve the safety of aircraft departure/landing and the efficiency of cargo handling.

The Project cost significantly exceeded the plan due to inflation caused by currency depreciation as well as a rise in bidding prices with fears of further inflation in the future, resulting in a funding shortfall. The objectives of the Project could not be achieved if the facility component was cancelled or scaled down, and it was difficult to forecast the increase in Project costs due to inflation and future inflation concerns caused by currency depreciation in advance. Therefore, “The Project for Improvement of Dushanbe International Airport (Phase 2)” was implemented as an additional grant aid.

1.2 Project Outline

The objective of this Project is to improve safety of aircraft operations and passenger and cargo handling capacity by upgrading air navigation safety equipment and improving cargo handling

¹ Source: Ex-ante evaluation summary

facilities at DIA, thereby contributing to the facilitation of logistics flow.²

Grant Limit/Actual Grant Amount	1,914 million yen (Phase 1), 356 million yen (Phase 2)/ 1,880 million yen (Phase 1), 337 million yen (Phase 2)
Exchange of Notes Date/Grant Agreement Date	September 2014, August 2018 (Extended) (Phase 1), March 2017 (Phase 2)/September 2014, August 2018 (Extended) (Phase 1), March 2017 (Phase 2)
Executing Agency	Dushanbe International Airport (DIA)
Project Completion	July 2018 (Phase 1) (Phase 2)
Target Area	Dushanbe International Airport/Dushanbe city
Main Contractors	(Civil works) Dai Nippon Construction (Equipment) AddedValue Inc.
Main Consultants	Nippon Koei Co., Ltd., Japan Airport Consultants, Inc, Daiken Sekkei, Inc. (JV)
Preparatory Survey	November 2013 - September 2014
Related Projects	<p>[Technical Cooperation]</p> <ul style="list-style-type: none"> • Project for Improvement of Air Navigation Services (2016 – 2018) • The Capacity Development Project for Implementation of Performance Based Navigation (2020 - 2023) <p>[Government of France]</p> <ul style="list-style-type: none"> • Project for the construction of the new terminal of Dushanbe International Airport (2012) • Project for the improvement of the basic facilities at Dushanbe Airport (2012) • Project for the construction of the control tower at the Dushanbe airport (2013) <p>[European Bank for Reconstruction and Development]</p> <ul style="list-style-type: none"> • Project for Tajikistan State Air navigation systems development (2001) <p>[International Finance Corporation]</p> <ul style="list-style-type: none"> • Project for Improvement of airport control facility at Dushanbe Airport (2014)

² At the time of planning, the objective of the Project in Phase 1 was: “To improve safety of aircraft operations and cargo handling capacity by upgrading air navigation safety equipment and developing cargo handling facilities at DIA, thereby contributing to the facilitation of logistics in the country.” Phase 2 had a different description of the Project objective: “To improve the safety and passenger/cargo handling capacity by upgrading air navigation safety equipment and developing cargo handling facilities at DIA, thereby contributing to economic infrastructure development.” However, as the Phase 1 and Phase 2 is same in scope, the Project objective was set in the ex-post evaluation in order to show the impact in a concrete and comprehensive manner as described.

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Global Group 21 Japan, Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October, 2021 – November, 2022

Duration of the Field Study: July 4th – July 9th, 2022

2.3 Constraints during the Evaluation Study

The planned field survey could not be implemented by the evaluator due to the spread of COVID-19. For this reason, the first field survey was implemented by a local assistant under the direction of the evaluator, and the evaluator conducted a survey remotely based on the results of the field survey conducted by the local assistant, such as information collection, interviews with the stakeholders, and site inspections.

3. Results of the Evaluation (Overall Rating: B³)

3.1 Relevance/Coherence (Rating: ③⁴)

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Tajikistan

At the time of the Project planning, Tajikistan's mid-term action strategy, the *Living Standard Improvement Strategy (2013-2025)*, showed the need for strengthening the air transportation sector and had a specific target of increasing the share of air cargo to total cargo volume from 12% to 15% through airport development.⁵ The sectoral plan for the transport sector at the time of the planning, The *Transport Sector Development Strategy (2011)*, which was the sectoral plan until 2025, stated that development of the transport sector would ensure the country's economic development, and one of its goals was to improve airport facilities, air traffic control systems, etc.⁶

On the development policy at the time of the ex-post evaluation, the *National Development Policy to 2030*⁷ was formulated in 2016 as a long-term policy. The policy sets the long-term goal of improving people's living standards based on sustainable economic development, with the priorities of making effective use of human and natural resources, diversifying the economy, strengthening competitiveness, and expanding and strengthening the middle-income group.

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ④: Very High, ③: High, ②: Moderately Low, ①: Low

⁵ Source: *Living Standards Important Strategy of Tajikistan for 2013-2015 (2013)*

⁶ Source: *National Target Development Strategy for Transport Sector of the Republic of Tajikistan to the year 2025 (2011)*

⁷ Source: *National Development Strategy (2016)*

Regarding the sectoral level, the development strategy at the time of planning remains valid at the time of the ex-post evaluation, and this strategy is also identified as the strategy for the transport sector in the *National Development Strategy up to 2030 (2016)*.

As mentioned above, at both times of planning and ex-post evaluation, the purpose of the Project is in line with the Government's development plan for the country, which refers to the importance of air transportation and the need to develop airport facilities to enhance its use.

3.1.1.2 Consistency with the Development Needs of Tajikistan

At the time of the Project planning, DIA was expected to play a role in inter-regional trade and as a hub for such trade, and both the annual number of passengers and the cargo handling volume at the airport were expected to increase rapidly. On the other hand, the cargo terminal of the airport, which was about 50 years old, had deteriorated considerably and was equipped with only two cargo X-ray inspection units and weight scales, with no facilities or equipment capable of controlling temperature or handling large cargo. As a result, there were limitations on the volume and items of cargo that could be handled, creating a logistics bottleneck and an impediment to economic revitalization. Furthermore, the ILS to guide aircraft onto the runway was installed in only for one direction on the runway at the airport, resulting in frequent cancellations and delays due to heavy fog, so installation of air navigation safety equipment to ensure safe operations was an urgent need.

Despite the impact of COVID-19 and the situation in Ukraine, DIA continues to play an important role as the country's air services hub at the time of ex-post evaluation. For example, the annual number of passengers at the airport increased from 1.22 million at the time of planning to 1.44 million⁸ in 2019, before the rapid spread of COVID-19. The cargo terminal which handles most of the country's general air cargo, is the only airport in Tajikistan with cold storage facilities capable of handling quality medicines and perishables that need to be kept under appropriate temperature control. In addition, at the airport, where dense fog frequently occurs, ensuring visibility and safe guidance of aircraft is essential for the safe arrival and departure of aircraft, and the need for air navigation safety equipment on the runway is high, even at the time of ex-post evaluation.

As described above, at the time of planning and ex-post evaluation, the development needs for the improvement of the cargo terminal and the modernization of air security equipment were high, and the Project was consistent with these needs.

3.1.1.3 Appropriateness of the Project Plan and Approach

Although the outputs of the Project are mostly as planned, it was decided to carve out some of the outputs and provide Phase 2 due to the increase in bidding prices caused by inflation. No

⁸ Source: Questionnaire answers

additional scope or outputs were added in granting Phase 2. The decision was deemed an appropriate change since the rapid inflation was unpredictable, and it was judged that the Project objectives could not be achieved if the scale of output was reduced. In addition, the Project supported the development of air navigation safety equipment and the cargo terminal; thus no differences in intervention effects between beneficiaries are particularly envisaged. Therefore, the Project plan is not impartial. It should be noted that the reason why the cargo handling volume, an indicator of effectiveness, has not reached the target is due to the impact of the COVID-19 pandemic and the opening of the border gate connecting to Uzbekistan. Therefore, it can be concluded that there are no problems with the Project planning, design, logic and approach.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning of this Project, the *Country Assistance Policy for Tajikistan (2012)* identified the development of economic infrastructure as a priority area. It also indicated that the transport infrastructure would be developed to contribute to the revitalization and stabilization of the regional economy through improved logistics, for example by strengthening connectivity with Central Asia and its neighboring countries. The *JICA Country Analysis Paper for Tajikistan (2014)* also identified “the transportation at the connective point between Central Asia and South Asia” as a key issue. In light of the above, at the time of planning, this Project was consistent with the policy of Japan's assistance to Tajikistan.

3.1.2.2 Internal Coherence

At the time of planning, there were no other specific projects which was scheduled to collaborated or be coordinated with; however, the technical cooperation project for Capacity Development in Air Traffic Services (2016-2018) was implemented to improve the operational capacity of air traffic controllers as support in the aviation sector. Although there was no direct collaboration or coordination during the implementation of the Project, the installation of ILS and Precision Approach Lighting System (PALS) on the runway of DIA is one of the important basic conditions for achieving the output of the “Project for Capacity Development in Air Traffic Services.” The installation of this equipment is expected to have a synergistic effect in terms of air traffic control operations, as it will reduce the burden on air traffic control officers to facilitate smooth air traffic control, leading to improved safety in air traffic control, and in turn contributing to safer aircraft landings and departures.

3.1.2.3 External Coherence

No complementarity, collaboration, or coordination with projects implemented by other Japanese agencies, other developing partners such as other donors etc., or support provided by

the private sector was identified. In addition, although no consistency with international frameworks was pointed out in the documents as of the planning or by the executing agencies, the Project is in line with SDG Goal 9: *Industry, Innovation and Infrastructure (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation)* from the perspective of developing high-quality, reliable, sustainable and resilient infrastructure to support economic development. Furthermore, DIA was used as a domestic airport until 1991, and even after it became an airport handling international flights, the facilities and equipment were operated according to domestic airport standards, as they had been before. The Project has provided facilities for a cargo terminal (cold storage facilities, animal storage and dangerous goods space), lighting, fire protection and air conditioning, containers, etc., which previously the airport was not equipped with, enabling the airport to carry out the process in line with international standardization and meet international standards regarding cargo handling, registration, etc.

As described above, the implementation of the Project is in line with Tajikistan's development policy and development needs, and there are no issues with the Project plan and approach. Although there was no specific coordination or collaboration with projects or assistance provided by other organizations, and no outcome generated by collaboration could be confirmed, the consistency of the Project with Japan's aid policy, JICA's technical cooperation project, and international frameworks was confirmed.

Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)⁹

3.2.1 Project Outputs

This Project was designed to construct the facilities (cargo terminal and other ancillary facilities), procure air navigation safety equipment and equipment for the cargo terminal, and provide consultancy services, and guidance on training and manual preparation for cargo handling (soft component) at DIA. Table 1 shows the planned and actual outputs of this Project understood at the time of ex-post evaluation.

⁹ In this Project, Phase 2 was implemented by carving out some of the outputs due to the increase in the bidding price caused by inflation. There were no additional scope or outputs added in conducting Phase 2, and there were no changes of the planned outputs at the time of planning. Therefore, the inputs in efficiency (Project cost and period) were compared between the original (Phase 1) plan and actual results.

Table 1 Planned and Actual Outputs

	Plan	Actual
Construction of facilities	<ul style="list-style-type: none"> • Cargo terminal • Freight handling area (2,401 m²) • Build-up • break-down space^{Note1}, storage for exports and imports, X-ray inspection area, and cold storage facilities • Special cargo facilities (106 m²) • Valuable goods storage, animal storage and dangerous goods space • Office area (1,203 m²) • Cargo terminal office and staff rooms 	As planned Note2
Procurement of equipment	<ul style="list-style-type: none"> • ILS^{Note3} 1 set • PALS^{Note4} 1 set • Cargo handling equipment 	As planned Note5
Consulting services	Detailed design, construction supervision and procurement supervision	As planned
Soft component	<ul style="list-style-type: none"> • Creating the operation manual for handling pallets for international cargo handling • Training for operating methods of cargo handling and use of equipment <ul style="list-style-type: none"> - Lecture training Learning basic knowledge for handling diverse forms of cargo - Safety and security training Knowledge needed for on-site management, including safety in the workplace, accident prevention and aviation security measures - Practical training Handling of Unit Loading Devices (ULDs) procured as cargo terminal equipment, based on the content of lecture training 	As planned

Source: Preparatory survey report and documents provided by JICA

Note 1: It refers to the process of loading or unloading cargo on or from a tool for loading cargo onto aircraft.

Note 2: At the cargo terminal, installation works of ancillary facilities, such as electrical facility, water supply and drainage facility, air conditioning and ventilation facility, and outdoor facilities (paving, outdoor electrical and drainage) were carried out in Phase 2 of the Project.

Note 3: Systems that enable landing by providing highly accurate navigation information even when visibility is reduced.

Note 4: Lights that indicate the centerline of the runway and the direction of approach when an aircraft approaches an airport runway for landing. As a general rule, they are installed on runways where the landing approaches are instructed by ILS.

Note 5: ILS and PALS were procured in Phase 2.

As shown in Table 1, although the outputs were as planned, some changes occurred in the specification of a part of facilities and equipment to be covered by the Tajikistan side. According to the executing agency, each change (see below) did not affect the functions of the facilities and

equipment, and there is no impact on the generating effects or the Project period due to these changes.

Change in facility specifications.

- Change in the shape of the septic tanks (due to downsizing of the existing septic tanks installed in the cargo terminal facilities, as three years have passed after design).
- Increase of circuits in the main switchboard (based on changes/requests for construction work to be borne by the Tajikistan side).

Change to make some equipment covered by the Tajikistan side

Due to price increases, there was a deviation from the cost estimate, and then some equipment for the cargo terminal equipment (towing tractors, container and pallet dollies, bulk carts and forklifts) had to be covered by the Tajikistan side to ensure the E/N amount wasn't exceeded.

In addition, as mentioned above, since equipment that had not been handled before was installed at the cargo terminal in this Project, training on the handling of cargo using this equipment and guidance on the preparation of a manual on the operation of the cargo terminal were provided. According to the staff who received the training and guidance, the content, timing and duration of the training were appropriate. However, the number of staff who remained with the executing agency at the time of the ex-post evaluation was limited, and staff from the executing agency raised the opinion that the number of staff who participated for the training was limited.

In addition to the cooperation items from the Japanese side, the Tajikistan side was also expected to handle the following items in this Project:

- 1) Necessary steps related to Banking Arrangement and Authorization to Pay with payment of relevant commission
- 2) Exemption of taxes and duties on imported equipment and materials
- 3) Entrance to the site and construction permits
- 4) Securing construction sites, earth dumping sites, waste disposal sites
- 5) Removal of existing equipment for installation of new equipment
- 6) Taxes and fiscal levies for procurement of materials and services
- 7) Securing temporary yard for materials and equipment
- 8) Securing commercial power on site and provision of existing main power distribution network
- 9) Securing the budget and human resources for maintenance

According to the executing agency and Project consultant, all responsibilities on the Tajikistan side were carried out, though tax exemption took longer time than planned.

3.2.2 Project Inputs

3.2.2.1 Project Cost

This Project was planned to cost 1,932 million yen, consisting of 1,914 million yen on the Japanese side and roughly 18 million yen on the Tajikistan side. The actual Project cost was 2,228 million yen (2,217 million yen¹⁰ on the Japanese side, 11 million yen on the Tajikistan side), slightly exceeding the plan (115% of the original plan).¹¹

The reason why the Project cost exceeded the plan was inflation. Meanwhile, there were also concerns about further inflation in the future. The inflation caused the prices of tenders for the facilities component to rise, resulting in significantly exceeding the originally planned Project costs. In the tender in November 2015, as the bidding price was approximately 30% higher than the planned amount, it turned out that it exceeded the original E/N amount. Accordingly, the need for Phase 2 of the Project was confirmed based on discussions between the Tajikistan side and JICA¹². At the time, inflation was affected by the rapid deterioration of the Russian economy due to low oil prices and economic sanctions, and the resulting depreciation of the currency. On the other hand, it would have been difficult to foresee these circumstances at the time of planning¹³. The fact that the major materials for the construction were not produced in Tajikistan and were imported from outside the country, and higher fuel prices, also contributed to the increase in the inflation coefficient.¹⁴

3.2.2.2 Project Period

The Project period¹⁵ was planned to be 26 months, from August 2014 to September 2016, but the Project lasted 45 months, from November 2014 to July 2018, which significantly exceeded the plan (173% of the plan)¹⁶. The delays were caused because of the re-bidding by dividing the components as a result of an unsuccessful bid for the construction works due to increase in the bidding price which was affected by inflation. In addition, there was a delay of approximately six months in the Tajikistan Government's tax exemption procedures.¹⁷

¹⁰ 1,880 million yen out of 2,217 million yen was granted in the Phase 1 and the remaining 337 million yen in the Phase 2 of the Project.

¹¹ Excluding the estimated cost of procured equipment which was initially due to be covered by Japan, but later was decided to be borne by the Tajikistan side, the total Project cost at the time of planning was 1,902 million yen, which is 117% of the actual cost (2,228 million yen). Therefore, it can be said that the Project cost exceeded the plan even when the reduction in the output portion incurred is taken into account.

¹² Source: Documents provided by JICA

¹³ Source: Comments from JICA Financial Cooperation Implementation Department and questionnaire answers from the Project consultant

¹⁴ Source: Questionnaire answers from the executing agency

¹⁵ The Project period is defined as the period from the month in which the contract with consultant is made to the month in which the facility construction and equipment procurement /soft component are completed.

¹⁶ As described, there was no change in the outputs in this Project. Therefore, the Project cost was analyzed by comparing the planned Project period of Phase 1 with the actual results. On the other hand, Phase 2, for which the G/A was signed in May 2017, assumed a Project period of 45 months; thus it can be said that no Project delay occurred.

¹⁷ Source: Questionnaire answers from the Project consultant

Table 2 Planned and Actual Project Period by Item

	Plan	Actual
G/A – Detailed design	8 months	September 2014
Detailed design		November 2014 – March 2015
Tendering period	—	(Phase 1) September 2015 – December 2016 (Phase 2) Negotiated contract July 2017
Construction of the cargo terminal	15 months	February 2017 – June 2018
Procurement of equipment	8 months	September 2016 – March 2017
Soft component	2 months	May – July 2018
Project period	26 months ^{Note1}	45 months

Source: Preparatory survey report, documents provided by JICA, and questionnaire answers.

Note 1: As some of the work processes overlapped, the entire Project period was planned to be 26 months from the month of the contract of consultant for the detailed design.

In light of the above, the Project cost slightly exceeded the plan. While facility construction and equipment procurement were carried out almost as planned, the overall Project period significantly exceeded the plan due to re-bidding. Therefore, efficiency of the Project is moderately low.

3.3 Effectiveness and Impacts¹⁸ (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of planning of this Project, the ratio of aircraft making an approach or landing at DIA using the ILS system and the increase in the international cargo handling volume at DIA, or the operation and effect indicators of the project, were expected to increase. The actual values for these indicators after Project completion are shown in Table 3.

Table 3 Operation and Effect Indicators of This Project

	Baseline value	Target value	Actual value			
	2014		2018 ^{Note1}	2019	2020 ^{Note2}	2021 ^{Note3}
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
Ratio of aircraft making an approach or landing at DIA using the ILS system (%)	80	100	100	100	100	100
International cargo handling volume at DIA (ton)	3,258	8,700	2,268	2,543	368	966

Source: Documents provided by JICA and the executing agency, *DIA Annual Report each year edition*.

Note 1: International cargo handling volume as of July 2018

Note 2: As DIA was closed in April 2020 due to COVID-19, the data for 2020 shows the international cargo handling volume from January to March.

Note 3: DIA resumed operations in July 2021 and aircraft restarted operations.

¹⁸ When providing the sub-rating, Effectiveness and Impacts are to be considered together.

The ratio of aircraft making an approach or landing at DIA using the ILS reached 100%, achieving the target value. On the other hand, the actual international cargo handling volume was significantly below the baseline value. According to the executing agency, the result in 2018 was below the baseline value as the Project was completed in July 2018 and the cargo handling volume in the same year was limited to that from August onwards, which is why the cargo handling volume was lower than the baseline value. In 2019, the border gates between Tajikistan and Uzbekistan, which had been closed since 1998, were opened¹⁹. Increasing the transportation of cargo by road. This impact is considered to have continued not only in 2019, but also in subsequent years. With regard to 2020 onward, the closure of the airport due to COVID-19 was the cause. It is noted that the airport was closed in April 2020 due to the impact of COVID-19, and both passenger and cargo operations were suspended until July 2021.²⁰

Meanwhile, the international cargo handling volume in 2022 has already exceeded the previous year's figure by 1,061 tonnes²¹ as of June, and the executing agency explained that exports of fruit, which account for most of its exports, are expected, from the past experiences to increase from July onwards, which is the harvest season. At the time of the ex-post evaluation, cargo flights were mainly limited to operations from Russia and Turkey, with no resumption of cargo flights from China or Kazakhstan, which were the main cargo destinations until operations were suspended due to the COVID-19 pandemic. China's share of cargo handling volumes at DIA was particularly high, at around 30-40%²² every year, and the resumption of cargo flights from China is expected to increase cargo handling volumes.²³

3.3.1.2 Qualitative Effects (Other Effects)

For the qualitative effects of this Project, it was assumed that modernizing the air navigation safety equipment would improve the air traffic safety and reliability. According to the executing agency, the following effects were observed.

(1) Improved air traffic safety and reliability

Appropriate aircraft approach and landing/departure

Before the implementation of the Project, DIA had an ILS in only for one direction on the runway, which reduced visibility on the runway during dense fog, heavy rain or snowfall, as a

¹⁹ Tajikistan has had a complicated relationship with Uzbekistan, with both sides claiming to have the other's ethnic group in their country and both sides explaining to be harboring rebels from the other country. However, there has been a trend of improvement in this relationship, backed by efforts to strengthen relations with Central Asian countries by the Mirziyoyev Government, which was established in Uzbekistan in December 2016. Accordingly, the border gates have been opened between Uzbekistan and Tajikistan since 2018.

²⁰ Even after DIA reopened for operation, only four of the 14 airlines that previously operated there have resumed operations.

²¹ Source: Documents provided by the executing agency

²² Source: Interview with the executing agency

²³ According to interviews with the executing agency conducted in July 2022, the resumption of flights from China is planned for August of the same year.

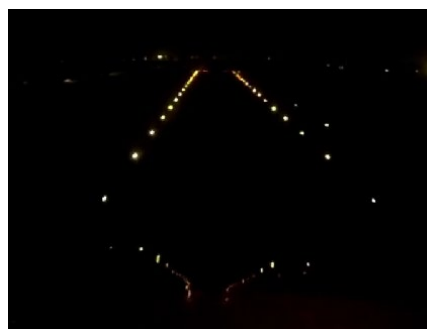
result posing a risk to departures and landings. The installation of ILS and PALS on the runway in the Project has ensured safety during departures and landings, as all aircraft are utilizing air navigation safety equipment and can take off and land without risk, even when visibility is poor. Since the implementation of the Project, there have been no emergencies during departure and landing at the airport.²⁴ In addition, as described in 3.1.2.2 Internal Coherence, the installation of ILS and PALS on the runway is directly linked to the safer landing of aircraft, which is also considered to improve air traffic control safety.

Reduction in cancellations and delays of flights to and from DIA

At the time of planning, the situation at DIA, where frequent dense fog with the absence of an ILS caused flight cancellations and delays, was taken as an issue. According to the executing agency, since the installation of the safety equipment in 2018, frequent flight cancellations and delays due to dense fog and other adverse weather conditions have improved, and the effects of ensuring improved operation and punctuality of flights have been realized.



ILS Antennas



PALS Light Seen from the Cockpit

(2) Improvement in the efficiency and quality of cargo handling operations

Improvement in the efficiency and quality of cargo handling operations was reported as an effect of the improvement of the cargo terminal as a result of the Project. According to staff working at the cargo terminal, cargo handling was carried out manually, in the old cargo terminal. In addition, there were no suitable warehouses to store cargo in the terminal at that time, which led to issues such as cargo losses and cargo being stored in an unsuitable environment. The cargo terminal developed through the Project has valuable goods storage, dangerous goods storage and cold storage facilities. Thus, after the installation of facilities and equipment, the cargo handling works have been mechanized with the use of equipment, which has improved the efficiency of operations considerably. In addition, it is currently possible to organize and store each cargo with defined storage conditions depending on each product and type. As a result, the work of receiving and sending cargo has become easier and the time required for cargo handling has been reduced.

²⁴ Source: Questionnaire answers and interviews with the staff of the executing agency

Transportation companies using the cargo terminal at DIA also reported effects such as an improvement in cargo quality control and enhanced operational efficiency by mechanized cargo handling works with the installation of new equipment. Furthermore, before the cold storage facilities were set up, it was difficult to store goods that require temperature control, such as fruit, Tajikistan’s main export cargo, for more than four hours. At the time of the ex-post evaluation, however, it is possible to handle these goods under appropriate temperature control, contributing to maintaining the quality of the goods.



Inside of the Cargo Terminal



Equipment for Cargo Handling

3.3.2 Impacts

3.3.2.1 Intended Impacts

The Project was assumed to contribute to the facilitation of logistics in the country by improving the safety of aircraft operations and passenger and cargo handling capacity. The value of Tajikistan’s imports and exports has increased by approximately 1.5 times since the time of planning, as shown in the table below. On the other hand, the direct contribution could not be ascertained due to the lack of clarity on the proportion of transport means with foreign countries in Tajikistan.

Table 4 Value of Tajikistan’s Imports and Exports

(Unit: Million US\$)

	2015	2016	2017	2018	2019	2020	2021
Export	891	899	1,198	1,074	1,174	1,407	2,150
Import	3,436	3,031	2,775	3,150	3,349	3,151	4,210
Total	4,326	3,930	3,973	4,223	4,524	4,558	6,359

Source: Data Bank, World Bank

According to the executing agency, the number of scheduled flights by large aircraft has been significantly reduced since 2020. Meanwhile, logistics services by air have continued within a limited scope except during periods when aircraft operations were temporarily suspended.

Therefore, it is considered that the Project has indirectly contributed to the facilitation of logistics through the effects of safe aircraft departure and landing even in adverse weather conditions, and improved efficiency of cargo handling operations and cargo quality maintenance due to the modernization and improvement of equipment and facilities at the cargo terminal.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

The Project did not fall into the large airport sector listed in the *JICA Guidelines for Confirmation of Environmental and Social Considerations (April 2010)*, and was classified as Category B, with less significant undesirable effects on the environment. An environmental permit was obtained in March 2017, and an Environmental Impact Assessment report is not required under Tajikistan's national legislation. At the time of planning, it was planned that surplus soil disposal would be carried out at the airport site as a pollution control measure to meet the country's environmental standards, and that surplus soil disposal would be monitored during construction. According to the Project consultant, during construction, the surplus soil was transported to the airport site (low ground) designated by the executing agency, and leveling work (spreading) was carried out. Although it was not allowed to visit the site due to airport access restrictions, it has been confirmed by the executing agency and the Project consultant that this was essentially a move of soil that was completed within the airport, and that the measures for contamination were implemented and had no environmental impact or negative impact on the outside of the airport.

(2) Resettlement and Land Acquisition

The Project involved the construction of a cargo airport terminal on an existing site, and no land acquisition or resettlement was planned. It was confirmed by the executing agency through the questionnaire answers that neither resettlement nor land acquisition had occurred.

(3) Gender Equality, Marginalized People, Social Systems and Norms, Human Well-being, and Human Rights

No specific and direct initiatives from the perspectives of gender equality, marginalized people, social systems and norms, human well-being, and human rights were articulated at the time of planning, and no relevant impact occurred during and after the implementation and completion of the Project.²⁵ In addition, due to the nature of the Project, there is no difference between beneficiaries in the Project effects.

²⁵ Questionnaire answers

(4) Other Positive/Negative Impacts

Use of cargo terminal facilities for emergency assistance

While the cargo handling volume has been significantly reduced due to the impact of Covid-19, the international cargo terminal has been receiving medical supplies, including vaccines, delivered as emergency assistance. The installation of cold storage facilities through the Project made it possible to manage vaccines and medicines transported by air at appropriate temperatures, and approximately 50 tonnes of medical supplies delivered as emergency relief supplies from foreign countries were transported to various parts of Tajikistan through the cargo terminal.

【Contribution of cold storage to the control measures for Covid-19】

The international cargo terminal at DIA has been receiving vaccines and medical supplies sent from foreign countries as emergency assistance. The lack of cold storage at the old terminal limited the handling of medical supplies to tablets and other items that can be managed at room temperature, but the cold storage facilities installed in the Project have enabled vaccines and medicines transported by air to be managed at the appropriate temperature. Due to the limited capacity of the refrigeration facilities of the Ministry of Health in Tajikistan, the DIA accepted approximately 50 tonnes of vaccines and medicines transported as emergency relief supplies, and most of the vaccines were transported directly from the airport's cold storage facilities to medical facilities around the country. According to the Ministry of Health, it would have been difficult to accept the same amount of vaccine without the cold storage facilities at DIA, and the facilities established at the airport have contributed to the country's fight against Covid-19.



Cold Storage Facilities



Inside of the Cold Storage

After the implementation of the Project, the airport has been able to use high-accuracy ILS for all departures and landings, which has improved the safety and reliability of aircraft operations. Although the opening of the border gate to Uzbekistan, Covid-19 and the Ukraine situation have restricted a number of air services, and the actual cargo handling volume has been below the baseline value, the cargo terminal has streamlined cargo handling operations and helped maintain the quality of cargo, including perishable goods. Furthermore, the impact of the use of cargo terminal facilities to transport emergency assistance (medical supplies) and to handle medical

supplies requiring temperature control, such as vaccines, was also confirmed, contributing to the country's Covid-19 control measures. In light of the above, this Project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the Project are moderately low.

3.4 Sustainability (Rating: ④)

3.4.1 Policy and System

As policies, rules and regulations on safety in aircraft operations in Tajikistan, the *General Aviation Rules of the Republic of Tajikistan: air traffic management* (2014) for aircraft has been developed. The rules provide guidelines for aircraft, special vehicles and means of mechanization at aerodromes in Tajikistan, and the facilities and equipment developed under the Project are also utilized in accordance with the rules. In addition, according to the executing agency, the operation manual for the cargo terminal which was created with the support of the Project is very useful for the operation of facilities and equipment in line with global standards and has been used effectively since it was prepared and will continue to be used as an operational guideline for airport facilities and equipment in the country.

3.4.2 Institutional/Organizational Aspect

The cargo terminal is operated and maintained by the Cargo Terminal Department of the DIA, while the security equipment is operated and maintained by the Equipment Department (see Figure 1: Organization Chart of the Executing Agency). Each department works closely together and there have been no problems with the reporting system. Out of a total of 1,582 staff members of the executing agency, 642 staff members including engineers, technicians and drivers, are engaged in the operation and maintenance (O&M) of the airport facilities and equipment, and the executing agency explained that the required number of staff is in place²⁶. Although a large number of staff temporarily left the DIA due to the suspension and restriction of air services as a result of the spread of Covid-19, the recruitments of new staff have proceeded and there are no concerns regarding staff numbers. In addition, there is close cooperation between departments and no problems have arisen with the reporting and maintenance systems.

²⁶ Source: Questionnaire answers, interviews with the executing agency

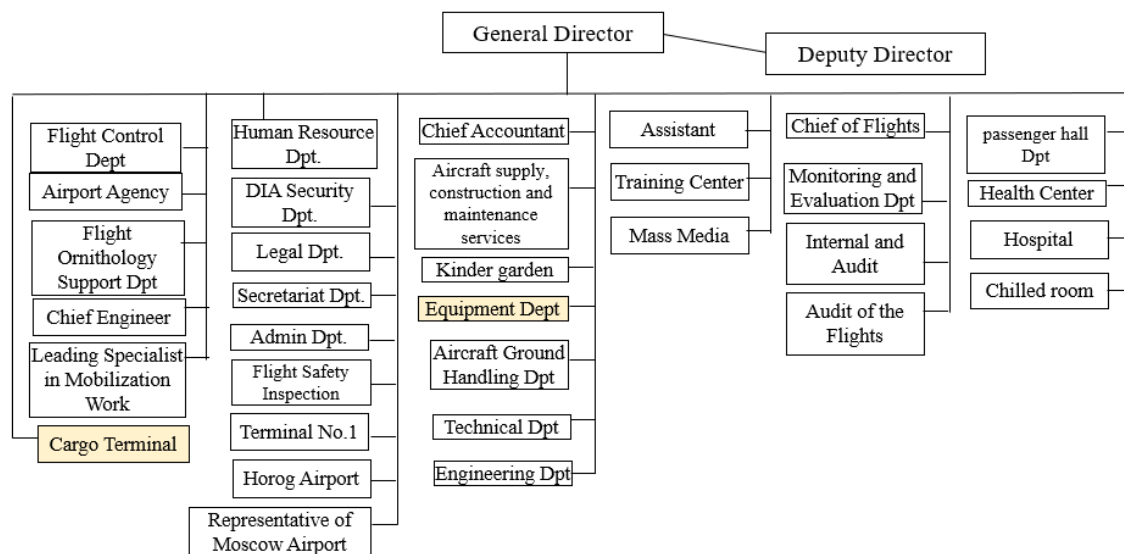


Figure 1 Organization Chart of the Executing Agency

Source: Document provided by the executing agency

3.4.3 Technical Aspect

In the executing agency, technical staff in charge of O&M have engineering vocational school or university degrees. In addition, the executing agency has the technical capacity required for O&M of the ILS and PALS, as they have owned and operated them before the implementation of the Project.²⁷ In the improved cargo terminal, the facilities and equipment not used in the past have been procured, and training necessary for operations using these facilities and equipment was provided during the implementation of the Project. According to staff who participated in the training, they had opportunities to learn how to operate and maintain facilities and equipment through both lecture and practical training as well as the knowledge of safety equipment in the production plant and safety management on-site through the training, and no technical problems had been encountered in operating and maintaining facilities and equipment by the time of the ex-post evaluation. On the other hand, after the Project was completed, many of the staff who participated in the training left their posts due to the limited air services caused by the spread of Covid-19. At the time of the ex-post evaluation, the staff who participated in the training are working on technology transfer to the newly deployed staff, but that tends to cause a heavy burden on those staff because of a limited number of staff who joined the training.²⁸ After the Project was completed, with the support of the Asian Development Bank, training was provided to improve the operational capacity of security equipment (once every five years) and transport dangerous cargo (2020). As for cargo terminal staff, training by the external organization is, for example, provided to strengthen their capacity to handle cargo within the budget of the executing

²⁷ Questionnaire answers

²⁸ Source: Interviews with the executing agency

agency, contributing to the maintenance of its technical capacities.

Manuals for facilities and equipment are provided in English and Russian and are used as required. Consumables and spare parts are stocked in its warehouse and can also be ordered and obtained. Some items need to be imported from abroad, but there were no cases of problems in obtaining them by the time of the ex-post evaluation.²⁹ Since both facilities and equipment are confirmed to be in good condition during the site visit, there are no technical concerns.

3.4.4 Financial Aspect

Information on the income and expenditure of the DIA could not be obtained from them since the information is confidential, but its financial position is considered stable as all shares are held by the Government.

For the facilities and equipment developed in the Project, the O&M costs estimated at the time of planning and the actual costs are shown in the table below.³⁰ The O&M cost of air safety equipment is significantly lower than estimated at the time of planning. This is due to the closure of DIA from April 2020 to July 2021 because of COVID-19. According to the executing agency, there is no shortage of O&M budget. It has been confirmed through site visits that maintenance of air navigation safety equipment and cargo terminal is carried out in accordance with the plan and that the actual maintenance situation is good. Therefore, it can be said that there are no particular problems, as the budget shortfalls have not caused any issues with the O&M activities.

Table 5 The O&M Cost of Air Navigation Safety Equipment (ILS, PALS)

(Unit: Million US\$)

		Estimated amount	2020	2021	2022 ^{Note 1}
ILS, PALS	Personnel expenses, Maintenance and repair cost	209,300	46,145	50,780	75,862
	Spare/consumable parts cost	8,000	778	3,504	2,236
	Flight inspection cost	160,000	31,000	31,000	31,000
	Total	377,300	77,923	85,284	109,098
Cargo terminal and related equipment	Personnel expenses, Maintenance and repair cost	301,000	N.A.	N.A.	N.A.
	Spare/consumable parts cost	10,000	N.A.	N.A.	N.A.
	Fuel cost	90,000	N.A.	N.A.	N.A.
	Total	401,000	N.A.	N.A.	N.A.

Source: Questionnaire answers

Note 1: The O&M cost for 2022 is based on estimates.

3.4.5 Environmental and Social Aspect

No negative environmental and social impacts were assumed at the time of planning, and it has

²⁹ Source: Questionnaire answers

³⁰ The executing agency explained that the O&M of the cargo terminal and related equipment are treated as part of the overall facilities at the airport, and it is not possible to indicate the costs for only the relevant facility part.

been confirmed by the executing agency that there are no possible negative environmental and social impacts in the future at the time of the ex-post evaluation.

3.4.6 Preventative Measures to Risks

No specific risks were assumed at the time of planning. According to the executing agency, there are also no specific risks envisaged for the future. On the other hand, depending on the future situation of COVID-19 and situation in Ukraine, there are expected to be risks that both passenger and cargo flights will continue to be suspended or reduced and that the operation of facilities and equipment will be limited. Although this is out of the control of the executing agency, it can be said that appropriate action will be required to ensure there is no deterioration of facilities and equipment while they are not fully in operation or used.

3.4.7 Status of Operation and Maintenance

In the site survey, both facilities and equipment were found to be maintained in good condition and well cleaned as shown in the table below. Facilities and equipment at the cargo terminal continue to have low utilization in line with the decline in cargo handling volume, and it is difficult to ascertain what the future outlook is for these facilities and equipment, including the impact of the situation in Ukraine. The operation status of the equipment at the cargo terminal is good excepting the scales and the utilization rate of air navigation safety equipment is also high.

Table 6 Status of Maintenance of the Facility and Equipment

Cargo terminal	Current condition
Freight handling area	
Build-up・break-down space	Good
Storage for exports and imports	Good
X-ray inspection area	Good
Cold storage facilities	Good (The one of two storages is was not in use as of the site survey.)
Special cargo facilities	
Dangerous goods space	Good
Valuable goods storage	Good
Animal storage	Good
Office area	
Cargo terminal office	Good
Staff rooms	Good
Equipment	Current condition
ILS	Good
PALS	Good
Cargo handling equipment	Good except pit and platform scales, aerial work platform

Source: Questionnaire answers and observations during the site survey

At the time of the ex-post evaluation, one of the two cold storage facilities is limited use and empty at times due to a decrease in the cargo handling volume. In addition, large and small scales³¹ installed at the cargo terminal have not functioned since their installation. Although the executing agency has contacted the suppliers, the causes have not been specified and it has remained unresolved.³² Therefore, the existing scale has been used, and the executing agency is planning to obtain quotations for the purchase of a new scale. In addition, the battery of the elevated work platform is out of order though the platform itself is utilized without any problems. According to the executing agency, although Chinese batteries are available on the market in the country, genuine batteries are not available locally, so they are considering purchasing them from abroad to use their equipment longer.

At the time of the defect inspection, it was noted that the septic tank pump was making noises due to the lack of regular lubrication, but appropriate measures have since been taken, and there's no noise in it and no problems have arisen.³³ In terms of the maintenance and management plans for facilities and equipment, a log book has been prepared in each department and preventive measures for maintenance and management are implemented on a daily basis. Minor repairs are handled and resolved by the engineers, while a system is in place whereby major breakdowns, such as problems with lift batteries or problems that occur in the cold storage facilities, are dealt with in each department and the information and necessary budgets are compiled and referred to the procurement department.

The executing agency responsible for O&M of the cargo terminal and air navigation safety equipment has the necessary number of staff with good coordination between departments. Therefore, there are no problems in the institutional aspect. They also have the technical capacity required for the O&M activities. Although financial information is not fully opened and the basis for the figures cannot be verified, a budget to conduct the O&M activities is secured. Furthermore, both facilities and equipment are well maintained and air navigation safety equipment is fully operational, although operations at the cargo terminal remain low due to the impact of COVID-19. As mentioned above, no issues have been observed in the policy/system, institutional/organizational, technical, and financial aspects, including the current status of operation and maintenance. Future the environmental and social issues and risks have been well mitigated. Therefore, sustainability of the Project effects is very high.

³¹ The large scale to measure the bulk baggage for export and the small scale for weighting the small baggage for import were procured.

³² While the executing agency states that the scales have not functioned since installation, the Project consultant confirmed the records of conducting a defect inspection on site in February 2017 and receiving a signature to acknowledge that the inspection was passed.

³³ Source: Questionnaire answers

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented with the aim to improve safety of aircraft operations and passenger and cargo handling capacity by upgrading air navigation safety equipment and improving cargo handling facilities at DIA, thereby contributing to the facilitation of logistics flow.

Its purpose is in line with Tajikistan's development policy at the time of planning and the ex-post evaluation, which has emphasized the importance of air transportation and development of airport facilities, and development needs to improve safety and facilities at the airport, which plays an important role in air transportation. Although there was no specific collaboration or coordination with projects or assistance other than from the JICA, it was confirmed that the Project was in line with Japan's aid policy, which has emphasized the development of transport infrastructure, and with Goal 9 of the SDGs, as well as with technical cooperation projects aimed at improving the operational capacity of air navigation services. Therefore, its relevance and coherence are high. The Project costs exceeded the plan, and the Project period largely exceeded the plan due to unsuccessful tenders and delays in tax exemptions. Therefore, efficiency of the Project is moderately low. The installation of air navigation safety equipment under the Project has improved the safety and reliability of aircraft operations by enabling appropriate aircraft arrivals and departures. At the cargo terminal, it has become possible to streamline cargo handling operations and handle perishable and medical goods that require temperature control, thereby contributing an impact such as receiving emergency relief supplies in the wake of the COVID-19. On the other hand, with the opening of land routes with Uzbekistan and air services limited due to COVID-19 and the situation in Ukraine, international cargo handling volume has decreased compared to before the Project, resulting in substantially lower volumes than planned. As mentioned above, this Project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the Project are moderately low. No issues have been observed in the policy/system, institutional/organizational, technical, financial, environmental, and social aspects, including the current status of operation and maintenance. Therefore, sustainability of the Project effects is very high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Due to the COVID-19 and situation in Ukraine, the operation of flights may continue to be reduced at DIDA for a period of time. In the meantime, utilization of the installed cold storage facilities and equipment is also expected to be low. The executing agency should keep facilities and equipment running on a regular basis, even during periods when there is no need to do so, to

ensure that the facilities and equipment are not deteriorated by not running them for long periods.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Developing a system for transferring the outcome of training within the organization.

Training was provided on O&M of the newly developed cargo terminal facilities and equipment through the Project. Thanks to the training, it was confirmed that the O&M of the facilities and equipment is being carried out without problems. On the other hand, the majority of staff who participated in the training have already left the executing agency, leaving a limited number of staff to take on the role of transferring skills in the form of on-the-job training to the newly deployed staff, placing a burden on them. As many projects have reported cases where staff who have participated in training leave their jobs, it is desirable to establish rules at the planning stage for the transfer of experience, knowledge and technical capacity gained in training to successors and other existing staff members appropriately when training participants are transferred or leave their jobs, and to establish a system in the executing agency to ensure a sufficient number of staff with technical capacity.

Use of defect inspection when equipment defects are identified at an early stage

Large and small scales procured under the Project have not functioned or been utilized since their installation. As defect liability inspections are usually carried out one year after Project completion, in cases such as this, where the equipment has not functioned or operated since installation and the contractor has not found a solution, it is an option to refer the case to an expert during the defect inspection survey to find a solution.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None

5.2 Additionality

None